Perceptions, Pedagogies, and Practices: Teacher Perspectives of Student Engagement in Grade 9 Applied Mathematics Classrooms

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
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This study investigates the teaching practices that three Grade 9 Applied Mathematics teachers use to increase student engagement and enhance student learning. Specifically, the study examines the factors within social and academic domains that teachers used to increase student engagement. Qualitative data were collected in the form of teacher interviews, classroom observations and teacher journals.

The evidence from the study shows that all three teachers were cognizant of attributes of their early adolescent learners as the teachers sought to increase student engagement in their Grade 9 Applied Mathematics classes. Six major findings as suggested by the case studies can be summarized as follows: (1) developing student self-confidence is a critical component of increasing student engagement for early adolescent learners; (2) teachers may focus on one domain more than the other as a result of their personal comfort with that domain; (3) domains for student engagement and the factors found within these domains are not independent; (4) the Ontario Ministry of Education’s TIPS4RM resource is an effective way to increase student engagement; (5) technology is also an effective and relevant way to increase student engagement; and (6) the use of a framework for student achievement may support teachers efforts to increase student engagement.
Implications from this study suggest that teachers should consider a variety of factors to increase student engagement in the Grade 9 Applied Mathematics class. Teachers can consider characteristics of their early adolescent learners, and factors for social and academic engagement. Teachers will favour approaches that parallel their personality and values and efforts in one factor may support another factor of student engagement. Suggestions for areas of further research are included at the end of the study.
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Chapter One: Introduction

1.1 Introduction

Less than 4% of students who fail Grade 9 Applied English or Mathematics have completed secondary school after four years (King, Warren, Boyer, & Chin, 2005). Students with severe academic difficulty during Grade 9 are more prone to leaving school without graduating (Neild, Stoner-Eby, & Furstenberg, 2008).

In this study, I investigate the teaching practices that Grade 9 Applied Mathematics teachers use to increase student engagement and enhance student learning. I chose this particular group because, through research and personal experiences and hearing students/teachers talk about this group of students, I realize that the students taking this course need extra attention. I want to discover more about teaching practices that will promote positive learning experiences for the students who will hopefully, in turn, stay motivated to continue to learn. In this chapter, I will outline the research context and questions, significance and my personal connection to the study.

1.2 Research Context

Grade 9 Applied students are under a great deal of pressure, scrutiny and have been found to struggle academically (Brown, 2008). In Ontario, education is compulsory for students until a high school diploma is achieved or until the age of 18 for students who have not attained their high school diploma. Teachers should use engaging teaching strategies, thereby encouraging students to attend classes and stay in school.

“Dropping out is viewed as a gradual process of disengagement from schooling that includes impaired or reduced participation, less successful outcomes, and reduced belonging, culminating in the student’s early departure from school” (Stout & Christenson, 2009, p. 18).
Research has shown that there are many factors that lead to secondary school dropout (e.g., Lee & Burkam, 2003; Rumberger, 2004; Stout & Christenson, 2009). Social, familial, socioeconomic, and academic pressures affect student academic retention and students in early adolescence are the age group at greatest risk of dropping out of school or failing in their academic studies (Alexander, Entwisle, & Horsey, 1997; Janosz, Archambault, Morizot, & Pagani, 2008).

Students tend to drop out if they lose interest in schooling and do not feel as though there is a personal benefit from staying in school (Ensminger, Lamkin, & Jacobson, 1996). Students are also at risk of dropping out if they do not form positive relationships with their peers (Janosz, Le Blanc, Boulerice, & Tremblay, 1997). Janosz, Boulerice, Le Blanc and Tremblay (2000) did a study with Montreal secondary school students and found that 40% of the secondary school dropouts were highly motivated in school in their early years in secondary school. An additional 40% of the secondary school dropouts had social challenges in school. The remaining 20% of secondary school dropouts in their study were consistently academically unmotivated.

In Ontario, students in Grades 9 and 10 are generally streamed into two levels: Academic and Applied. In some schools and school districts, other specialized courses may be offered. For example, “[i]n cases where students’ educational and/or career preparation needs cannot be met by courses authorized by the provincial curriculum policy documents” (Ontario Ministry of Education, 2004, p. 2), a Locally Developed Course may be created. These courses may be counted towards students’ Ontario Secondary School Diploma. The Grades 11 and 12 Ontario curriculum provides courses that are intended to support the students’ focus post secondary school. These courses take the form of university preparation, university/college preparation, college preparation, and workplace preparation courses. Students in the Applied level stream
tend to transition into the workplace or to college programs after completing their secondary diploma. The Grades 9 and 10 Applied level courses are pre-requisites for the college preparation and workplace preparation courses in Grades 11 and 12. Students in the Academic level stream may continue their studies at a university as their Grades 9 and 10 courses are pre-requisites for the university preparation and university/college preparation courses in Grades 11 and 12.

Students in the Applied level are at greater risk for academic failure as they enter the secondary level more disengaged compared to their Academic counterparts (King et al., 2005). Students in Grades 9 and 10 are also at greater risk than to students in Grade 12 (Allensworth & Easton, 2005; Archambault, Janosz, Morizot, & Pagani, 2009). Brown (2008) examined a Grade 9 cohort in an urban center of Southern Ontario in the fall of 2002 and his results showed that only 44% of students taking Applied courses graduated after five years of study as opposed to 84% by their Academic counterparts. The dropout statistics for these students are a drastic 43% compared to just 12% respectively. The students taking Applied credits seem unmotivated about reaching academic success.

In Ontario, Grade 9, students taking the Applied or Academic credit are required to write a large-scale standardized exam set by the Education Quality and Accountability Office (EQAO). The EQAO is the third and final mathematics or numeracy exam that Ontario students write (the others are written in Grades 3 and 6). In other Canadian provinces and territories, students also have to write large-scale exams (Klinger, DeLuca, & Miller, 2008). These exams may be subject specific (e.g., mathematics or numeracy, language or literacy, sciences, social science) or to assess general academic knowledge. While all Canadian provinces and territories have large-scale standardized exams for mathematics or numeracy, some provinces or territories
only mandate these exams for elementary students (e.g., Nova Scotia, Nunavut, and Quebec) while the remaining provinces or territories mandate three or four exams within elementary and secondary school. There are no provinces or territories that exclusively have large-scale mathematics or numeracy exams in secondary school.

For the EQAO, students with Individualized Education Plans (IEPs) may have the same accommodations to write the EQAO exam as allowed for regular classroom assessments. Additionally, English Language Learners may also be granted special provisions. The list of accommodations and provisions acceptable for students who qualify are published each year by the EQAO (e.g., EQAO, 2013).

Although the EQAO exam is considered a low-stakes exam because the Ministry of Education has not mandated that the exam will affect students’ outcomes on the Grade 9 Applied Mathematics course nor on their completion of the Ontario Secondary School Diploma, many schools have individually decided to make students results on the EQAO exam count towards their final course grade.

As indicated on the EQAO’s website:

EQAO’s tests measure student achievement in reading, writing and mathematics in relation to Ontario Curriculum expectations. The resulting data provide accountability and a gauge of quality in Ontario’s publicly funded education system. By providing this important evidence about learning, EQAO acts as a catalyst for increasing the success of Ontario students. (EQAO, n.d.)

As school, school board, and provincial results are publicly available on the EQAO website, Grade 9 Applied teachers, and school and school board administrators feel pressure for their students to perform well. Popular media is quick to scrutinize educators and the educational system based on EQAO results and often, students are caught in the crossfire of actions and reactions resulting from the EQAO exam. For educators who feel a pressure to produce
successful students, their unmotivated and disengaged Grade 9 Applied Mathematics students are of grave concern.

American research emphasizes the importance of student engagement and its direct implication on student retention and academic success (e.g., Lowe et al., 2010; Mergendoller, Marchman, Mitman, & Packer, 1988). Much of this research has been completed at the elementary level, so there appears to be a gap in the research at the secondary level (Singh, Granville, & Dika, 2002). As the needs of secondary school students are different from those of elementary students (e.g., Osterman, 2000; Sullivan, Tobias, & McDonough, 2006), I wish to explore this neglected population in a Canadian context. More specifically, Grade 9 students who are in their young adolescent years are even more vulnerable to the many stresses that they face (Carnegie Council on Adolescent Development, 1989). I use case studies of Grade 9 Applied Mathematics teachers to determine if the findings at the elementary level are consistent with those for this vulnerable age group.

Teacher perception can affect student learning and student achievement (Bruce & Ross, 2008). The mathematics beliefs and values of teachers also affect their pedagogical practices (Kajander, 2004). Teachers who believe that their teaching practices affect student learning and achievement positively are more willing to implement new teaching strategies, take risks with their instructional practices and work to achieve student goals (Bruce & Ross, 2008). Research has shown that this type of teacher contributes to an increase in student achievement (e.g., Bandura, 1997; Brouwers & Tomic, 2001; Henson, 2002; Ross, Bruce, & Hogaboam-Gray, 2006; Tschannen-Moran & Hoy, 2001). These teachers also affect student perceptions of their own abilities (Ross, 1998).
Bruce and Ross (2008) describe teacher efficacy, innovative instruction through professional development support, goal setting, current instructional practice, teacher self-assessment, and student achievement to be domains that interact and contribute towards positive changes in each. My study will invite teacher participants who are consciously working on improving their instructional practice to increase student learning to share their views about their teaching practice, student motivation and student achievement. Although my study does not look at the students’ perspective, the teachers’ perspective will provide valuable insight into how teachers of Grade 9 Applied Mathematics can increase student engagement and strengthen student learning through purposeful teaching practices.

1.3 Purpose of the Study

The purpose of this study is to determine how Grade 9 Applied Mathematics teachers are increasing student engagement. Specifically, I investigate the beliefs and teaching practices of Grade 9 Applied Mathematics through teacher interviews, teacher journals and classroom observations.

1.4 Statement of the Problem

In this study, I intend to find how teachers of Grade 9 Applied Mathematics courses increase student engagement. Acknowledging that student engagement can be impacted by two domains: social and academic considerations, I pose the following two research questions:

1. What factors increase student engagement in the social and academic domains?

2. What is the relationship between the social and academic domains for these teachers?

1.5 Significance of the Study

The goal of my research is to better understand the teaching practices of teachers of Grade 9 Applied Mathematics. My study will shed light on Ontario’s Grade 9 Applied
Mathematics course and assist Grade 9 Applied Mathematics teachers in utilizing appropriate teaching strategies for these at-risk students. The results will also benefit department heads, administrators and educational leaders seeking to improve their mathematics program and encourage these at-risk students to remain in secondary school and achieve academic success.

I believe that, if mathematics teachers try to improve their teaching practices for the Grade 9 Applied course, they will improve their pedagogical knowledge and abilities, and can also transfer these skills to other courses they teach. By improving the mathematics teaching practice in many grade levels, there will be an increase in student engagement. The academic knowledge of our youth will be improved and thus, more students will be successful in secondary school.

1.6 Background of the Researcher

I have always wanted to be an educator. As a child, I liked helping others to learn. I enjoyed thinking of different ways to get learners to understand what was being taught and have fun at the same time. The concept of pedagogy and thinking about what teachers can do to help their students to learn more effectively has always been interesting to me. In all of my jobs in which I was an educator, I enjoyed the process of considering the different ways in which I could teach my students. While completing my Bachelor of Education, I enjoyed learning more about teaching and during my practica, experimenting with, and collecting new ideas. After I started my career, I continued to be interested in pedagogy and exemplary teaching practices. It was inevitable that I would go to graduate school to further these interests.

My Master’s thesis focused on the teaching strategies used to foster the construction of knowledge in an elementary classroom. I would like to continue this exploration of exemplary
teaching practices at the secondary level where students are thinking about future stages in their lives.

One reason why I want to write about this topic is because of my experiences as a secondary school teacher. While on staff at Neuchâtel Junior College in Neuchâtel Switzerland, I realized that I had a unique group of students. Neuchâtel Junior College (NJC) is an independent school, offering Grade 12 Academic and Advanced Placement courses. My students were academically motivated and wanted to get into the most prestigious programs in universities across Canada and the United States. While not all of my students were interested in the subject material, they were motivated to succeed and dutifully came to lessons prepared and demanded highly of themselves.

These students were a contrast to the students whom I had encountered as a pre-service teacher at urban public schools in Toronto. At these schools, the student body was more diverse. They came from different cultures, communities, upbringings and values, and had a variety of academic and life goals. It was easy to keep the students at NJC engaged, but I knew that, in most schools, this would not always be the case. I knew that my students at NJC were a minority group and I often thought that, regardless of my teaching practices, those students would inevitably succeed. In personal reflection and thinking about the big picture, I could not help but wonder what it would be like to teach in a school of a completely opposite setting to the one that I had experienced at NJC. Would my teaching strategies produce successful students? What were their academic and life goals? What teaching practices could I use to meet the needs of these students? This student group is more unfamiliar to me that I felt I have much to learn. I did not have much experience teaching them, nor could I use my own experiences as a student to relate to them.
Mathematics came relatively easy for me in secondary school. I enjoy the subject, and always have. From an early age, my parents gave me mathematics worksheets to do, and I remember it being like a game. A challenge. I wanted to be successful at these simple worksheets, partly to get their approval, but also because I liked that feeling of success. This feeling of success was a motivation to me. Many people have negative feelings towards worksheets, but I never saw it this way. I managed to turn a mundane exercise into something that I enjoyed. In general, I have always liked mathematics and learning, in any shape or form, has been a positive experience.

I think the fact that I thought mathematics was fun has been a large contributor to why I have decided to pursue education as a profession and of course, continuing to be a student for so many years. I truly enjoy the process of learning and thus, am happy to continue to take classes and as they say, be a “lifelong learner”. I think these ideas are important things that I want to try to promote within my students or students in general in the field. I am lucky to have liked my educational experience. I am lucky to like learning, and I think this directly impacts my path in life.

As such, I would like to conduct research to find out what mathematics teachers can do to provide a “fun” environment for their students. For me, fun was created through my motivation to be successful, doing activities that were challenging and required dedication. I realize that my version of fun may not be the same for other learners. Thus, I want to investigate what multiple teachers are doing in their classrooms to make learning fun for their specific student group. It was easy for me to make learning fun, but I am more interested in what teachers do to make learning fun for students who are not able to be self-motivated to learn. I believe that it is more challenging for teachers of this particular student group to make learning fun, and much like I am
drawn to a good challenge as a mathematics student, I am drawn to a challenge as a researcher and practitioner.

1.7 Limitations of the Study

This study examines the practices and belief of three Grade 9 Applied Mathematics teachers. The small sample size makes it difficult to generalize from three individuals who bring to their teaching a unique set of experiences, beliefs, biases and nuances. Additionally, two of the three teachers teach at the same school and all three teachers teach generally in the same geographic area of the Greater Toronto Area. Thus, the two teachers who teach at the same school may be influenced by common school and/or school board directives and all three teachers may also have similar tendencies due to common trends in the locations in which they teach.

All three teachers were part of the same Collaborative Teacher Inquiry Project, a professional development initiative. As my intention was to investigate the teaching practices of those teachers who are actively seeking strategies to improve their Grade 9 Applied Mathematics program, I sought out participants for my study from those teachers who were part of the Collaborative Teacher Inquiry Project. As part of this initiative, the teachers attended a series of professional development workshops potentially skewing their teaching practices such that the teachers are not representative of the entire Grade 9 Applied Mathematics teacher population. I believe that the proactive intentions of the Collaborative Teacher Inquiry Project participants show that these teachers are more likely to use and implement teaching approaches to engage their Grade 9 Applied Mathematics students.

Another limitation of this study is that it focuses on teacher beliefs and perception. I investigate the teaching practices used by Grade 9 Applied Mathematics teachers that these
teachers believe to be effective in increasing student engagement. This study does not take the students’ perspective into consideration. The findings from this study could be skewed as a result of the participants’ abilities to reflect on their teaching practices and the extent to which they are critical of the effectiveness of said practices. How the teachers communicate their teaching practices, the degree to which they are confident in their teaching approach, and the extent to which the teachers amplify their beliefs and actions, all have an effect the study. The self-confidence of the teachers and the amount they amplify their experiences and observations also has an impact. I include classroom observations as part of my study as a means to negate some of these issues so as to compare my observations in the classroom with the teacher’s accounts. I also use specific instances from the classroom observations and ask teachers to connect their thoughts to specific classroom episodes as a means to anchor teacher interviews.

Additionally, the study does not determine whether or not the teachers’ perceptions of their teaching practices are truly effective. Student outcomes are not noted nor is the degree to which students become engaged in their class. It is not known which students are more engaged than others and which students in which school or classroom are the least engaged out of all students. The extent of student engagement and change in student engagement over the duration of the study and determining relative effectiveness of teaching practices across teacher participants was not a focus for my study.

Although limitations do exist, the case studies from my study will provide three rich descriptions and examples of what Grade 9 Applied Mathematics teachers are doing to increase student engagement. They can act as examples of what reflective and proactive teachers are doing to enrich their students’ learning experience.
1.8 Plan of the Thesis

This thesis is comprised of five chapters. Chapter One provides an overview of my proposed study including the research context, research questions, and significance of the study.

Chapter Two is a review of existing literature and examines previous research conducted in this area. Student success provides an overarching goal for teachers and this concept is examined by means what teachers can do to encourage it. Student engagement is presented as an integral facet of student success and teachers should consider the social and academic needs of the learner. As my study will investigate teachers of the Grade 9 Applied Mathematics course the domains of social and academic engagement will be presented with the early adolescent learner in mind.

I describe the methodology used for my study in Chapter Three. Within this section, I further describe the research context and present the characteristics of my participants. I outline the qualitative data sources for my study and method that will be used to analyze this data. I conclude this chapter by discussing the ethical considerations of the study.

Chapter Four presents the findings from my three case studies. Chapter Five integrates the findings from the three case studies to answer the research questions presented in Chapter One and links these findings to existing literature about student engagement. I also share some implications of my study and suggest areas for future research.
Chapter Two: Literature Review

2.1 Introduction

In this chapter, I will situate my study within the related areas of literature. I first examine the concept of student success and how teaching practices and other components of students’ academic context may influence their achievement. Next, I discuss the importance of student motivation and elaborate on the components that encompass student engagement. I provide a context for the early adolescent learner then situate student engagement through two lenses: social engagement and academic engagement. I also discuss the importance of tasks, technology, construction of knowledge, assessment, and learning environment to teaching practices that may affect student engagement.

2.2 Student Success and Achievement

“Adolescence is a developmental period characterized by social, behavioural, cognitive, and emotional transitions” (Archambault et al., 2009, p. 409). Eccles, Lord, and Midgley (1991) define an adolescent as an individual who exhibits an increase in: “desire for autonomy from adult control, especially from one’s parents’ control; peer orientation, self-focus, self-consciousness and salience-of-identity issues; concern over sexual relationships, and capacity for abstract cognitive ability” (p. 534). Early adolescence can be classified as the first few years of adolescence, typically between the ages of 13 and 15. I use these two terms interchangeably as characteristics and qualities of adolescent and early adolescents are generally consistent.

It has been suggested that individuals who are undergoing significant and rapid changes in their life are at greater risk for both positive and negative repercussions (Eccles et al., 1993). Simmons and Blyth (1987) found that the effects of stress during times of early adolescence have long-term effects, especially in females. As such, teachers need to be aware of the needs of these
learners and make decisions in their teaching practice to support their students at this crucial time.

Early adolescence is an at-risk phase for students’ academic success. Lee (2010) found that American students’ academic achievement plateaus at middle school and begins to decrease in secondary school. The results of the Trends in International Mathematics and Science Study (TIMSS) showed that American students have a larger achievement gap in the middle and secondary school years as compared to other countries (National Center for Education Statistics, 1996, 1997, 1998). Studies from the United States have found that many teaching practices discourage student engagement. Thus, we need to take caution in our Canadian context that we do not carry out the same practices in our own classroom.

A learner’s attitude has been found to have an effect on academic success, specifically in mathematics. Ifamuyiwa and Akinsola (2008) define attitude as “the sum total of a man’s inclinations, feelings, prejudice or bias, preconceived notions, ideas, fears, threats and convictions about any topic” (p. 570). Looking at learner attitude and academic success in an African context, it has been found that, students with negative attitudes towards the subject tended to become disengaged and not do well on the standardized mathematics examination (Ifamuyiwa, 2004; Oyedeji, 1997). A mathematics teacher or peer group may not explicitly voice their negative opinions about mathematics, thereby influencing the attitude of a student. However, if the student’s experiences in the mathematics classroom are influenced through, for example, a negative teacher-student or student-student relationship or uninspired teaching strategies, the student may form a negative attitude about the subject.

Student academic success has further repercussions outside of the academic setting. Studies have shown that, as a result of adolescent school failure or dropout, there are long-term
economic effects, including costs to individuals, families, communities and society as a whole (Caspi, Wright, Moffit, & Silva, 1998; Day & Newburger, 2002; Orfield, Losen, Wald, & Swanson, 2004). More specifically, data from a United States Census Bureau (1992) showed that “high school dropouts overwhelmingly tend to work at low-paying jobs, averaging less than $13,000 a year” (Smith, 1997, p. 144). Those who did not complete secondary school are also challenged to find employment in the first place. The United States Department of Education (2002) reported that in the year 2000, the unemployment rate for secondary school dropouts ages 25 and older was 6.4%. This unemployment rate is higher than adults with a secondary school degree (3.5%) and those with 4-year college degrees (1.7%).

There are many reasons for a decline in mathematics achievement as students reach adolescence. One such reason is that many students find mathematics difficult and not relevant to their lives (Zakaria, Chin, & Daud, 2010). A number of factors lead to the diminishing academic success of early adolescents. During adolescence, students are going through many social, emotional and physical changes. Socially, adolescents are looking for support and belonging amongst their peer group and their self-confidence is at risk. Within the academic environment, the curriculum content is becoming increasingly challenging. Teachers must use teaching practices that nurture both the human and curriculum development components of adolescents in order to best facilitate student success. All of these components contribute to the probability that a student will drop out of school (Alexander et al., 1997; Stout & Christenson, 2009).

2.3 Student Motivation and Engagement

Quinn (2005) defined students to be engaged when they are “captured, heart and mind in learning [and] are cognitively and affectively connected with the learning experience” (p. 12). Engaged students will be involved in their learning, take school seriously and want to do well
academically (Simons-Morton & Crump, 2003). Additionally, students who are engaged with school will find the experience rewarding and enjoyable (Marks, 2000). Student engagement is important in the school setting because disengagement leads to rebellion, disruptive behaviour, and academic disinterest and failure (Hand, 2010).

Many researchers have investigated student engagement through various lenses. Fredricks, Blumenfeld, and Paris (2004) used three measures of student engagement: behavioural, affective and cognitive. Within the behavioural dimension, factors including student compliance, and participation in school and extra-curricular activities are measured. Within the affective dimension, factors such as social and emotional interest in school are included, and learning motivation and use of self-regulation strategies comprise the cognitive dimension.

Willms, Friese, and Milton (2009) also used three measures of student engagement, however they define their constructs as social, academic and intellectual. They identified two components to social engagement: 1) quantity of sports and school clubs that the students participated in; and 2) the sense of belonging felt by students at school and amongst their peers. South, Haynie, and Bose (2007) showed that students who participate in many school-related activities are less likely to drop out of school during the following year. Within the academic engagement construct, student attendance including classes skipped or missed without reason and tardiness is examined. Finally, for the intellectual engagement construct, student enjoyment, interest, and motivation to excel in Language Arts and Mathematics as well as the extent to which the students find the content relevant to their everyday lives is measured (Willms et al., 2009).

Janosz et al. (2008) stated that students need to be engaged socially and academically to be successful. They included “social isolation/rejection, quality of student-teacher relationships,
and participation in extracurricular activities” as components for social engagement, and “achievement, motivation, and involvement in learning activities” (p. 22) as factors for academic engagement respectively. This academic engagement encompasses Willms et al.’s (2009) academic and intellectual constructs.

I draw from Willms et al. (2009) and Janosz et al.’s (2008) notions of engagement to frame my research. Specifically, I use two domains of student engagement: social and academic. I build upon the characteristics of early adolescent learners to describe how social engagement can be created through community and a sense of belonging (Willms et al., 2009) and student-teacher relationships (Janosz et al., 2008). I then use academic engagement to discuss specific strategies that teachers can use in the mathematics classroom to support achievement, motivation and involvement in learning activities (Janosz et al., 2008).

### 2.3.1 Social Engagement

As early adolescents are going through a time of immense changes, a supportive and consistent environment in all parts of their lives is important. For early adolescents, developing positive relationships with parents, peers, and teachers are paramount.

An adolescent’s relationship with his or her parents has a great effect on personal and social development (Hill & Tyson, 2009; Jeynes, 2007; Maccoby, 1992). Much research has been conducted to determine the characteristics that are needed to support adolescents in their home environment (e.g., Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Baumrind, 1971; Steinberg, Elmen, & Mounts, 1989). These characteristics include: consistent involvement, communication, warmth, and trust, and lead to a heightened self-esteem and stability. A supportive home life and relationship with parents has benefits to children’s motivation in the classroom (Pianta, 1999). For example, children with caring and secure relationships with
parents may form closer relationships with their teachers (Furrer & Skinner, 2003). Although the relationship between a child and parent has positive implications on academic life, Garcia-Reid, Reid, and Peterson (2005) found that teacher-student relationships had a greater affect on student engagement than those between parents and students.

Early adolescent learners’ social interaction with their peers can greatly affect the degree to which the students are engaged in their learning. Students are aware of the effect that their peers have on their learning and often consider how their actions will be perceived (Simon-Morton & Crump, 2003). Peer pressure is present and may have negative implications (Sullivan et al., 2006).

Adolescent students are generally self-aware and fragile. Hill and Wigfield (1984) found that highly-anxious students tend to back away from challenging tasks. It follows that Pintrich and De Groot (1990) found that students who believed that they are capable of success are more creative in dealing with challenging situations and show an increased engagement in tasks. In the academic environment, students will inevitably face situations that are unfamiliar and challenging. As adolescent students are in a tentative stage in their development, teachers should act to reassure their students and encourage them to persevere.

Teachers should act to develop student self-confidence, personal identity and autonomy (Archambault et al., 2009). Sullivan et al. (2006) stated that early adolescent learners are likely to engage in disruptive behaviour, an indicator that engagement is low. Students at this age are also questioning behavioural boundaries, and navigating social relationships with their peers. Alienation and isolation may occur, also causing students to become disengaged in their learning (Kalil & Ziol-Guest, 2008).
The support of their peers can greatly impact students’ feeling of belonging and willingness to be engaged in their learning. Hartup (1989) reported that peer support can be more powerful than a teacher’s support because of the lack of a power differential. Students feel as though they can reciprocate the support given by their peer more than they can with a teacher.

In schools, adolescents have the chance to develop relationships with many people. Whether with school staff or with other students, each of these relationships has an effect on student engagement (Neild et al., 2008). Rosenfeld, Richman, and Bowen (2000) found that the more positive relationships that students had, the greater the chance that students would be able to adjust to changes in the school environment, have a good attendance record, and a high level of engagement and satisfaction with school.

The relationships that adolescents develop with their peers and teachers have an impact on their feeling of belonging to the school community. Students who feel like they do not belong can distance themselves from their learning in various ways including by not attending class and by limiting the amount of participation to academic activities. Conversely, students who do have a sense of membership in their learning community are more likely to make an effort in their learning and persevere through academic challenges that they may face along the way (Solomon, Battistich, Watson, Schaps, & Lewis, 2000).

Researchers have used various terms to describe students feelings of belonging to their school environment. Mouton, Hawkins, McPherson, and Coley (1996) use “school attachment” and describe this to be the degree to which students believe people at school like them. Gottfredson, Fink, and Graham (1994) used the same term but stated that students’ school attachment is the degree to which students respect their teachers and care what their teachers think of them and are thus more focused on the student-teacher relationship than Mouton et al.
Eccles, Early, Fraser, Belansky, and McCarthy (1997) used the term “school connection” to identify the degree to which students like school and look forward to going to school. Each of these terms and definitions refer to the extent to which students feel connected to their school environment.

Adolescent students need to feel like they belong. Many middle and secondary schools are large and function on an impersonal rotary system of classes rather than students belonging to a tightly knit cohort of students. This design can be detrimental to adolescent students (Osterman, 2000). Simmons and Blyth (1987) found a marked decline in adolescents’ academic results as they move to a new school environment, for example, from middle to secondary school. They found that this decline had a direct relationship with school failure and dropout. In Ontario, the junior high school model where students are at the same school from Grades 7 to 9 is less common than the elementary school with Kindergarten to Grade 8, followed by a secondary school with a Grade 9-12 model or even a K-6, then middle school (Grades 6 to 8) and secondary school model. Most students move to a new school environment in Grade 9 and the shock of this new environment as well as their own personal changes as an adolescent can amount to a potential at-risk situation (Stout & Christenson, 2009).

When starting secondary school, in addition to having to adapt to a new school environment, students are often faced with a different school model. Traditionally, secondary schools follow a rotary system where “instruction is the division of knowledge into separate components, each with its own set of specialists who are grouped into departments” (Lee & Smith, 1996, p. 105). Thus, instead of students being able to be members of their school community as a whole, as they were able to their cross-curricular elementary school, students
struggle to become part of any number of communities (e.g., the mathematics community, music community, etc.).

One strategy that a school can adopt to support their adolescent learners is to create a communally organized school. A communally organized school transcends individual classrooms and advocates for community amongst staff members, both within and across departments (Neild et al., 2008). This structure demonstrates to the students that collaboration and community is important to all members of the school community, not just to students.

In a semestered school context, a course spans four to five months. As opposed to a full year’s worth of time in an elementary school during which students can develop strong relationships with their teachers, secondary school teachers are already disadvantaged in developing these relationships (Lee & Smith, 1996). A communally organized school makes staff collaborations more visible to students and through practices such as team teaching and interdisciplinary teams, students will have an increased exposure to their teachers and allow for more opportunities to develop strong relationships. These practices have been shown to increase student engagement (Lee & Smith, 2001) and student success (Lee & Smith, 1996).

Secondary schools, when compared to their elementary counterparts “typically allow students’ greater independence…but this freedom sometimes works to the detriment of freshman (Grade 9) academic success” (Neild et al., 2008, p. 548). Kerr (2003) described secondary schools as contexts in which students have more opportunities for truancy. As such, schools need to foster an environment in which students feel both invited and supported. In addition to developing student-teacher relationships, teachers can create a classroom-learning environment that fosters a sense of community (Hargreaves, Earl, & Ryan, 1996). This sense of community promotes more personal connections between students and other members of the school.
community, for example, students and their peers (Lee & Smith, 2001). By creating stronger teacher-student relationships and fostering a sense of community within their classroom, teacher actions may encourage students to remain in the classroom and feel a sense of belonging and place within the classroom rather than in the hallways of the school during class time.

Teacher support can have an impact on a student’s feeling of belonging and engagement (Libbey, 2004). Rosenfeld et al. (2000) found that middle and secondary school students who felt that their teachers cared about them were more engaged. Students who feel as though their teachers are approachable and feel comfortable talking to them feel a greater sense of belonging to the school community (Voelkl, 1996).

Teachers should create environments that are inclusive and accepting so that students can be supported in multiple ways. This supportive environment can develop feelings of belonging, thereby increasing student engagement (Goodenow, 1993b; Hargreaves et al., 1996; Osterman, 2000; Voelkl, 1997). Researchers have also asserted that a safe school community can support students’ self-esteem and diminish psychological distress (e.g., Hoge, Smit, & Hanson, 1990; Roeser, Eccles, & Sameroff, 1998). A learning environment in which students are working collaboratively and have the opportunity to develop relationships with their peers can lead to increased student engagement. These specific strategies will be discussed in more detail in subsequent sections of this chapter.

At this important stage in students’ lives, adolescence, teachers have an important role to play. Comer (2003) encouraged educators to “interact with young people in ways that help them grow socially, psychologically, emotionally, ethically, linguistically, and physically, as well as intellectually” (p. 20). Because of these multiple supporting roles, the influence of a teacher in the development of an adolescent is significant. A teacher’s support needs to be well-rounded
rather than just to support academic development (Poncelet & Metis Associates, 2004). Goodenow (1993a) reported that students who feel emotionally supported by their teachers show an increased engagement in their academics. Students who feel as though their teachers cared for them reported stronger academic engagement (Patrick, Ryan, & Kaplan, 2007).

A teacher-student relationship in which the teacher conveys his or her high expectations of the student can influence student engagement and achievement (Raudenbush, 1984). Research by Ladson-Billings (1997) found that a teacher who had high expectations of her students and insisted that each student was capable of being successful increased her students’ feelings of belonging. Students in this classroom also reported that they felt a stronger sense of community.

The rotary system also affects the relationship between teacher and student. The teacher-student relationship can have a considerable impact on student engagement. In high-stress situations, adolescents rely on strong relationships to support their academic progress, so in the classroom setting, weak or negative relationships with teachers can be disadvantageous (Meehan, Hughes, & Cavell, 2003). There is a typically marked decline in the quality of teacher-student relationships from elementary to middle school (Lynch & Cicchetti, 1997), which is partly attributable to the transition from students having all of their classes with the same teacher, to a rotary style where students have different teachers for different subject areas. There simply is not always the opportunity to build and strengthen teacher-student relationships. This adjustment can lead to a decrease in students’ self-esteem and decline and student achievement (Reddy, Rhodes, & Mulhall, 2003). Specifically, Croninger and Lee (2001) found that, in contrast to the positive relationships described by their peers who graduated secondary school, the students who did not finish their studies described relationships with their teachers to be weak and had met with teachers less frequently.
To compensate for not spending as much time with their students, rotary teachers can take time outside of their teaching time to develop a stronger relationship with their students. Teachers can choose to be involved in supervising extra-curricular activities at the school and develop relationships outside of the mathematics classroom. In general, schools that create opportunities for students and teachers to be involved in extra-curricular life at the school can lead to a strengthened school community (Poncelet & Metis Associates, 2004; Voelkl, 1996). These opportunities can be in the form of music groups, athletic teams, special interest groups or student council (Hagborg, 1998; Jenkins, 1997). If this is not an option, another way that teachers can develop stronger relationships with students would be to use their teaching practices as a vehicle to develop the relationships (Murray, 2009). This could be in the form of providing positive feedback within lessons and using strategies that develop a better understanding of the students’ lives.

Adolescents have relationships with many different people in their lives, each having an effect on the students’ academic engagement (Christenson et al., 2008). While teachers may attempt to mediate a potentially hurtful relationship between a student and a peer or parent, teachers can only be most effective in the relationship between the student and themselves. “A supportive relationship with at least one adult (i.e., parent or teacher) appears to compensate for a negative relationship” (Murray, 2009, p. 398). For example, if teachers put their effort into building a quality relationship with their students, the direct benefits of these relationships will outweigh the detriments of other weak relationships. Way and Robinson (2003) reported that positive relationships between adolescents and members of their school community more strongly impacted the students’ self-esteem than familial support.
In a study examining the relationships between early adolescents’ and their parents and teachers, Murray (2009) found that both types of relationships affected student engagement. Conducted in the United States, Murray’s participants were primarily students of colour and came from a low-income urban environment. Although both types of relationships had positive effects on student life, teacher-students relationships specifically resulted in an increase in mathematics achievement. More specifically, it was found that high “closeness-trust”-type relationships between teachers and students led to higher mathematics achievement. These relationships also had a positive effect on language arts achievement, but to a lesser extent.

Within the walls of their own classroom, teachers need to create environments in which early adolescent students can thrive. These environments should be equally inviting to students and in these positive social-emotional spaces, teachers can further incorporate specific teaching strategies that encourage student engagement.

2.3.2 Academic Engagement

Early adolescent learners are at a greater risk of becoming disengaged with their learning. Teachers must use teaching strategies that will encourage these students to be motivated to learn. Most students at this age enter the mathematics classroom with curiosity, however if they are presented with material that is not appropriate to their needs, they will become disengaged very quickly (Raphael, Pressley, & Mohan, 2008).

The negative effects of this change of learning environment can be a result of the difference in learning context of elementary schools as compared to the secondary school context. Research of the transition from elementary to intermediate grades in the American system has shown to negatively influence students’ self-perception and self-esteem (Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Wigfield, Eccles, Mac Iver, Reuman, & Midley, 1991).
Eccles et al. (1993) found that teachers in middle school felt that their students required more discipline compared to their elementary school counterparts. As a result, the teachers taught in a more traditional manner, using more teacher-centric approaches and restricted student choice and decision-making. Alspaugh (1998) reported on a change “from small-group and individual instruction to whole-class instruction” (p. 20) as students moved from K-6 to middle or junior high schools in the United States. Alspaugh’s description of American middle schools as being structured so that class sizes are larger and class lengths are shorter parallel the Canadian secondary school context. Thus, the negative impact that American students experience as a result of transition from K-6 to middle or junior high school may caution Canadians about a similar effect for students transitioning from K-8 to 9-12 schools. Additional details about specific factors in the learning contexts that may affect adolescent students’ learning will be shared in subsequent sections of this chapter.

Research has shown that teachers in more engaging classrooms used numerous research-based practices. This includes teachers connecting material to prior knowledge, making learning challenging and relevant, using appropriate student tasks, and keeping cultural and technological conditions consistent (Luke et al., 2003; Pressley et al., 2003). Raphael et al. (2008) suggested that it is not the type of practice that teachers use to stimulate student engagement but rather the quantity of practices. They asserted that the sheer diversity of practices ensures that students are engaged. Allan (2012) agreed by stating that varying tasks and activities keep students curious about their learning as they will not be able to predict what will be coming next.

In this section, I will highlight some factors of teaching practices that encourage students’ engagement in the mathematics context; namely, teaching strategies, activities and tools to engage their students during a mathematics lesson. I also discuss the importance of allowing
adolescent learners to feel in control of their learning and how assessment impacts student engagement. Many of these factors can be found in McDougall’s (2004) Ten Dimensions Framework.

The Ten Dimensions of Mathematics Education (McDougall, 2004) is a framework for effective teaching. The framework allows teachers to focus on the areas of teaching practice that generate higher levels of student achievement.

The Ten Dimensions are as follows: (i) Program Scope and Planning (encouraging teachers to consider all strands, expectations/outcomes and key ideas of the mathematics curriculum); (ii) Meeting Individual Needs (teachers should vary lessons and instruction to cater to the needs of all students); (iii) Learning Environment (varied student groupings and student input should be used); (iv) Student Tasks (teachers should vary the types of tasks that are being used in lessons and all tasks should be meaningful); (v) Constructing Knowledge (multiple instructional strategies and thoughtful questioning techniques help students construct knowledge); (vi) Communicating with Parents (parents are influential in student achievement and as such, should be kept informed); (vii) Manipulatives and Technology (these teaching tools enhance student learning); (viii) Students’ Mathematical Communication (students should experience oral, written and physical forms of communication); (ix) Assessment (teachers should use a variety of assessment strategies to gain diagnostic, formative and summative data about their students); and (x) Teacher’s Attitude and Comfort with Mathematics (teachers affect student perception and should project positive attitudes towards mathematics).

2.3.2.1 Program Planning

The needs of students in today’s classrooms are very diverse. Some students are able to persevere through challenging tasks and block out distractions while others need constant
positive reinforcement and a quiet learning environment. Some students will enjoy learning in small groups while others prefer to work independently. As such, teachers need to be mindful of the types of teaching strategies that they use so that they can best support their students.

Teachers need to consider the often shorter attention spans of adolescent students when planning their lessons. Erlauer (2003) suggested that the attention of an adolescent spans 20 minutes. Thus, teachers should, after approximately 20 minutes of a lesson change approaches or summarize the material that was just presented. Erlauer continued to say that two days after the initial information was presented, students should have the opportunity to review the material or else it will not remain in their memory. Finally, Erlauer asserted that 20 days after the initial period of instruction, students should have a chance to apply their skills in a more complex context. For example, students can be presented with a culminating task that incorporates many different mathematics concepts that may have been taught separately. Teachers should keep students’ application of knowledge in mind when doing unit plans for their courses.

2.3.2.2 Meeting Individual Needs

Many of today’s classrooms contain a diverse group of students. In order to meet the needs of each of these students, teachers must differentiate their instruction and this can be done in many different ways. Some students may learn better in smaller groups while their peers may learn better through independent work. Some require scaffolding to help them understand a concept, others do not. Some students are visual learners while others are auditory. If teachers use a single teaching strategy in their classroom, they will invariably lose the interest of some of their students, and could find that some of their students are not able to be successful (Karp & Voltz, 2000).
Some students will benefit from learning in smaller groups. As this closely relates to the idea of cooperative learning and the benefits that this strategy can afford, I will discuss cooperative learning in the next section. In terms of meeting individual needs, when working in smaller groups, teachers can better address the needs of individual students if there are fewer students for whom the teacher pays attention. In fact, some students will feel more comfortable participating in a small group setting rather than a whole-class context. Additionally, due to the smaller number of members in the group, students will have a greater opportunity to participate meaningfully in discussions.

For students who are struggling to learn the material, teachers can support these students through scaffolding. As described by Henningsen and Stein (1997):

Scaffolding occurs when a student cannot work through a task on his or her own, and a teacher or more capable peer provides assistance that enables the student to complete the task alone, but that does not reduce the overall complexity or cognitive demands of the task. (p. 527)

Examples of ways that teachers may scaffold for students include: modeling, prompting, conducting think alouds, and making analogies. These supports are intended to be temporary measures to help students be successful and prepare them for completing similar tasks in the future without these supports (Stone, 1998).

In order to provide scaffolding, teachers need to get to know each of their students and predict who may struggle with the presented material. Teachers may also need to scaffold the material in different ways for different students. As Henningsen and Stein (1997) mentioned, teachers may use other students to help scaffold the material for struggling students. In a subsequent section about learning environment, I will discuss how the use of cooperative learning and grouping students of diverse abilities together in a heterogeneous group can support struggling students’ learning.
A school can offer extra support programs to provide support focused on the individual needs of students. For example, Neild et al. (2008) described a “transition math” course that was offered to Grade 9 students in their first semester to reinforce basic mathematics skills that the students should have previously learned but may need to be revisited. Similar courses that brought students up to the expected academic level for their grade level have been shown to have positive effects for English students (McPartland & Jordan, 2004). In these courses, teachers focused on key concepts that students were lacking. By bolstering the students’ basic skills, students’ self-confidence increased and students felt more comfortable in the mathematics classroom and became more engaged in their learning.

Other programs that work in similar ways to better meet the needs of individual students include that described by Mac Iver and Epstein (1991) in which students had an extra period in their school day dedicated to the subject in which they are struggling. The students took this course instead of an elective course. Other support programs suggested by Mac Iver and Epstein (1991) included before- and after-school coaching sessions and summer school. Mac Iver and Epstein advocated for these types of support programs instead of those where struggling students are withdrawn from their mathematics class. In this “highly visible public event” (p. 606), the students who are being pulled out for remedial work may feel more self-conscious about their abilities and perceive that their peers are judging and labeling them.

2.3.2.3 Learning Environment

In keeping with the sensitive social needs of adolescent learners, teachers need to create a classroom environment and use teaching practices that nurture student interactions so that all members feel included and welcomed. Teachers must also facilitate the development of positive
relationships amongst peers. One strategy to accomplish all of these goals is through the use of cooperative learning.

“In cooperative learning, small groups of students of mixed ability work together to solve problems and complete tasks” (Brown & Goren, 1993, p. 13). Cooperative learning allows students a chance to work with their peers to develop their mathematics skills and strengthen the sense of community and camaraderie amongst classmates that is so important to adolescent success.

Cooperative learning has also been found to lead to an increased positive attitude towards mathematics (e.g., Brush, 1997; Isik & Tarim, 2009; Nichols & Miller, 1994). In working with their peers, adolescents will feel rewarded for learning the mathematics concept as well as being able to support their peers’ learning (Joyce, 1999). Students can also improve their own self-confidence in the subject as they are able to rely on the support of their peers (Zakaria et al., 2010).

In order to achieve a collective goal, the cooperative group must work together as a team. Through teamwork, the students will develop a sense of belonging and social skills, such as how to deal with conflict amongst peers and how to persevere through challenging situations that are commonplace in adolescence (Ifamuyiwa & Akinsola, 2008). Other skills that are developed include explaining one’s thinking (Webb, Troper, & Fall, 1995), providing critiques (Bos, 1937), and listening and observing the strategies of others (Azmita, 1998; Coleman, 1998; Webb, 1985). Trusting relationships are crucial to successful group work, thus teachers should create opportunities throughout the year for students to become better acquainted with one another and build trust (Allen, 2012). Once these relationships are formed, each member of the group will
have a greater investment in the process and the product of the cooperative task and move from individualistic goals to group goals (Webb, 1985).

Teachers can support their students in successful group work by assigning roles to group members, developing students’ social skills, and structuring the task such that students must share their understanding with other group members (Webb, 1991). By assigning roles, teachers can minimize any potential imbalances amongst the group (Cohen, 1994). For example, highly verbal students who naturally may want to dominate the discussion could be tasked with a role in which they are required to be an active listener. In a study by Webb, Nemer, and Ing (2006), students were quick to mimic the way their teachers’ modeled various roles thus draw attention to the fact that when modeling, teachers should demonstrate the constructive components of each role.

The teacher’s role during cooperative learning can greatly support the learning process. As students may not yet be fluent in expressing their ideas and facilitating discussions with their peers, a teacher can encourage and model these skills. More specifically, research has presented various strategies that a teacher may consider to support cooperative groups including: instructing students on communication skills (e.g., Fuchs, Fuchs, Kazdan, & Allen, 1999; Gilles & Ashman, 1998); providing prompts that students can use to start their explanations (e.g., Coleman, 1998); and modeling strategies such as summarizing, making predications, and questioning (e.g., Palincsar & Brown, 1989).

Johnson, Johnson, and Smith (2006) cited five elements to effective small-group learning: positive interdependence, individual accountability, face-to-face interaction, interpersonal and small group social skills, and group processing. Three of these elements parallel the suggestions for teachers given by Webb (1991) to support small-group learning:
positive interdependence, in which group members believe that their independent contributions have an impact on the group’s overall success; interpersonal and small group social skills, in which students can effectively work together removed from the mathematical task; and face-to-face interaction, in which students promote each other’s learning through oral explanations and discussion of individual and group understandings of the concept and how they relate to previously learned material. Specific cooperative learning tactics may also reinforce some or all of these ideas. For example, Aronson’s Jigsaw tactic (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978) involves each member of the cooperative group learning about a different concept or component of a similar concept. When the group comes together, each member will share his or her understanding of the component that he or she was responsible for so that the entire group will gain from each individual’s ‘expert’ knowledge and have a more well-rounded knowledge base.

Shimazoe and Aldrich (2010) identified many benefits to cooperative learning. In addition to developing social skills through work with their peers, cooperative learning can lead to a deeper understanding of mathematics, a development in higher-order and critical thinking, higher academic achievement and a stronger sense of self. This research suggested that as a result of cooperative learning students developed a better understanding of their own character, which at a time in their lives where students are struggling to realize how they fit into the community, is of great benefit.

Cooperative learning also has direct implications on student mathematics achievement. Traditional teaching strategies use a teacher-centred approach. Conversely, cooperative learning is more student-centred, allowing more time for students to discover the material, discuss and clarify concepts, and problem solve. This extra, and ideally quality, time spent on more deeply
understanding the mathematics concepts can lead to higher mathematics achievement (Zakaria et al., 2010).

Students can benefit from learning from their peer group during cooperative tasks. Although students can learn from the teacher, students share a similar language with one another and can use their common vocabulary and expressions to more effectively help each other understand a concept than they could from an adult (Noddings, 1985). Similarly, students may feel more empathy towards their struggling peers as they are all working to understand the mathematics concept together rather than a teacher who most likely already understands the material (Vedder, 1985). Although the teacher may not use a traditional method in which the teacher is the expert, while facilitating an inquiry-based activity, the teacher will often still understand the concept better than most students and will not have the shared experience of deciphering the concept together.

Studies have indicated that mixed-ability groups have varying degrees of efficacy on the students depending on the students’ abilities. In these mixed-ability groups, the high- and low-ability students pair up to form a teacher-learner relationship, often resulting in positive gains for each member of the partnership (Webb, 1991). Other group members who fall between their high- and low-ability peers may not be as engaged in the cooperative learning (Peterson, Janicki, & Swing, 1981). Conversely, in homogenous groups, low-ability groups were collectively not as engaged and were challenged to support one another academically (Webb, 1991). In medium- and high-ability groups, students are more consistently engaged (Webb & Kenderski, 1984). Mixed-ability groups that draw from a more narrow range of abilities have yet another outcome on student engagement and achievement. In these mixed-ability groups in which there is no “middle” group of students (i.e. low- and medium-ability groups, and medium- and high-ability
groups), all students in the group tend to be active participants (Webb, 1984). Studies have shown that low-ability students perform equally well in heterogeneous and homogeneous groups (e.g., Hooper, Ward, Hannafin, & Clark, 1989). For high-achieving students, heterogeneous groups may not be as effective. Thus, there is not a consensus on the most advantageous means of grouping students. Yet, more importantly, teachers need to be aware of the types of students in their classrooms and consider the types of groups that they can create. While research may encourage teachers to form certain types of groups to yield the greatest benefit, the make-up of their student body will dictate the types of groups to be formed (Webb, Baxter, & Thompson, 1997).

Poncelet and Metis Associates (2004) described two K-6 schools that were restructured to become a K-8 organisation in order to support their adolescent learners. Although these two schools used different approaches to support their students, the researchers found that both schools’ efforts led to an increase in student achievement in Grades 7 and 8. While specific pedagogical practices varied, it was noted that both schools “placed students in the role of self-directed learners who had opportunities to collaborate” (p. 89). In one school, students worked on culminating projects in small groups and conducted research using a variety of research tools. The other school followed a Montessori structure and although students mostly worked independently and at their own pace, the teachers encouraged students to exchange ideas based on their own learning. The teachers encouraged students to describe to one another alternative approaches used to solve the mathematics problems and provide explanations for their answers.

In summary, cooperative learning has academic and social benefits. Academic benefits include: a deeper understanding and retention of mathematics concepts, listening to peers and building off of their ideas, an inherent opportunity to communicate students’ understanding, and
lessening mathematics anxiety. Socially, students develop group processing skills such as effective communication and justification of ideas, teamwork, active listening and conflict resolution.

2.3.2.4 Student Tasks

In traditional elementary school mathematics classrooms, many teachers give students low-level tasks, including worksheets and skill and drill exercises. While elementary students may be able to maintain their interest in the subject in this environment, early adolescent students are often not able to sustain their engagement (Mergendoller et al., 1988). As a result, these students may not feel as though they are being challenged enough and may disengage from their learning (Lowe et al., 2010).

The standards set by the National Council of Teachers of Mathematics (NCTM, 2000) require teachers to use “mathematical tasks that engage students’ interests and intellect” (p. 1). These tasks are beneficial to students on many levels. If properly implemented in the classroom, student tasks “can help develop students’ understanding, maintain their curiosity, and invite them to communicate with others about mathematical ideas” (Silver, Mesa, Morris, Star, & Benken, 2009, p. 504). The use of these tasks will also result in an increase in student achievement (Hiebert et al., 2005).

A rich task is one that will provide enough challenge for the students. These meaningful activities should integrate mathematics curriculum as well as allow students to focus on a broad range of ideas rather than smaller, discrete concepts (Sullivan et al., 2009). The tasks should also be open-ended to allow for students to explore rather than direct students on a prescribed pathway of learning. Raphael et al. (2008) found that high-level and challenging tasks kept students engaged and also offered the most academic instruction. Teachers using these tasks
covered a wider range of concepts in more depth than teaching using less engaging tasks. High student engagement involves student emotional output as result of pedagogical decisions.

Teachers should also use tasks and activities that are matched to their students’ interests. By making mathematics learning relevant to the students’ lives, the students can become more invested in their learning (Bobis, Anderson, Martin, & Way, 2011). Pintrich and De Groot (1990) found that students who found their tasks to be interesting and personally important were more engaged in learning in science and English classes. Students who are presented with personally-relevant tasks tend to see learning as something worthwhile to engage in rather than solely a task to be accomplished (Davis, 2006). In addition to the types of tasks that teachers present to students, the manner in which they are presented can affect student engagement. The beliefs and enthusiasm projected by teachers has been shown to influence whether or not students find a task to be interesting or relevant (Allexsaht-Snider & Hart, 2001).

As students in their early adolescent years are also finding their place in the world, teachers should link the mathematics curriculum to other subject areas and different contexts. This will allow students to see the global relevancy of mathematics while giving students the opportunity to learn more about their personal interests. Students should not view mathematics as a discrete subject area in the world of knowledge much like their own existence in the broader social network of their community (Kidwell, 2010).

In general, students have been found to disengage from their learning if they do not find the content to be relevant and applicable to their current lives or their future (D’Amato, 1993). D’Amato (1993) asserted that a culturally relevant classroom can increase student engagement. Within such a classroom, teachers should use tasks that respect, complement, and build upon the students’ experiences. Tate (1995) showed that students were more engaged in their learning
when they felt like the mathematical task that they were presented could help the students themselves or help the community in which they lived. In Tate’s (1995) study, the students were presented with a rich task, in which the students investigated the impact of liquor stores in their community. The students used mathematics to present their findings to the local government and successfully advocated for fewer liquor stores within the school’s proximity. Additionally, the students reported that these tasks increased the sense of belonging that they felt towards the school community. As previously discussed in this chapter, students’ sense of belonging can increase their engagement within the social domain.

Although rich tasks can increase student engagement and academic results, Stigler and Perry (1988) shared that a perceived challenge to using these tasks regularly in the classroom is the amount of time that they require. It is not necessarily that the task itself takes much time to implement but that for the students to get involved in the task and benefit from the discussions and discourse that results takes more time than a traditional task would need (Hiebert & Wearne, 1993).

Cooperative tasks can be used to maximize the benefits of cooperative learning and effective tasks. By combining components of effective group work and strong tasks, Watanabe (2012) suggested that cooperative tasks have the following six features: a central big idea, being open-ended, accessible to students of all ability levels, interdependence, individual accountability, and an assessment component. Willis (2010) stressed that cooperative tasks need to be accessible, yet challenging for students. Additionally Cohen (1994) asserted that open-ended tasks force students to debate and discuss as there is no clear-cut answer.

Stigler and Perry (1998) found that the amount of time spent on a task can indicate the degree to which the students were engaged. The longer the duration of the task, the more the
students were invested in their learning. Yet, Doyle (1988) warned that the longer a task, the more opportunities for students to become disengaged in the activity. Doyle clarified that it is not the task itself that could present problems but rather the duration it takes to complete the full scope of the task allows for other possibly disengaging factors to arise.

Student tasks can be rich in terms of being open-ended and challenging, encompassing a range of concepts and can appeal to students’ interests. Additionally, student tasks can allow students to construct their own knowledge of a concept through investigation and inquiry. It is through all of these means that student tasks can be an effective means to increase student achievement (Newmann, Bryk, & Nagaoka, 2001). In the next section, I will discuss how students’ construction of knowledge can support mathematical learning and students’ engagement.

2.3.2.5 Construction of Knowledge

Early adolescent learners like to be in control of their learning. In a meta-analysis of various instructional techniques, Marzano (1998) found that strategies in which students generate and test their own hypotheses about new knowledge have a positive effect on student achievement. Students who perceive that they are in control of their achievement in the classroom have an increased level of engagement in their learning compared to their peers who believe that teachers hold the power to student success (Chapman, Skinner, & Baltes, 1990). The students who felt that their efforts directly impacted their results were the most motivated to learn. Boaler (2002) found that secondary school students who attended a school favouring reform-based approaches outperformed peers at a school that favoured a traditional approach. In this particular reform-based school, students were encouraged to use higher-order thinking and take responsibility for their own learning.
This control of students’ own learning has effects on teachers’ practices as well. Skinner and Belmont (1993) reported that, when students feel that they have a direct effect on their achievement, they tend to be more engaged in the classroom. When these students are more engaged, their teachers tend to more positively support the students’ efforts. Teachers put a more enthusiastic effort into their own teaching and with this dual force striving for student success positive results are more likely to occur.

Teachers also need to ensure that students have adequate opportunities to share their learning. Over a series of three observation episodes in a low-track, secondary mathematics classroom, Hand (2010) found that students’ off-task behaviour increased as a result of the teacher narrowing the opportunities for students to participate in mathematics and articulate their mathematical ideas. In the first observation, students willingly participated in classroom activities and discussions when presented with ample opportunities and encouragement to do so and the teacher praised the students for their participation. When the teacher noticed that some students were not academically prepared to engage in the activities, he restricted opportunities for students to get involved in mathematics activities, as shown in the second observation. During this episode, the teacher focused on students getting the solution to the mathematics problem rather than engaging in a discussion about the process of solving the problem. Thus, the teacher was focusing on the product rather than the process. The third observation was even more teacher-centred and students’ mathematics involvement consisted solely of observing the teacher carrying out mathematical operations on the board. In episodes two and three, the students became disengaged and turned their attention to off-task activities even beginning to resent their teacher’s actions. This study shows the importance of actively involving students in
the process of constructing knowledge through multiple opportunities and of teachers showing respect and encouragement for students’ participation in knowledge construction.

In the student-centred learning environment, teachers will need to take a back seat and allow students to muddle through their emerging understanding on their own. Teachers may step in to guide their students, however, giving students the answer can negatively affect student outcomes (Webb, 1991). Anderson (1989) wrote that teachers can facilitate the learning process through modeling, elaborating that it can be either teachers or students that model in the learning environment.

While students are developing their mathematical understanding, teachers can be a source of encouragement for their students. Teachers should motivate students to be self-monitors of their learning. Self-monitoring is comprised of students checking-in to ensure that they are accurately constructing mathematical knowledge (Schoenfeld, 1983). These “check-ins” can increase student self-confidence and engagement (Henningsen & Stein, 1997).

Open-ended questions can also support students’ developing mathematics understanding (Wimer, Ridenour, Thomas, & Place, 2001). Open-ended questions may elicit higher-order thinking and teachers can focus their questions more on process rather than on product (Reinhart, 2000). Additionally, Reinhart (2000) said that students can feel more included in discussions when wait time is lengthened to allow all students the chance to fully consider their response before the teacher asks for the answer or calls on a student.

2.3.2.6 Technology

Another way that teachers can make mathematics relevant to adolescent learners is through the use of technology (Gee, 2003). Students use technology in their daily lives, and removing this component of their lifestyle would detract from a school’s attempt to provide a
welcoming space to students. Adolescents use computers, the Internet, iPods, gaming systems, and cellular phones, among others. If teachers can incorporate these tools into their teaching, student engagement will be easier to maintain. Teachers may need to put extra effort into integrating technology into their teaching, as many teachers are not as in tune with technology as their students are. Teachers will have to educate themselves about what is the most technologically sophisticated tool and devise a way to integrate it into their teaching (Gee, 2003).

Technology can have benefits on student achievement. In addition to being able to enhance student understanding (NCTM, 2000), one of the most popular technologies used in the mathematics classroom, calculators, demonstrates multiple benefits of technology. Calculators are a more efficient tool to allow students to explore mathematical concepts (Harskamp, Suhre, & Van Streun, 2000). Specifically, graphing calculators with their multiple modes of representing data, support a deeper understanding of mathematics concepts (Doerr & Zangor, 2000). The ability for students to be hands-on with their learning and the open-ended ability to explore concepts also increases student motivation (Phillips-Bey, 2004).

As shown with the example of calculators, technology can also serve as a tool for more active engagement in learning. As described in the section about constructing knowledge, active learning is an effective strategy for student learning. In this section, I will elaborate on interactive whiteboards, virtual manipulatives, and immediate response devices as three such tools.

Interactive whiteboards (IWBs) are interactive devices in which when hooked up to a projector and computer, images on the computer can be projected onto the IWBs and manipulated via a pen, hands, or other specialized devices (Swan, Schenker, & Kratcoski, 2008). Images in the form of pictures, diagrams, animations, and other visuals found on websites
expand the variety of representation forms that students are exposed to when using an IWB (Holmes, 2009). The use of multiple representations has been found to support construction of student mathematical knowledge (Pape & Tchoshanov, 2001).

The interactive and visual characteristics of IWBs lend themselves to be a versatile resource in the classroom. Specifically, this versatility can help teachers cater to the needs of various learning styles (Higgins, Beauchamp & Miller, 2007). This versatility is one of the reasons why IWBs have been found to increase student motivation (Glover, Miller, Averis & Door, 2005), yet, reviews of existing literature show mixed results regarding the effect of the devices on student achievement (e.g., Hall & Higgins, 2005; Kennewell & Morgan, 2003; Smith, Higgins, Wall, & Miller, 2005).

Some research has shown that IWBs reinforce traditional teaching methods in which the teacher is at the front of the classroom and the students’ attention is focused on the IWB and the information that the teacher has chosen to present (e.g., Gillen, Staarman, Littleton, Mercer, & Twiner, 2007; Tanner & Jones, 2007). This contradicts reform-based ideals of student-centred and constructivist learning and could be a reason for the lack of strong evidence that IWBs increase student achievement. Yet, other researchers (e.g., Painter, Whiting, & Wolters, 2005) have found that use of IWBs shifts instruction from a teacher-centred presentation to an interactive mode of learning.

To further dampen its potentially positive effects in the classroom, Reedy (2008) found that teachers using IWBs in their teaching practice, more often used whole-class teaching rather than small group work. With much evidence showing the positive effects of small-group learning on student achievement, teachers may need to be cognizant of the natural tendency to use whole-class teaching if implementing IWBs into their teaching practice.
These findings, however, may be skewed based on early adoption of IWBs by educators who may not be using the technology to its full capacity (Higgins et al., 2007). As IWBs are still relatively new, teachers may not be fully adept at using IWBs in their teaching practice and be able to integrate the technology with already implemented teaching strategies that have already been found to be effective (Holmes, 2009).

Virtual manipulatives have been found to have a positive impact on student achievement (Marzano, 1998). “Manipulatives are concrete or symbolic artifacts that students interact with while learning new topics. They are powerful instructional aids because they enable active, hands-on exploration of abstract concepts” (Cholmsky, 2003, p. 12). There are many reasons why virtual manipulatives may be more effective than physical manipulatives. Clements and McMillen (1996) described one such reason to be that virtual manipulatives dynamically link multiple representations (e.g., graphs, equations, pictures, tables). By using a virtual manipulative, students are able to change data in a table and immediately see the corresponding change in a graph.

One computer program that offers virtual manipulatives is ExploreLearning’s Gizmos. Gizmos are interactive online simulations that are specifically targets for the mathematics and science class for Grades 3 through 12 (ExploreLearning, n.d.). Teachers are able to use Gizmos in the mathematics classroom by projecting a simulation onto an interactive whiteboard or by having students work on individual computer workstations. As there are multiple online simulations per concept available for teachers and students to access and investigate, students are more likely to find a simulation of personal interest. Additionally, if students are working at individual workstations, each student may be working on a different “Gizmo” while still learning about the same mathematics concept. Thus, learning can be much more individualized based on
students’ interests and level of understanding (Cholmsky, 2003). Students can work at their own pace, change to different Gizmos when they see fit, and select Gizmos that are most interesting to them. The interactivity and highly visual nature of Gizmos increases student engagement (Cholmsky, 2003).

In order to fully maximize the interactivity of Gizmos, teachers need to allow students to be in the drive seat and experiment with the Gizmos themselves (Cholmsky, 2003). As such, the role of teachers in this type of classroom shifts towards that of a facilitator in which teachers guide discussions and support their students based on what students have explored and discovered (Clements & McMillen, 1996).

A virtual manipulative, however, needs a host and research has shown that many teachers shy away from teaching advances that rely on a computer due to logistical challenges (Ozel, Yetkiner, & Caprano, 2008). These challenges include the lack of functioning computers, not having access to a computer lab and not having enough computers to ensure that each student will have their own workstation.

Immediate response devices (IRDs) are typically handheld, remote control devices from which students can provide instantaneous feedback to the teacher. Teachers pose their students a question and give students various answers to choose from and. Once students have keyed in their response, teachers can generate class and individual data to inform them of student learning. This data can also guide teachers as they determine next steps in their teaching. IRDs have also been referred to as clickers, audience paced feedback (APF), classroom communication systems (CCS), personal response systems (PRS), and audience response systems (ARS).

Similar to other forms of technology, IRDs provide students with instant feedback about their performance. After students key in their response, teachers can choose to display class data
in the form of percents or graphically. Teachers can also display individual student’s responses. These representations may or may not be anonymous depending on how the teacher has set up the technology. Students may be using IRDs that are registered with their name or even with a pseudonym that allows for anonymity. Teachers can choose to limit the amount of information that they have gathered to be projected for the entire group to see at their discretion. Students can use this data to compare themselves to their peer group (MacArthur & Jones, 2008). Research has also been carried out to show the positive effect of the use of IRDs with student collaboration (Roschelle, Penuel, & Abrahamson, 2004).

IRDs have also been found to increase student engagement due to its game-like nature (Martyn, 2007). The multiple-choice format of questions with an immediate chance to see individual performance and potential competitive environment in which student can compare themselves to the correct answer and their peers’ performance is enticing to many students. Most of the research on IRDs, however, has been done at the post-secondary level (e.g., Nicol & Boyle, 2003; Robertson, 2000; Wieman & Perkins, 2005).

IRDs can also be combined with other strategies that increase student engagement. For example, to take advantage of the benefits of students’ mathematical communication (Premkumar & Coupal, 2008), a means to increase student engagement that I will discuss in the following section, teachers can pose a question to be answered with the IRD. After students input their answers, teachers can view the results without showing them to the students and elicit comments and ideas from the students to rationalize their selection without judgment. Alternatively, teachers can post the class results anonymously and similarly generate ideas and prompt the students to share their rationale for a particular answer. In this way, students will be communicating their ideas and benefit from verbally articulating their thoughts as I will further
discuss in the next section. Premkumar and Coupal (2008) also suggest that teachers use IRDs in small group learning settings.

Technology, in its various forms, has been found to have positive effects on both student achievement and engagement (e.g., Weaver, 2000). Although teachers are aware of the benefits of technology and are beginning to implement technology into their teaching practice, teachers need support in order to reap the full benefits of these teaching and learning tools. It is important for teachers to receive training on how to use the technology in an effective manner and to align with the mathematics curricula (Ozel et al., 2008). Additionally, teachers should be given resources and supports to sustain their professional development with new technologies (Ozel et al., 2008).

2.3.2.7 Students’ Mathematical Communication

The NCTM (2000) advocates for communication as an integral part of the mathematics classroom. Via communication, “ideas become objects of reflection, refinement, discussion and amendment…[and] helps build meaning and permanence for ideas and makes them public” (p. 60). The Ontario Ministry of Education (2005a) also lists communication as a priority in the mathematics classroom.

Student communication has been found to increase student engagement (e.g., Pimm, 1987). Ball (1993) found that students can personally benefit from expressing their ideas and mathematical understanding to peers. Ball reported that, through communication, students will be able to strengthen their own understanding of mathematics concepts and notice any inconsistencies and flaws in their understanding. Webb and Palincsar (1996) stated that students can also take these opportunities of student communication to help their peers and receive help.
In a previous section, I discussed the benefits of small group learning. Noddings (1985) added to the benefits of small-group learning in that it allows students to work more closely towards and gives students more opportunities to speak as compared to a whole class setting. Webb (1991) agreed and shared that verbal expression in small groups promotes student learning. Students who are asked to articulate their rationale or answer “why” questions have been shown to have stronger mathematics knowledge as compared to peers who do not articulate their understandings (Chi & VanLehn, 1991). Additionally, students who are asked to explain their chosen problem-solving approach have shown similar benefits (Martin & Pressley, 1991).

Teachers can also promote students’ mathematical communication via the types of tasks that they give to students. Student tasks that allow opportunities for students to share their findings can increase student learning (Craven, 2000). The mode of student communication can vary, from oral communication to visual or written forms. In fact, the more forms of communication that students have an opportunity to experience as the communicator and receiver of communication can strengthen student understanding (Whitin & Whitin, 2000).

In order for students to feel comfortable to articulate their ideas, understandings and confusions, teachers need to create a safe learning community as earlier discussed in this chapter (Patrick et al., 2007). If students feel that they are being judged by the teacher or their peers, students will not be willing to fully share their thoughts and cannot benefit from communicating in the classroom.

2.3.2.8 Assessment

Students in the junior secondary years are navigating their relationship with their peers. While mathematics teachers need to assess their students’ learning, they should take care in how they frame their assessments. The beginning of secondary school introduces the notion that
students need to get high grades if they are to pursue post-secondary studies. Teachers who foster a competitive environment where there are few winners and many losers will find their students rapidly disengaging from their learning (Wigfield et al., 1991). If teachers nurse the idea that high marks are the only thing of value in secondary education, students who may not be academically able to achieve high marks will become disengaged. By stressing learning for understanding, teachers will be able to retain student interest for all students regardless of their academic potential (Anderman, Austin, & Johnson, 2002).

In these environments where students feel as though high achievers are the most valued, students may quickly become off-task in the classroom as a defense mechanism (Covington & Omelich, 1984). Students may also lose interest in learning if they feel that it is impossible for them to achieve success in mathematics. If students believe that they are unable to reach success, they will become disengaged from learning and as a result of not being actively involved in the learning process, continue to fail (Maheady, Harper, & Mallette, 2001). In a defensive move, students who believe that they are not capable of being successful may attribute their lack of academic achievement to a lack of engagement (Kroeger & Kouche, 2006). Students who believe in their abilities will have a greater chance of being engaged in their learning.

Stereotype threat and its effects on student performance has been researched in a variety of contexts including gender, ethnicity, socioeconomic status, and age (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Croizet, & Claire, 1998; Inzlicht & Ben-Zeev, 2003; Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). Research shows that stereotype threat decreases student performance for those students who belong to a group of which a negative stereotype exists. For low-achieving students who have struggled with their mathematics performance and believe that their peers see them as struggling students, stereotype threat may also be in play (Dweck, 2001;
Ryan & Ryan, 2005). The effects of stereotype threat may begin in early adolescence as it is at this age that students begin to be aware of negative stereotypes and perceptions (Keating, 1990). In general, students with low self-efficacy tend to struggle to perform well on assessments (Pajares, 1996; Pajares & Graham, 1999).

Students who have test-anxiety will quickly disengage in a testing environment (Tobias, 1985). These students, even if fully competent with the mathematics concepts, will freeze in testing situations and their anxiety will interfere with their ability to perform to their capabilities. Teachers can support these types of students by simulating the test-taking context, providing students with mock tests and giving students test-taking strategies.

2.3.2.8.1 EQAO – A Provincially-Mandated Large-Scale Exam

In Ontario, students taking the Grade 9 Applied and Academic mathematics course will write a provincially-mandated large-scale exam. As discussed in the previous chapter, although the results of the Education Quality and Accountability Office (EQAO) exam do not largely impact the student’s result in their course performance, teachers still focus much of their energy in preparing their students to be successful on this exam.

The EQAO is considered a low-stakes large-scale assessment as the results of this exam are not mandated to have an effect on students’ academic success. Schools may choose to count the EQAO exam as part of their students’ final course mark and it is up to the discretion of the school the amount to which the exam is worth and how much of the exam to count. Some teachers mark only the multiple-choice questions from the exam to be counted towards their students’ final course mark, while others may have a combination of multiple-choice and open-response questions. Although the exam is low-stakes, data from student responses to EQAO
questionnaires show that knowing that the exam would count towards a portion of their final course mark was a motivator to take the exam more seriously (EQAO, 2011).

The EQAO exam is comprised of a combination of multiple-choice and open-response questions. The exam is written in two, 2-hour segments and each segment has both multiple-choice and open-response questions. The exam is administered by individual schools and schools vary in whether they have students write the exam during an extended class time or a separately scheduled time. When creating a timed assessment, the length of time that students will generally take to answer a question must be considered. Thus, to ensure that students will have a fair amount of time to complete the assessment, the number of questions must be limited. Due to the limited number of questions that are on the assessment, there is a risk that the content does not appeal to all students nor that they are well-prepared to answer all of them (O’Neil & Brown, 1998). Although the EQAO is a timed assessment, each year, the team behind the exam ensures that the questions are representative of the mathematics curriculum and are accessible to all students across the province.

Senk, Beckman, and Thompson (1997) asserted that, due to the nature of large-scale, standardized exams, these assessments tend to focus on key areas of the curriculum and especially in the multiple-choice sections, focus on low-level thinking. As a result, teachers often use teaching practices that reflect this focus of the exam. This often means that teachers reduce the challenge in their teaching methods and limit the opportunity for students to stretch their academic engagement (Senk et al., 1997).

While traditional multiple-choice questions as described by Senk et al. (1997) tend to focus on low-level thinking in comparison to their open-response questions counterparts, this traditional model of multiple-choice questions was of concern to the EQAO. When the EQAO
was beginning their process of creating their large-scale assessment, they identified that “multiple choice tests were being criticized for placing too much emphasis on facts and procedures and failing to elicit a range of higher order thought processes” (Earl & Torrance, 2000, p. 117). Thus, the EQAO strives to create more complex multiple-choice questions for example, including multi-step problems.

In order to best prepare their students to an upcoming assessment, teachers may allot class time for test preparations. During this time, teachers may review previously learned material, simulating the test-taking context, or provide students with test-taking strategies. Some students, however, find that test preparation adds to their assessment anxiety. A study by Ryan, Ryan, Arbuthnot, and Samuels (2007) reported that student anxiety increases as test preparation time increases.

O’Neil and Brown (1998) reported that open-response questions are more stressful than multiple-choice questions. For students who are already insecure about their mathematics ability, facing open-response questions is additionally intimidating. On large-scale assessments, low-achieving students tend to resort to avoidance, become stressed and are unable to use effective test-taking strategies, (Ryan et al., 2007). Similarly, research by Burger and Krueger (2003) reported that students with low motivation use inappropriate responses on standardized exams. These include writing editorial comments about the test itself or drawing unrelated pictures to the questions themselves. Students tend to have different strategies to solve the two types of questions that appear on the EQAO exam.

Research has shown that when answering multiple-choice questions, students are more likely to use a trial and error or guessing approach (Herman, Klein, Heath, & Wakai, 1994). This
is in comparison to open-response questions where students need to write their response, thus often believe that they are being graded based on their line of reasoning.

Although I previously mentioned that providing students with mock tests and providing test-taking strategies can help students with test-anxiety, teachers should take caution that they are not “teaching to the test”. While teaching to the test can increase student achievement on standardized exams, the extent to which students learned the material is questionable (Smith & Fey, 2000). Additionally, other research found contradicting results in that teaching to the test does not in fact increase student outcomes (e.g., Neil, 2003). The risk of teaching to the test is that teachers may focus so closely on the types of questions presented on the test and narrow the scope of the curricular content taught. These teachers put their students at risk if the test has questions that the teacher did not predict or ask the students to apply their understanding (Herman, 1992). Thus, to balance out the time it takes to develop the skills required to effectively respond to the types of questions posed on a standardized exams and the instruction of a breadth of content knowledge, Volante (2004) suggested that teachers use one to two hours of course time on test-taking strategies.

**2.3.2.9 TIPS4RM – A Teaching Resource**

The Ontario Ministry of Education (2005b) published the Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM) for Grades 7, 8, 9 Applied and 10 Applied Mathematics. This series of teacher resources was created to support teachers as they teach students in their tumultuous adolescent years. “Students in this age group are at a critical, transitional stage where their perceptions of mathematics will help to shape their success in secondary mathematics and their career decisions” (Ontario Ministry of Education, 2005b, p. 1).
TIPS4RM is a research-based resource created by a group of educators and researchers from various schools, school boards, faculties of education, and stakeholders at the policy level.

Within this resource, teachers are provided with tools to strengthen their teaching practice by considering many areas including: instruction, assessment, program planning, mathematics learning, students’ prior knowledge, and cross-curricular connections. The focus of this resource directly aligns with factors discussed in the academic domain for student engagement.

The TIPS4RM resources are comprised of: one-page overviews of the mathematics program per grade targeted by TIPS4RM, a suggested sequence of curricular concepts, a clustering of themes in mathematics as a suggestion for how teachers can deliver their content, summative tasks, and lesson plans. TIPS4RM resources include research-based rationale for its different components and summative tasks, and lesson plans integrate multiple components of mathematics curricula and a variety of learning experiences for students. The TIPS4RM resources were created to meet the needs of adolescent learners and the diversity that is represented in the classroom. Lesson plans and summative tasks hope to be accessible to all students yet provide a challenge to encourage students to achieve more. A student-centred, inquiry-based approach is valued and conceptual understanding is prioritized over procedures and algorithms.

2.4 Summary

Teachers that make pedagogical decisions based on their students’ needs will produce more successful and motivated learners. For early adolescent learners to be engaged, teachers can use rich tasks that are both challenging and relevant as well as implementing technology in their mathematics teaching. If students believe that their efforts directly impact their level of success, they will remain engaged in their learning. This can be taken one step further to say that,
if early adolescent learners believe that what they are learning in the mathematics classroom helps them to attain their future goals, in life or employment, the students will be more engaged (Greene, Miller, Crowson, Duke, & Akey, 2004; Miller & Brickman, 2004; Wigfield & Eccles, 2002).

Adolescent learners are in a period of their life when they are more at-risk of becoming disengaged in the mathematics classroom. These students are learning more about themselves and their surroundings with a heightened sense of self-awareness. Teachers should consider pedagogical decisions to create an inviting classroom environment where these vulnerable students feel safe and employ teaching practices that make mathematics curriculum relevant to their students’ lives. Teachers should engage their students through discussion and collaboration with other students (Posamentier, Smith, & Stepelman, 2006) in order to encourage students to become active learners. Teachers should strive to keep their adolescent learners engaged because engagement has direct implications on student success (Stout & Christenson, 2009).
Chapter Three: Methodology

3.1 Introduction

I used a case study (Yin, 2002) methodology in my study. My goal was to determine how Grade 9 Applied Mathematics teachers felt that they increased student engagement in their class. I used interviews, classroom observations, and teacher journals to report on the teachers’ beliefs and practices.

My study was exploratory and uncovered the strategies and tools used by the teachers. The data analysis highlighted themes regarding teacher beliefs, teaching strategies and practices used to foster and motivate student engagement in the Grade 9 Applied Mathematics course. A qualitative approach was chosen to gain a deeper, authentic and descriptive perspective of the issues being explored (Denzin & Lincoln, 2000). Additionally, a qualitative design was chosen to allow for a more open-ended approach in which through data collection methods, the participants could choose how they would articulate their response (Creswell, 2012). As my study did not investigate the degree to which the teachers were successful or seek to find a value for the teachers practices, a quantitative component was not included.

3.2 Research Design

A case study allows the research to investigate and analyze multiple factors within a defined object of study (Flyvbjerg, 2006; Merriam, 1988; Smith, 1978; Stake, 1995). My study consisted of observational case studies (Bogdan & Biklen, 1998) that were examined to uncover the teaching practices used by three Grade 9 Applied Mathematics teachers. I also analyzed teacher journals and teacher interviews to explore teacher beliefs and rationale of observed practices. These multiple data sources provided a richer story to complete my cases. My collective case study (Stake, 1995), “in which multiple cases are described and compared to
provide insight into an issue” (Creswell, 2012, p. 465) allows three examples of teaching approaches to increase student engagement within the Grade 9 Applied Mathematics course.

A constant comparative method (Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1994) was used for my study. As such, data collected and analyzed in earlier parts of the study were more explorative and key issues, recurrent events, and activities that were noticed became categories of focus for later parts of the study. This earlier data informed both data sources collected and the analysis process. These core themes were further examined through the lens of pre-existing research about these concepts and I looked for additional examples of these themes in each of the participants’ teaching practice during classroom observations and in teacher journals. I also further investigated these themes by asking participants about these areas in teacher interviews. Final analyses were made with these core themes in mind.

3.2.1 Research Context

The Learning Consortium was a partnership between the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT) and the four public school boards in the Greater Toronto Area. The goal of the Learning Consortium was to improve “student achievement through exemplary instruction and assessment practices and enhanced leadership capacity” through various projects as prioritized by the Consortium (OISE/UT, 2010). Most recently, the Learning Consortium chose to focus on the Grade 9 Applied Mathematics program, and created the Collaborative Teacher Inquiry Project.

Phase I of the Collaborative Teacher Inquiry Project (McDougall, Jao, Maguire, Stoilescu, & Gunawardena, 2010), focused on teacher collaboration as a means of professional development for the improvement of instructional strategies in the Grade 9 Applied Mathematics program to improve student achievement in mathematics. This project spanned three consecutive
academic semesters, beginning in December 2008 and concluding in May 2010. Components of Phase I included: professional development workshops on areas of school focus (e.g., technology, student tasks, assessment), time for teacher collaboration and co-planning amongst and across school teams, an administrators meeting to discuss implementation of new teaching strategies, school visits by the researchers to observe classes and interview participants about their experiences with the project, and a final session in the form of a research celebration during which school teams presented new components of their Grade 9 Applied Mathematics program that were developed as a result of the Collaborative Teacher Inquiry Project. Eleven schools across the four school boards participated in this phase of the initiative.

Phase II of the Collaborative Teacher Inquiry Project began in September 2010 and concluded in June 2012. The goal of Phase II remained unchanged (i.e., teacher collaboration as professional development to improve instructional strategies in Grade 9 Applied Mathematics), however only two out of the four original school boards chose to continue with the project. There were twelve schools participating in Phase II of the project. Four out of the eight schools from one school board and one out of the four schools from the other, had also been involved with Phase I of the project. Components of Phase II were similar to those of Phase I.

In the project, each participating school had a team comprised of an administrator, a Curriculum Leader or Department Head of Mathematics, and between two to five teachers. The roster of teachers was varied, from those who had been part of the project since the beginning of Phase I, to those who had just been part of the project since the beginning of Phase II, and finally, those who had been a part of the project for just one or two semesters. Often teachers discontinued participation in the project if they were not teaching the Grade 9 Applied Mathematics course during the particular semester in which the project was taking place.
3.3 Participants

I approached teachers from schools participating in Phase II of the Collaborative Teacher Inquiry Project to participate in my study. Some of these teachers had also been involved in part of Phase I of the Collaborative Teacher Inquiry Project. As a result of their participation in the project, the teachers were engaging in professional development sessions and were actively focusing on improving their instructional strategies for the Grade 9 Applied Mathematics course. In keeping with the project’s goals, the teachers’ involvement in the Collaborative Teacher Inquiry Project increased the chances that they were experimenting with and using a variety of teaching strategies and tools to increase student achievement.

As part of the Collaborative Teacher Inquiry Project, all teachers participated in an introductory interview facilitated by an OISE/UT research team. These interviews were approximately 45-minutes in duration and were semi-structured. Questions posed to the teachers related to the teacher’s background, goals, and ideas about success and student engagement. Teachers were also asked questions about the school in which they teach; this allowed for contextual elements of the teaching and learning environment to be better understood. The questions used in this interview can be found in Appendix A.

The selection criteria for my study were as follows. During the introductory interview, if a teacher mentioned student engagement as a key feature of their goals for teaching or ideas of student success, they were invited by e-mail to participate in my study. Furthermore, when asked about student engagement, teachers who shared that they were aware of how the type(s) of teaching strategies or tools used in a lesson may affect student engagement were also identified as potential participants for my study and were similarly approached. Potential participants were briefed on the goals of my study and the commitment that it would entail and teachers who were
eager to participate were chosen to be a part of my study. This briefing was done individually with potential participants in person at a professional development workshop hosted by the Learning Consortium as part of the Collaborative Teacher Inquiry Project.

At the final Collaborative Teacher Inquiry Project workshop of the 2010-2011 academic year, which took place in May 2011, I received verbal confirmation from five teachers that they were interested in participating in my study. At the time, they were unsure as to whether they would be teaching the Grade 9 Applied Mathematics course in the first semester of the 2011-2012 academic year, thus I said I would follow up with them towards the end of the summer.

Upon following up with these five teachers, all five said that they would be teaching the Grade 9 Applied Mathematics course in the first semester of the coming year, however two teachers removed themselves from the study for personal reasons. The remaining three teachers – Benjamin, Mathieu, and Nadia – were still enthusiastic to participate in my study.

Each of these three teachers were keen to having me visit their classrooms even prior to the start of my study. In getting to know the then-potential participants during the Collaborative Teacher Inquiry Project, the three teachers invited me to visit their classes at my convenience. In these introductory visits, I could see the passion that the teachers had for increasing student engagement in their Grade 9 Applied Mathematics classes. All three teachers took time before and after my introductory visits to communicate their enthusiasm for my study and were eager to describe their perceptions, pedagogies and practices. It was clear that I had three motivated participants for my study. In the following chapter, I present the case studies of Benjamin, Mathieu, and Nadia. A more detailed description about the academic and professional background of each of these teachers is presented in the next chapter.
3.4 Data Collection

My study took place during the first semester of the 2011-2012 academic year from October 2011 to January 2012, inclusive. Although the teachers started teaching in September, all participants shared that they were quite busy at the beginning of the year and wanted a chance to get settled into their class routines. I gathered data from three sources: 1) classroom observations; 2) teacher interviews; and 3) teacher journals. One set of interview data was collected from Benjamin, Mathieu, and Nadia (all names are pseudonyms) prior to the start of my study – the Collaborative Teacher Inquiry Project introductory interviews. All three participants consented to me using this interview data. The remaining data came from classroom observations, additional teacher interviews, and teacher journals collected during my study.

3.4.1 Classroom Observations

I observed each of my three participants an average of six times as they taught their Grade 9 Applied Mathematics class; Benjamin was observed 6 times, Mathieu 7 times, and Nadia 6 times. The dates of these visits were scheduled based on convenience in both the teacher’s and my schedule. Benjamin and Nadia were both teaching at the same school (Blessed Star School), so I selected days during which I could observe and interview both teachers. This meant visiting Blessed Star School on days when Nadia taught first thing in the morning, followed by a prep period during which I could interview Nadia, then meeting with Benjamin for an interview during his lunch period and joining him in his class that afternoon. For Mathieu at Newcastle School, I opted to visit on days during which he had a prep period immediately after teaching the Grade 9 Applied Mathematics class as this made it easier for Mathieu and I to conduct classroom observations and teacher interviews more efficiently.
For each of the classroom observations, I was in the class for the entire duration of the one hour and fifteen minute teaching period. I would start the class by sitting at a desk towards the back of the classroom that was out of the way of the students and their classroom activities. I would engage with students if they initiated conversation, but this hardly ever happened. For the most part, they seemed to ignore my presence in the classroom. At times, during group work activities, I would move around the room, in a similar style to the teacher’s so as to not create a different pattern of adult behaviour in the class, while more closely observing teacher and student behaviour and listening to student-student and teacher-student discussions and conversations.

For the majority of the classroom observations, I would write notes immediately after the class ended about what I had observed and potential follow-up questions with the teachers. I chose not to take field notes as the lesson was taking place to allow my presence to be more discreet and appear less evaluative. In some lessons towards the end of the semester, once I believed that the students were used to seeing me in the classroom, I took field notes in situ to better ensure that I captured a more detailed account of classroom events, reactions, and record words spoken during the lesson.

Regardless of when I took notes about my classroom observations, I wrote down details of specific events that happened during the lesson. I made sure to include the course content that was covered, the teacher’s strategy or strategies employed to teach the material, the teacher’s interactions with students, and teacher and student actions and reactions. I also made notes relating to my initial interpretations of how teacher and student actions and reactions were perceived by other members of the class and some preliminary ideas of the rationale for actions and reactions so that later when I went back to this data I could use my own initial reactions to
guide and inform my analysis. Additionally, I highlighted some recurring themes or areas that needed further investigation. Many of these themes were further explored in subsequent teacher interviews.

### 3.4.2 Teacher Journals

Each participant was invited to keep a journal for the duration of my study. I asked teachers to write as often as possible. At the beginning of the study, I provided participants with some prompts that they might use to frame their journal entries (see Appendix B). Teachers were given the option of hand-writing or typing their responses. I proposed that typed journal entries would be directly e-mailed to me upon completion of the entry and written responses would be collected weekly.

As the scope of my study did not include examining the development of each teacher’s practices, it was not essential for the teachers to reflect on changing practices throughout the duration of the study. It was, however, important that I collected journal entries in a timely manner so that I could use emergent themes from earlier journals to develop core themes that would be focused on and inform the unfolding of the study.

Only two out of three of my participants completed the journal writing although all three participants did start the study intending to write journals. The teachers’ frequency in writing journals and decision to continue or desist journal writing are further explored in the findings section.

### 3.4.3 Teacher Interviews

As previously noted, the teacher interviews of Benjamin, Mathieu, and Nadia conducted for the Collaborative Teacher Inquiry Project were used with participant consent for my study. Additionally, I interviewed the teachers for my study to follow up on practices seen in classroom
observations and emerging themes from these classroom observations and teacher journals. These interviews took place immediately before or after the observed lesson depending on the participant’s schedule. For Nadia and Mathieu, interviews happened immediately after classroom observations and for Benjamin, the interviews took place immediately prior.

The interviews were informed by themes that were starting to develop as a result of initial analysis of introductory interviews, classroom observations and the teacher’s journals. The interviews that took place with Benjamin before the classroom observation of that day were open-ended. Although I began the interview with some idea of the themes that I wanted the teacher to elaborate on, the direction of the interview depended on ideas expressed by the teacher. The interviews that took place immediately after classroom observations with Mathieu and Nadia followed more of a semi-structured format.

Although I asked teachers about themes emergent in other data sources, I also asked for the participants to debrief their lesson and explain their beliefs about and rationale for observed practices. I also had the participants reflect on how the lesson went and on students’ reactions to their lesson. The list of introductory questions for these follow-up interviews is found in Appendix C.

All interviews were audio-taped and transcribed. I transcribed each interview verbatim and participants had the opportunity to review transcripts of their interviews if they wished. Participants also had the opportunity to add their own comments, clarify and elaborate on their thoughts if they wished. None of the participants chose to do this.

3.5 Data Analysis

Qualitative analysis software, Nvivo9, was used to efficiently organize and perform a multi-faceted data analysis to uncover trends and patterns in the data. Using a constant
comparative method (Glaser & Strauss, 1967), earlier data were analyzed soon after data
collection to decide upon core themes that would be further investigated in remaining study. I
drew upon previously existing literature about student engagement for which potential themes
could be created and began coding through the use of “coding families” (Bogdan & Biklen,
1998, p. 172). Apart from setting/context codes that helped me to organize the data sources,
codes were mainly created to fit within families of “definition of the situation” (p. 172),
“perspectives” (p. 173), “strategies” (p. 175), and “relationship and social structures” (p. 176)
codes. Within these coding families, I created more specific codes based on characteristics of
student engagement and supplemented this with specific recurring themes for each participant.

3.6 Ethical Considerations

My study was reviewed by the Office of Research Ethics of the University of Toronto
and was granted approval for completion. Pseudonyms for teachers and the schools were used in
this study to ensure confidentiality. Specific details about the location of the schools have been
omitted. Participants first verbally agreed to be part of this study and then signed a formal
consent letter (Appendix D) to confirm their participation.

The participants were recruited to join the study if they met selection criteria as described
in an earlier section of this chapter, however it was up to the individual teacher whether or not
they wished to participate in the study. The participants could participate as much as they wanted
(as evidenced in Mathieu’s decision to not complete teacher journals) and could stop at any time.
Participants were reminded that pseudonyms would be used and all interviews were confidential.
Chapter Four: Findings

4.1 Introduction

This chapter describes the teaching practices of the three Grade 9 Applied Mathematics teachers, Benjamin, Mathieu, and Nadia. I first describe the school contexts of my participants to provide a better understanding of their teaching context. I begin each case study by describing the academic background of the teachers and some of their professional goals. I then describe each teacher’s beliefs and teaching practices within the social and academic domains for student engagement. Each of these domains are further elaborated on through factors that the teacher considers and acts upon. Each case study will conclude with a summary of the important findings from the teacher.

4.2 School Contexts

Although I did not explicitly seek out teachers that taught at the same school or at different schools, two of my participants do teach at the same school and the effect of this will be further explored in their case studies. Mathieu teaches at Newcastle School and Benjamin and Nadia teach at Blessed Star School. The context of the school and resources and opportunities provided to the teachers affects their teaching practice so I will provide a brief background of the school contexts here.

4.2.1 Blessed Star School

Blessed Star School is a co-educational secondary school, located in the Greater Toronto Area. It is a Catholic day school offering courses from Grades 9 through 12 and enrollment is approximately 1300 students. The school follows a two-semester academic school year. Blessed Star School is known for its many extra-curricular activities and boasts programs and clubs in athletics, and the arts. Sports teams offered for boys, girls, and co-educationally include:
badminton, baseball, cheerleading, cross country, dragonboat racing, hockey, rugby, soccer, track and field, ultimate frisbee, and volleyball. Arts programs are offered within the dramatic arts, visual arts, and music. Some examples of clubs offered include: Student Council, Reach for the Top, Chess Club, Knitting Club, Liturgical Choir and Yearbook.

The administrative team at Blessed Star School is comprised of a principal and two vice-principals. The school is organized into departments and there are a number of teachers who are members of one department, but teach across several disciplines. Support staff at Blessed Star School is comprised of administrative assistants, educational assistants, custodial staff, and student supervisors. A social worker and police officer are also affiliated with the school.

The Grade 9 EQAO mathematics results from the 2011-2012 academic year show that, for the Grade 9 Applied Mathematics group just over half of students (53%) are meeting Provincial expectations (Level 3 or 4). Blessed Star School students scored higher than Board (39%) and Provincial (44%) averages. These results are a combination of the first (during which my study took place) and second semester classes from the 2011-2012 academic year. Additionally, 14% of the participating students received one or more accommodations, 11% of students were classified as English Language Learners and 18% of students have special needs (excluding gifted).

Over the past five years, the percentage of students at the school taking the Applied level exam who scored at or above the Provincial standard has been between 21% and 53%. The results from 2008-2009, 2009-2010, and 2010-2011 showed a decrease from 32% to 30% and finally 24% respectively. There has been a marked increase in school results in the past two years, from 24% to 53%.

Table 1 shows a more detailed breakdown of the school’s results over the past five years.
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Table 1: Blessed Star School Grade 9 Applied Mathematics EQAO results over time.

It is worth highlighting that Blessed Star School participated in only Phase 2 (2010-2012) of the Learning Consortium’s Collaborative Teacher Inquiry Project during which time only Benjamin and Nadia were teaching the Grade 9 Applied Mathematics course at the school. In the first year of their participation, the school’s EQAO results decreased from the previous year, and in the final year of the project, during which my study took place during the first semester, Blessed Star School’s Grade 9 Applied Mathematics EQAO scores showed a marked increase.

### 4.2.2 Newcastle School

Newcastle School is a public secondary school offering Grades 9 through 12 in a semestered format. The school is situated in the Greater Toronto Area. Over 80% of Newcastle students identify with a primary language that is not English and approximately 20% of the students at the school have lived in Canada for less than five years. Enrollment of the school is approximately 1800 students. Newcastle School is led by a principal and a team of three vice-principals. The academic program at the school is divided into 12 departments.

Newcastle School offers students a variety of sports teams, clubs, and activities to get involved in. Some of the sports teams offered include: archery, basketball, curling, hockey, soccer, swimming, and track and field. Clubs range from those in the mathematics, science, and technology disciplines, to those in music, art, and drama. The school also has special interest clubs, for example, Debate Club, Model United Nations, and Yearbook.
The Grade 9 EQAO mathematics results from the 2011-2012 academic year show that approximately 15% of students taking the exam took the Applied level course. The results for the Grade 9 Applied Mathematics group show that the majority (61%) of students at Newcastle School are meeting Provincial expectations (Level 3 or 4). The school is scoring higher than the Board (34%) and Provincial (44%) averages. Additionally, 33% of the participating students received one or more accommodations, 44% of students were classified as English Language Learners and 26% of students have special needs (excluding gifted).

Over the past several years, the percentage of students taking the Applied level exam who are at or above the Provincial standard has fluctuated. Results from 2006-2007 through to 2008-2009 were fairly consistent, increasing slightly from 27%, 29%, to 30%, respectively. From 2009-2010 through to 2011-2012, there were more fluctuations in overall results. In 2009-2010, there was a significant improvement in results with 50% of students scoring at or above Provincial expectations, then dropping to 40% the following year and then increasing again, most recently to 61%. In the year that the score dropped to 40%, the school had experimented with encouraging more special education students to write the exam and they did rather poorly. The 61% was based on the previous format and showed an increase from the 50% two years earlier.

Table 2 shows a more detailed breakdown of the school’s results over the past five years.

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Table 2: Newcastle School Grade 9 Applied Mathematics EQAO results over time.
Newcastle School participated in both phases of the Learning Consortium’s Collaborative Teacher Inquiry Project. Mathieu taught the Grade 9 Applied Mathematics course throughout the entire duration of the project (seven semesters), but he was the only teacher at the school who remained a constant in the teaching team. In the final year of each phase of the Learning Consortium project, school results increased. This included the final year of the project, during which my study took place in the first semester.

4.3 The Case of Benjamin

Benjamin attended university in Australia where he completed a Bachelor of Education (concurrent) in physical education and mathematics. After teaching in Australia for three years, Benjamin taught in various countries before settling in Canada with his family. At the start of his career, he mostly taught courses in physical education but, since moving to Canada, has found that he is becoming more involved in teaching mathematics. Benjamin is currently in his fourth year teaching at Blessed Star School. Prior to teaching at Blessed Star School, he taught at a small private school in the same city where he taught Grades 11 and 12 mathematics and physical education courses.

He currently teaches courses in both the Physical Education and Mathematics Departments at Blessed Star School. During the time of this study, Benjamin taught one class of each of the Grade 9 Applied and Academic Mathematics courses in addition to a Grade 9 Boys Physical Education course. He is also the numeracy lead for the school; this role entails attending meetings to discuss numeracy initiatives at the school and board level and the direction of the numeracy program at Blessed Star School.

Although Benjamin feels comfortable teaching mathematics at all grade levels, he shares that the subject did not come naturally to him. He says, “I was always good at mathematics, but I
was not sensational at it. I had to work my backside off in university to get through the courses. And I found university mathematics really hard” (Benjamin interview, December 20, 2011). This experience allows Benjamin to sympathize with struggling students and he advocates that hard work can pay off in a subject like mathematics. Benjamin attempts to have a balanced effort on his part in that he is supportive and encouraging of his students as well as providing the best learning opportunities for his students to succeed.

At Blessed Star School, Benjamin teaches the Grade 9 Applied Mathematics course with a co-teacher, Carol. Carol has taught for 10 years at Blessed Star School. She teaches in both the Science and Mathematics Departments, but calls Science her home department. Out of the three courses that she teaches each semester, two of them are science and one is mathematics. Carol has taught a range of courses in each department from courses at the Grade 9 Applied level through to Grade 12 Academic. Carol attended a university in southern Ontario for her undergraduate degree in biology and mathematics and completed her teaching certification in New York. This allowed her to get a teaching license for both Ontario and New York State. It also gives her a head start should she decide to pursue a Masters degree.

Although Carol enjoys teaching mathematics, she says that she does not have any desire to get her Honours Specialist in the subject. Carol shares that, although she initially wanted to choose a different career path, upon volunteering in a secondary school classroom after her first year in university, she fell in love with the profession. She says that her experience volunteering gave her a chance to see all facets of teacher life. She says of her experience and how it helped her decide to become a teacher:

I absolutely loved it. I did marking, I helped out in the classroom, and I got to see the teacher life and I did it for two years, May and June at the end of my first year and second year. I loved it and knew I wanted to do it. Kind of an easy decision actually. (Carol interview, November 7, 2011)
This semester was the second time that Carol and Benjamin have co-taught the Grade 9 Applied Mathematics course together.

Benjamin chose to type his journal entries and would sometimes e-mail me single entries or groups of journal entries when he remembered to do so. Benjamin started the study writing journal entries every couple of days, but as the semester continued, his entries were more infrequent, perhaps being completed once a week, and not at all in the final month of the study. In each of the journals towards the end of the study, Benjamin would always apologize for not having written more often, but citing that he had been so busy with other commitments that he did not have a chance to get around to writing. When I interviewed and observed Benjamin in the final two months of the study, he would also apologize for not writing journal entries more often or not writing them at all. All of Benjamin’s journal entries were written to reflect on an already taught lesson. Benjamin would share the content of the lesson, the strategies that he used, his perception of how the students responded to the lesson, and his own reflection about the success of the lesson. At times, Benjamin would also write about professional development events that influenced his thoughts about the Grade 9 Applied Mathematics course. This included workshops from the Collaborative Teacher Inquiry Project, workshops that he had organized with feeder school teachers, and workshops with other secondary school teachers from neighbouring schools in the school board.

Benjamin hopes to improve the academic results of his Grade 9 Applied students. He shares that this is an obvious goal because the government, school boards, administrators, parents, students, and teachers all want to see a quantifiable improvement or result by students. Benjamin says that his goal is to get over a third of his students to perform at or above the Ministry standard on the EQAO but would ideally like to get over 40% of the class at that level.
Although Benjamin has goals to increase the academic results of the students in the Grade 9 Applied Mathematics course, he asserts that it is more important for him that his students are engaged and interested in learning. In his words, he says that his goals are to “increase marks, obviously, so I would love to get their marks higher on the EQAO” (Benjamin interview, November 7, 2011), but he has much more to say about increasing student engagement:

I do not know if passion’s the right word, but it is what I would love for them to [have]. Some level of excitement whether it is for mathematics or English or Physical Education. So they feel engaged. I think that is the biggest thing. That they want to come to the class and when they are there, they feel like they are doing something that is interesting and is different from what they did yesterday. (Benjamin interview, April 19, 2011)

Although a focused goal of increasing student academic outcomes is one of Benjamin’s goals, he also values student engagement as being important in his teaching practice. I will now discuss the approaches that Benjamin takes to increase student engagement highlighting areas in both the social and academic domains as components of his teaching practice.

4.3.1 Social Engagement

In this section, I describe the beliefs and actions of Benjamin that target the social needs of his Grade 9 Applied Mathematics students as he increases student engagement. Benjamin asserts that student engagement will increase if students are able to develop relationships with their teacher and other students in the Grade 9 Applied Mathematics classroom. Additionally, Benjamin acknowledges that his students feel insecure due to their stage in development as well as their previous struggles in the mathematics classroom. Thus, Benjamin creates a community in which his students feel safe and are willing to participate. Benjamin further emphasizes to his students that being part of a learning community can ease individual concerns by modeling various successful communities in which Benjamin is a member.
4.3.1.1 Developing Relationships

To increase the social engagement of students within his Grade 9 Applied Mathematics classroom, Benjamin develops relationships with his students by connecting via personal interests that are common to both Benjamin and the student. Benjamin does this by asking about a student’s personal interests and by sharing a variety of experiences outside of the mathematics classroom. Additionally, Benjamin creates opportunities and encourages students to develop relationships with other students in the class as he understands that peers have a strong influence on one another at their stage in development.

Building relationships, connecting with students, and helping students to develop as people are all integral to Benjamin’s teaching practice. Benjamin knows that, if he does not treat the students like people first (rather than just as mathematics learners) and respect them for who they are the students will not develop as effectively. He says:

I simply could not overstate, for me, how important building relationships with kids is. If you do not show them the respect and just make them valid people, it does not matter what sort of wonderful things I was doing in my classroom, it does not matter. If you are not a person respecting teacher [sic], it does not matter what you do, they are just not going to be engaged. (Benjamin interview, April 19, 2011)

The relationships that Benjamin developed with his students are what he is most proud of when reflecting back on the semester. Benjamin directly attributes some of the academic successes and positive feelings towards mathematics that the students developed as a result of the relationship that he developed with students. He says:

I always take pride in the relationships that I get with kids by the end of the semester. And probably Lauren was a really good example. That she felt…I think she enjoyed mathematics by the end of the semester. Genvieve, to go from being really socially withdrawn to making jokes and what other people are talking about was really good. So they were the biggest positives for me. (Benjamin interview, January 31, 2012)

Benjamin describes a variety of contexts in which he gets to know his students and develop relationships with them individually. These include: as a teacher in a summer remedial program
for incoming Grade 9 students, as a physical education teacher, and as a coach of extra-curricular sports teams.

During the summer prior to the 2011-2012 school year, Benjamin facilitated the numeracy portion of a remedial summer program in which incoming Grade 9 students could attend to enrich their mathematics skills. During this program, the students got to know Benjamin as well as other soon-to-be peers.

Teaching in the summer school program and his role as a physical education teacher at Blessed Star School gives Benjamin additional opportunities to develop relationships with students. He shares:

I taught the summer school with all of these kids and I was doing physical education, I have a different relationship with them. I think that helped me in the start with this class that they knew who I was. And they felt like they could have a bit of a relationship with me because I was Physical Education so those kids who are interested in sport, Victoria, one of the girls in particular, really liked the fact that I was the physical education teacher, because we had fun in the summer, so she was good. (Benjamin interview, January 31, 2012)

Benjamin also believes that the relationship that he developed with his students was fast-tracked because many of them had met him prior to the start of the school year. By being a familiar face to students as they started at a school where the building, the teachers, and the majority of the students were unfamiliar, Benjamin was able to make an early connection with the students.

As the coach of various extra-curricular sports teams at the school, Benjamin has yet another opportunity to develop relationships with students outside of the mathematics classroom. Benjamin says of this, “Usually I would have coached four or five [students] through either rugby or basketball. And that is usually a really easy way to relate to them” (Benjamin interview, January 31, 2012).

Benjamin shares that being a coach at the school and developing relationships with students outside of the mathematics classroom has its benefits. He says:
I think that is a huge benefit for me that I do coach throughout the entire year so I build relationships with kids that otherwise would not come across. It might be the problem kids in my classrooms and I just do not have problems with kids in my classroom and I think a lot of it is got to do with the fact that I see them outside of the classroom. (Benjamin interview, April 19, 2011)

Benjamin also shares that he develops relationships with his students by speaking with them individually. Benjamin will have conversations with his students on a variety of topics, from common interests to interests that Benjamin knows that the student enjoys.

Benjamin notes that there are different ways that he tries to connect with his students. The following quote describes one such strategy:

The fact that getting to know them and knowing what they are doing outside their school and asking them questions about that is huge. And it gets easier the longer you are in school because you get to know their brothers and sisters and parents and you can sort of have those discussions as well. I think the longer I teach, the more I realize that that is my starting point for student engagement and student achievement I think, is building relationships. (Benjamin interview, April 19, 2011)

Thus, when Benjamin talks to his students, he connects with them on a personal level based on students’ non-academic interests.

Benjamin says that, if there is not an obvious shared interest between himself and a student, he will use a student’s extracurricular commitment as a way to connect with the student. Benjamin says that he will use “some aspects that they are doing in school whether it is a play or whatever” (Benjamin interview, January 31, 2012). Benjamin says that knowing more about a student’s interests becomes fodder for future conversations or ways to develop a relationship with the student. Although Benjamin may not be involved with, for example, the school’s drama program, he can use the knowledge that a student is in the school play as a way to connect with them.

Benjamin may also choose to ask a student about a hobby or interest from outside of school life:
I find it very useful to engage personally with them. “How did this go?” Some of them like to stay behind and talk about what is going on in the football over the weekend or the Raptors game. I think that is awesome with kids. (Benjamin interview, January 31, 2012)

Benjamin says that all teachers will develop different types of relationships with students based on their personalities and experiences. He says that his co-teacher, Carol, developed a particularly strong relationship with one student based on a similar experience. “Carol had a good one because she told the kids about her cancer and then Marlene…went through a similar thing. So they had a really strong connection” (Benjamin interview, January 31, 2012).

Although Benjamin tries to connect with his students on a personal level and believes that this relationship is foundational to the student becoming engaged in his classroom, Benjamin shares that sometimes it is difficult to make connections with students. Benjamin finds it easy to make friends and will use different topics that he knows many students are interested in to try to engage with his students, however, there were some students whom he was not able to connect with. Benjamin shares his confusion about how to reach out to some of his students:

They are just at that stage where they are not interested in things and doing things. So the normal conversations that I would have about sports or music or whatever they are involved in and interested in, they just…they pretty much were not interested in anything. So I find that hard as a person. Not even as a teacher, just as a person, it is hard if you cannot find a common ground. (Benjamin interview, January 31, 2012)

Benjamin shares that, although sometimes it may be difficult to develop a relationship with a student, it is well worth the effort. Benjamin describes one example where, as a result of a language barrier, he found that he was unable to connect with two students, but over time and a continued effort to socially connect with the students, student engagement increased:

That effort [of developing a relationship] really pays off. Nancy and Renata…they are not ESL students, but they are very close to…they must be barely above. Because their English was a real problem for them in the questions as well. But they seemed to really come out of their shell and engage a lot more with the class. They were ones that the first half of the semester, would not answer a question of their own volition. They would answer if I asked them, but by the end they were actually putting their hand up and being
involved and not scared to have the wrong answer. Or not scared to say it in the wrong way, which in an Applied class is huge. (Benjamin interview, January 31, 2012)

Benjamin acknowledges that, without a personal connection with these two students, they may not have taken the risk to engage in the class. It was Benjamin’s efforts to get to know the students on a personal level and to create a safe classroom environment that helped encourage these two students to feel comfortable enough to participate in class. As a result of their increased participation, the students could develop their mathematics knowledge more efficiently because they could reshape their understanding as a result of instant feedback from their participation.

Benjamin created a learning environment in which his students could develop relationships with other students in the classroom. Benjamin knew that the students would want to rely on their peers for support, thus he encouraged students to work together and develop bonds amongst classmates. Benjamin gives an example of a student within whom he saw a behavioural shift as a result of developing relationship with her peers:

Genvieve…she was another one that really, she would not say a word and by the end of the semester, she was engaging and she was laughing. She built good relationships with the people around her and [at the beginning] she seemed like she was socially, pretty scared and stuff. (Benjamin interview, January 31, 2012)

Benjamin’s description alludes to the fact that the social component of his students’ experience in the Grade 9 Applied Mathematics classroom is integral to their level of engagement in the course. While the classroom environment that Benjamin created most likely contributed to Genvieve’s growth in the class, the fact that she built relationships with her peers, felt comfortable with them, and enjoyed interacting with them was very important in her ability to engage in learning.

Genvieve’s ability to interact with peers is important especially since Benjamin integrates many activities that involve group work and discussions. Genvieve’s level of engagement in the
classroom also is due to Benjamin’s purposeful seating arrangement. Had Benjamin not placed Genvieve close to the students with whom she had developed good relationships, she could have remained withdrawn in the classroom and may not have been as engaged as she was. I further describe Benjamin’s use of the physical arrangement of the classroom to support student engagement in a later section about learning environment as a factor of academic engagement.

The example of Genvieve is not unique in Benjamin’s classroom. Benjamin also describes another student, Lauren, who made a positive shift in her engagement as a result of feeling comfortable with her peer group.

I think the fact that Dana who [Lauren] is really good friends with, was engaged, that helps a lot. Lauren was one that I worked hard on building a relationship with. And she seemed to like it. Lauren was one that really started to ask questions at the end. And rather than sitting there and pretending she knew [the answer], Lauren would actually find out what she did not know and Marlene, the girl beside her, actually, improved a lot as well. (Benjamin interview, January 31, 2012)

These two examples support my assertion that, for adolescent students, feeling comfortable with their peer group can positively affect their learning.

Benjamin fosters relationship development amongst peers so that the students feel a part of the learning community and feel more socially engaged in the classroom. Later, in the section about academic engagement, I will discuss how Benjamin uses cooperative learning to further peer to peer relationships to get students academic engaged in their learning.

**4.3.1.2 Developing Student Self-Confidence**

Benjamin believes that Applied level students are already more insecure about their mathematics abilities. He explains that previous to secondary school during which they are streamed by ability level, from Kindergarten to Grade 8, all students, regardless of ability, were in the same class. Benjamin believes that, as a result, the Applied level students have gone through their schooling feeling like they were the weakest students in the classroom. Benjamin
says for his students, “They are so used to getting things wrong” (Benjamin interview, January 31, 2012). He elaborates on this and uses it to justify why the students are so hesitant to be engaged in his classroom and unwilling to participate in class discussions at the beginning of the semester.

Last year, three months ago, at the start of that semester, they were in a classroom with such a huge range, Locally Developed all the way through all the way through to gifted kids, so why would they say anything? The chances of being wrong are enormous. And it is easier for them, in all walks of life, it is easier for those kids to be the funny kid and to mock other people and to sort of, get by being loud and messing around, then it is to delve into the academic side of things. (Benjamin interview, January 31, 2012)

Benjamin’s final thought indicates that he does not believe that classroom management issues in the Applied level classroom are indication of the true nature of the students in his classroom, but are instead symptomatic of years of being the weakest student in the class and feeling insecure about their academic abilities.

Benjamin is an encourager and this could be his coaching side coming into his teaching practice. Benjamin shares that he will often give positive reinforcement to boost students’ morale and when he senses that students are struggling or have had a bad day, he will pull them aside to give them a pep talk. Benjamin says of his approach, “At the end of the class [you] hold them back and talk to them and continue to encourage them that ‘You can do this.’” (Benjamin interview, January 31, 2012). Benjamin further shares an example of a student who thrived as a result of his encouragement:

We talked to [Shawn] because he was all about laziness and not wanting to put in any effort in. To push him to do more. And then [Shawn] actually talked to me at the end about perhaps going to do the transfer credit and trying Academic. That was awesome because I thought he was just going to spend the whole semester doing nothing. It was good that he realized that he can do something as well. (Benjamin interview, January 31, 2012)

As the students are already tentative about their mathematics abilities, in order for the students to engage, they will have to take risks. These risks include, among others, answering
questions, participating in discussions, responding to peers, and interacting with the learning material. Benjamin describes how a safe classroom environment is prerequisite to student engagement:

   My goal in teaching is to create an environment where kids feel safe so that they are encouraged to take risks. And if students do not feel safe and they do not feel comfortable with me as a teacher, and if they do not feel comfortable with their peers, in terms of, “He is not going to say anything if I get this wrong”, then they are not going to take a risk. They are not going to answer questions, they are not going to ask questions, they are not going to delve deeper because they do not want to look stupid for not knowing something they do not want to look wrong. (Benjamin interview, January 31, 2012)

In general, Benjamin’s students have low self-confidence in the mathematics classroom. Socially, his students are insecure about their abilities and Benjamin knows that he needs to cater to this social challenge in his adolescent learners.

   Benjamin says that he has noticed that, especially for the Applied level students, they seem to be more supportive of one another. He says, “They do not tend to laugh and mock someone for making a stupid answer, which is weird” (Benjamin interview, January 31, 2012). This is reassuring to Benjamin because it is these students who are most socially vulnerable.

   In this section, I describe how Benjamin creates communities in his learning environment to support his students so that they feel emotionally supported. I will further describe specific teaching strategies that Benjamin uses to reinforce this positive learning environment in subsequent sections about academic engagement.

4.3.1.3 Creating a Community

   Benjamin creates a community where students are able to chat with their peers. Benjamin also ensures that he is available to answer any questions that students may have as they work. He regularly walks from table to table, checking-in with students and encouraging as they go about their work. In fact, Benjamin ensures that the students have multiple points of contact if they want support from an expert.
Benjamin teaches his class with a co-teacher, Carol, and also has a peer helper (a senior student from the school) in the room. Benjamin always ensures that there is a helper available to interact with the students. For example, while Benjamin is setting up his laptop at the beginning of class, Carol is chatting with the students. This is to ensure that the student feels like they always have an access point to this mathematics community.

Since Benjamin knows that his students have low self-confidence in mathematics, he creates a community where asking for help is welcomed and students feel safe in doing so. Benjamin says of this:

I really try to encourage kids to communicate when they do not understand something, either with each other or with me so that they are not letting – not to let kids slip through the cracks. Being positive with kids, with the language that I am using with kids, giving them access to different styles of learning and expressing their styles of learning. (Benjamin interview, April 19, 2011)

Benjamin has a teaching goal to create a safe classroom community. He shares that this safe learning environment will allow students a comfortable space to take risks, because his students are so insecure about their mathematics abilities. When asked about how successful he feels in achieving this goal, Benjamin reflects that his classroom was a safe space as evidenced by the amount of student participation.

Benjamin is happy with the classroom environment that he creates because his students are comfortable in taking risks and still continue to take risks even if their earlier input was mathematically incorrect. Benjamin describes his feelings about the classroom environment that he has created: “I felt like [the students] were asking lots of questions and I felt like they were willing to say something and if it was wrong, still answer another question later in the class” (Benjamin interview, January 31, 2012).

Benjamin shares that his ideal classroom environment is easily created by reminding students of the values that the school aims to instill. Benjamin says that teaching at a Catholic
school lends itself to a common foundational set of values that students and teachers are familiar with, if not share. He admits that these are values that could be translated into a secular context, but the connection to biblical contexts makes highlighting the values that he hopes are enacted on in the classroom, easier. Benjamin describes this:

At the start, I talk a ton about the fact that we are in a community and try to relate that to being in a Catholic school. No different really in being in any school, except that you can marry it to the fact that there are Bible references to this and this is what Jesus wanted us to do. I would still say exactly the same thing in any classroom, I just would not intertwine it with Jesus. But that is a big thing. (Benjamin interview, January 31, 2012)

Benjamin then continues to describe how these religious values should encourage students to be supportive of one another and to create a community amongst peers. Benjamin recounts one example where he noticed some girls not being supportive of another female student in their class. He said to the students, “You are destroying this community, we need to be a community with each other. That does not make someone feel good” (Benjamin interview, January 31, 2012).

In addition to the classroom community that Benjamin creates within the Grade 9 Applied Mathematics classroom, Benjamin is part of various professional communities that he hopes act as positive models for his students. He hopes that these models with inspire his students to engage in similar communities within their peer group. One of the professional communities that Benjamin is a part of is his teaching partnership with Carol and additionally, Benjamin and Carol have teamed up with Nadia, as the other teacher of the Grade 9 Applied Mathematics course. Together, the three of them make up the Grade 9 Applied Mathematics teaching team at Blessed Star School and meet to discuss the program goals, share ideas, and co-plan components of the course. Benjamin describes how he subscribes to the community that he has created with Carol and Nadia:
I guess working as a team towards [our] goals is a huge help to moving towards [a community feel]. It is going to create success across the board in our classrooms and I guess what we need to do is be proactive in sharing that with other teachers. Really working with them to get that happening in their classrooms as well. (Benjamin interview, April 19, 2011)

Benjamin firmly believes that, through working in a community, teachers will improve their school’s programs. On top of this, students will see their teachers working as a community and will in turn do so with their peers. Benjamin cites the Grade 9 Applied Mathematics teaching team as one of the most important contributions to his enjoyment of teaching the course and reason why the school has such a positive program.

Benjamin has valued collaboration and believed in its benefits. Even before he started co-teaching with Carol and working with Nadia, he shares that, in Australia, he found that teachers would collaborate more often than they do in Canada. Benjamin claims that:

Co-teaching is not big in this school. I do not know if it is big anywhere because it requires you to give up a lot of your own time. You are not giving up your own time. I found there was more of it in Australia. You were encouraged a lot more to go and look at someone else’s class, work together to plan a class, see how you teach with other people, and that sort of stuff. I do not really see that as much here. I have a little bit of experience doing that at home. (Benjamin observation, November 7, 2011)

Benjamin also says that he not only learns new strategies from his colleagues, but he also is motivated by their energy and enthusiasm for teaching. Of Nadia, Benjamin states:

That is what is great when you have talked about being supportive of the partner. Nadia is a very passionate teacher and she is fantastic to work with because when she does something and it works, she gets really excited and she works really hard at finding new things as well, so it has been really supportive. (Benjamin interview, April 19, 2011)

Benjamin acknowledges that being part of a community can be emotionally beneficial. The actions and emotions felt by other members of the community transfer into Benjamin’s practice. Although Benjamin feels that teaching the Grade 9 Applied Mathematics course can, at times, be disheartening, being part of a community in which other members are so passionate and enthusiastic about their work encourages Benjamin to put forth his best effort.
Although collaborating as a Grade 9 Applied Mathematics team is of great benefit, the strongest community that Benjamin has is with Carol, his co-teacher. Benjamin believes that this collaboration with Carol has improved his own teaching practice and allows his students the benefit of having two teachers in the classroom. The students can also see a successful collaboration being modeled by the teachers and Benjamin hopes that his students will similarly value the collaborative approach in their own learning of mathematics.

Benjamin believes that creating a community is an important contributor to the success of a Grade 9 Applied Mathematics class. This was also a focus between Benjamin and Carol as they collaborated about how they would approach their class. In describing the effort that Benjamin put forth into creating a community within the classroom, Benjamin says:

I tried to do more this semester than we have done previously. I guess it is been a transition to that with Carol. Engaging the kids in group oriented learning and investigation and coaching in pairs about what they might do wrong. If we do not encourage that fact that you are in a community and you are a little bit responsible to everyone else, then I do not think that works. (Benjamin interview, January 31, 2012)

Benjamin’s words indicate that specific teaching strategies help support the sense of community that he hopes to achieve in his classroom. He emphasizes that students should be respectful of themselves, their peers, and their teachers and feel a sense of responsibility towards the rest of the classroom community at all times. These are ideals that Benjamin himself models. Although his students do not directly see the collaboration that takes place between all three members of the Grade 9 Applied Mathematics team, the students definitely see how the co-teaching partnership of Benjamin and Carol works. The students are able to see that Benjamin and Carol respect one another and put forth an effort to ensure that their co-teacher feels valued and responsible for all components of the course.

As the school’s Numeracy Lead, Benjamin organizes events that support the mathematics program at his school. One of Benjamin’s initiatives is to build a stronger relationship between
Blessed Star School and its feeder elementary schools in the area. The teachers from the feeder schools come together with the three Grade 9 Applied Mathematics teachers at Blessed Star School to create another community. Benjamin hopes that by planning events for mathematics teachers from Blessed Star School and the feeder schools, lines of communication will open up. Benjamin also hopes that the teachers will better understand the types of learners that are in their classrooms and the types of things that the students are doing in the elementary schools as well as later on in secondary school. Most of the teachers participating are familiar with either elementary or secondary teaching and have no knowledge of the curriculum and instructional approaches used in the other teaching context. Benjamin hopes that, through his initiative, teachers will develop an understanding and sympathy for educators in the other panel.

Last year, Benjamin organized this community for the first time. Leading up to the one-day event, Benjamin and Nadia met with two Grade 8 teachers in a feeder school that was located directly across the athletic field from Blessed Star School. The four teachers co-planned two lessons (one for Grade 8 and the other for Grade 9) together on a topic shared by both the Grade 8 and 9 curriculum. Prior to the event, Benjamin describes what they will be doing:

We are planning a lesson on the Pythagorean theorem with the elementary teachers and we are going to go over there and teach that with them and the other four schools are going to come in and observe and then we are all going to come over here and we are going to team teach a 9 Applied class. So the planning and the following strands through and building relationship with the elementary teachers and the kids that are coming into our school seeing this is part of it. It benefits them as well. (Benjamin interview, April 19, 2011)

In addition to this community being beneficial for the teachers involved, the Grade 8 and 9 students whose classes participated in the event witnessed first-hand another successful community. Additionally, Grade 8 students also met Benjamin during this lesson and much like the students who said that they benefited from meeting Benjamin in the summer program, these students in Grade 8 could walk into their new environment at Blessed Star School with at least
one familiar face as a teacher. The Grade 9 students enjoyed seeing some of their former teachers again and as the feeling of an elementary school classroom, including the layout of the classroom and the atmosphere in the school, can be quite different, the Grade 9 students may have benefitted from a familiar face of a teacher whom they may have fond memories of.

As a result of the safe community that Benjamin has created, he is able to get the students to participate in classroom discussions and learning activities. I return to this idea in a subsequent theme of Encouraging Oral Communication where I discuss specific strategies that Benjamin uses to further encourage student participation.

4.3.2 Academic Engagement

When asked what teachers can do to increase student engagement, Benjamin responds:

I think the biggest thing is to try to vary what they are doing. Give relevance to things while they are doing something to start and to provide opportunities to see it in different ways. See different types of solutions, using manipulatives, using technology so that the kids are not just staring off at the back of the room. (Benjamin interview, April 19, 2011)

From this quote, we can see that Benjamin considers a variety of teaching strategies to appeal to the academic needs of his Grade 9 Applied Mathematics students. Benjamin believes that planning for a variety of strategies including: assigning relevant and open-ended tasks, manipulatives, technology, and allowing for student-centred learning will increase student engagement. In this section, I elaborate on each of these considerations.

4.3.2.1 Strategic Program Planning

Now in his fifth semester teaching the course, Benjamin believes that he has a good structure in place and is now modifying this structure and improving upon its current components. Benjamin explains that he is taking different components of the course and adding new ideas to the course in order to improve the program. Upon getting a sense of the type of
student taking the Grade 9 Applied Mathematics course, he is able to tweak the course to increase the level of student engagement. Benjamin says:

> I have got all of the resources there and it is just fine tuning it. I feel like we just keep fine tuning and adding and finding new things, totally in a positive way, not in a sense that it is a bad thing, continually looking at how can we make this better, how can we make this more interesting, how can we check that they are learning, we can we make it in a way that they are going to be more successful on their final exam and EQAO. (Benjamin interview, November 7, 2011)

Benjamin shares that the Grade 9 Applied Mathematics team’s planning involves ensuring that there is a variety in its teaching. He says, “Our planning is just going through the booklet and eliminating things that we think are redundant” (Benjamin interview, December 14, 2011). The team always considers the variety of activities that they are presenting and thus, if the teachers find that the activities in a booklet are redundant, they may decide to streamline the booklet and remove overlapping activities.

Benjamin finds that when compared to students in Academic level classes, Applied level students are more demanding in the types of strategies that they find engaging. He says of this, “In an Applied class, if it does not appeal, they will completely switch off” (Benjamin interview, November 7, 2011). Thus, Benjamin is more purposeful when planning this course about the types of strategies that he will use.

### 4.3.2.2 Focusing on Each Learner

Benjamin believes that one of his greatest challenges is meeting the needs of each and every one of his students in his Grade 9 Applied Mathematics class. He says:

Meeting individual needs, I just think that is a challenge for every single teacher. I do my best to and I continue to try to improve and think of different ways and I certainly now use learning styles as a discussion point with the kids. Why would you use this method in comparison to that. I do not think that anyone could be perfect at that. I think that is the hardest thing in any classroom. You have got all of these kids and they learn in different ways. They come in with different levels of pre-requisite knowledge and getting them into the right thing. (Benjamin interview, December 20, 2011)
Although he tries to vary the teaching strategies and activities that he uses in his teaching, Benjamin finds it to be an ongoing challenge to ensure that all of his students are involved and engaged in their learning.

Benjamin acknowledges that getting to know his students as best as possible can be helpful when deciding how to approach his teaching. In taking an idea from his colleague, Nadia, at the beginning of the semester, Benjamin gives his students a survey to help him know a little bit about his students. Benjamin describes the types of questions on the survey:

[The survey has] some pretty direct questions about what do you like, what has been your best mathematics experience and then sort of leaning from there into more personal things. What do you do outside of school, that sort of thing. (Benjamin interview, April 19, 2011)

After the students have completed the survey, Benjamin takes time to read them so that he can adapt his teaching to address some of the concerns or preferences that his students mention in their surveys. Benjamin also reviews this survey again later in the semester. He says of this, “I usually go back at midterms and read them again and try to get an understanding of where they have come from” (Benjamin interview, April 19, 2011). His thinking indicates that re-reading might help to remind Benjamin of the needs of individual students so that he can continue to make appropriate decisions in his teaching practice. Additionally, the answers to some of these survey questions also gives Benjamin some ideas of topics of interest that he might use when speaking with individual students to develop a good relationship with them. This teacher-student relationship is an important component of how Benjamin increases social engagement for his Grade 9 Applied Mathematics students.

Benjamin highlights that each of his students are unique and have different needs, learning styles and strengths. Benjamin says, “What works for one [student] works for the other, does not work for one, does not work for the other. That sort of thing” (Benjamin interview,
January 31, 2012). Thus, Benjamin endeavors to find out details about individual students, and will adapt his teaching to cater to his students. Of this differentiated instruction, Benjamin says, “I think that is very important” (Benjamin interview, January 31, 2012).

Benjamin says, “I think there is a greater range of learners in an Applied class than there is in an Academic class” (Benjamin interview, November 7, 2011). Thus, in order to meet the needs of individual students, Benjamin believes that working with students individually or in smaller groups is more effective. In the setting of the classroom with the entire group of students, Benjamin finds it difficult to meet the needs of each of the students all of the time. He finds that, by splitting the class into smaller groups, he is able to individualize his instruction directly to the students in these smaller groups. In a later section, I will discuss how Benjamin uses small groups for cooperative learning to increase student engagement more generally, however in this section I will focus on how small groups help meet individual student’s needs.

Benjamin feels very fortunate that, for the past couple of years, he has had the opportunity to have a co-teacher in his Grade 9 Applied Mathematics class. He knows that, for the next semester, he will not have this luxury. Benjamin knows that the students will benefit from having another teacher in the classroom. He believes that the individualized attention that his students will receive, and the possibility of being able to divide the students into smaller groups for individualized attention and remedial work, is something that the students enjoy and will benefit from. For these reasons, Benjamin is working to have an Educational Assistant (EA) in the room. He says:

I will continue to push for [an EA] next year because I think that is enormously helpful. I asked Amy to speak to Resource about making sure that we have an EA in each class and one that is very mathematics orientated. (Benjamin interview, January 31, 2012)

Benjamin believes that Amy, the Department Head of Mathematics at Blessed Star School, can be an advocate for additional supports in the Grade 9 Applied course. Benjamin’s final words
indicate that it is not just having another teacher in the classroom that will help the students, it is having another adult who has the mathematics content knowledge. The individualized attention that the students receive must be subject specific for it to be of benefit.

Benjamin further discusses how the ratio of teachers to students makes a difference in student learning. He identifies the average size of the Grade 9 Applied Mathematics classes as being smaller than their Academic counterparts and acknowledges that the school administration realizes that these students will not thrive in an environment in which they do not get individualized attention: “[The administration] does a good job of keeping [the Applied classes] fairly small. Especially with two teachers in there, it is not a bad size” (Benjamin interview, April 19, 2011). Benjamin continues by saying that the ratio of teacher to student has also been improved by having a peer helper in the classroom. A peer helper is a senior mathematics student who is in the classroom with the class for the entire semester and can act as an extra support for students. Benjamin says that the peer helper is another way that his Applied level students can get the specific and individualized attention that they need. He says:

If you are lucky enough and you get a Grade 12 student who is a good mathematician that can sort of be your helper. A peer helper - that is a benefit as well. (Benjamin interview, April 19, 2011)

Some of Benjamin’s students have Individualized Education Plans (IEPs). While these students are able to seek individualized support from the Resource Department, Benjamin believes that these students’ individual needs will still be met if they stay in the classroom and get individualized attention via small groups or one-on-one assistance from Benjamin, Carol or the peer helper. Benjamin believes that, if the students with IEPs leave the classroom to go to the Resource Department for help, they will miss out on being part of the learning community. He says: “If they go to Resource, they just work on their work and they get a bit of extra help.
Whereas [in] a small group…they would know exactly the same stuff, but being the small group, they get [individualized] help” (Benjamin interview, December 14, 2011).

Benjamin is purposeful in his planning to create the opportunity for small group work so that his students will get more individualized attention. Benjamin writes, “Carol and I have already divided up the delivery of the content, and plan during this unit to remove more often a small group of students who would benefit from the extra attention” (Benjamin journal, November 8, 2011). Benjamin describes one instance in which he was working with a small group and first mentions how an individual student who usually would not engage in learning was able to thrive in this more intimate learning environment:

I took a small group of four to the library and was really impressed with how productive the students were. One student, who really tries to 'hide' in class was forced/encouraged by the size of the group to contribute a lot more and it was a lot easier to assess his prerequisite knowledge. (Benjamin journal, October 24, 2011)

Benjamin continues by describing how another student’s needs were met as a result of the more individualized attention afforded by the small group setting: “Another student at the end of the period mentioned how much better she understood the concepts when she was able to ask questions straight away” (Benjamin journal, October 24, 2011).

Although Benjamin believes in giving students individualized attention with multiple teachers in the classroom and working with students in smaller groups, the wide range of levels makes it difficult to truly meet the needs of each and every one of his students. Benjamin proposes a strategy that he hopes Blessed Star School will adopt to further meet the needs of these struggling students: “Something that I would like for next year is actually having Grade 9 specific Locally Developed credit in the first semester” (Benjamin interview, January 31, 2012). Benjamin believes that the weakest students in the Applied level class should take this Locally Developed class in the first semester of their Grade 9 year before taking the Grade 9 Applied
course in the second semester. In these even smaller classes with a smaller range of abilities of students, teachers will be able to give students even further individualized attention and remediate the students’ mathematical skills. He says of this option:

I think that is really important. I think so many people are closing doors for their kids by putting them into courses where they are not going to be successful rather than, do this course because you have only got 40s and 50s all the way through elementary school? Go and do Locally Developed and see if we can get your foundations to a level where you can be successful in Applied and then try that. (Benjamin interview, January 31, 2012)

4.3.2.3 Developing a Learning Community

As mentioned in the section on social engagement, Benjamin fosters a learning community in his Grade 9 Applied Mathematics classroom so that all students in his class feel included and engaged. In this section, I will share how Benjamin uses the physical layout of the classroom and small group, cooperative learning to support this learning community.

Benjamin notes that the physical layout of the classroom, and where the students are situated within it, can affect student engagement and their ability to feel part of the learning community. Benjamin’s classroom is set up with students seated in rows, but within each row, the students are seated in pairs. This is a set up that remains consistent throughout the semester and is related to how the classroom is set up not only for Benjamin’s class but also for other teachers who also use the classroom. Even if Benjamin wanted to move his students to a different arrangement, the hassle of having to move the desks to his preferred arrangement, and then back to the traditional arrangement that other teachers in the school want to preserve prevents Benjamin from setting up his classroom in a different arrangement than is provided to him. Nonetheless, given these constraints, Benjamin is still able to assign seating to his students in such a way that can positively affect the learning environment.

At the beginning of the semester, the students could choose where in the classroom they wanted to sit. After noticing that one of the students, Mitchell, was quite chatty sitting at the back
of the classroom, Benjamin shifted students around in an attempt to eliminate the chatting.

Benjamin shares the result:

He was shockingly chatty for the first two months. So when we re-ordered it, he really engaged and he started to write his work down. He went from a 60 to probably a 75. I think he is a lot more confident in his ability. (Benjamin interview, January 31, 2012)

In this situation, there were two benefits of moving this student away from the back of the classroom. Firstly, Benjamin had a quieter classroom and thus could put more of his energy towards teaching rather than worrying about the noise level in the classroom. Secondly, Mitchell was better able to engage with the learning community and as a result, his marks improved.

### 4.3.2.3.1 Cooperative Learning

Benjamin alters the size of learning groups to increase student engagement. In the theme of *Focusing on Each Learner*, I discussed how Benjamin did this to meet the needs of individual students. In this section, I discuss how small group cooperative learning helps promote the classroom community and benefits all students. Benjamin says that the opportunity for students to interact with one another and learn cooperatively has positive repercussions for student engagement.

The desks in Benjamin’s classroom are arranged in rows, facing the front of the classroom. Within each row, students are seated in pairs and this facilitates the ability for students to work in small groups. Usually when working small groups, the students work in groups of three or four. As it is cumbersome for students to turn pairs of desks to face each other, the students whose backs would naturally face the fronts of their group members often sit on their chairs sideways and share the same desk space as their group members. Sometimes, when working together for shorter periods of time, while two group members sit in the paired desks, the other members of their group will work standing up.
Benjamin describes that the teaching strategies he uses complement the classroom environment that he would like to create. To support the sense of classroom community, Benjamin uses group investigations and peer coaching on a regular basis. He shares that he mentors the students on how to engage in these activities: “If we do not encourage the fact that you are in a community and you are a little bit responsible to everyone else, then I do not think that works” (Benjamin interview, January 31, 2012). Benjamin says that, without the guidance of a teacher, the students might not have the necessary skills for successful small group work or peer coaching.

To further reinforce the idea that each student is an integral part of the learning community, Benjamin creates learning situations in which each member of the group has a contribution to add and responsibility to be engaged in the activity. Benjamin describes an example in which all of his students were engaged in their learning and, as a result of the atmosphere that Benjamin had set up right from the beginning of the semester, students knew their roles and responsibilities and worked towards a common goal.

Today’s lesson was a good example of differentiated instruction where [groups of] students were allowed to pick any two of the six composite shapes displayed and calculate the area. Most pleasing was that all but one of the students were willingly involved in the group work, and I think this was enhanced by having each group nominate a scribe, calculator and coordinator - we will continue to experiment with that 'designation' within group work in the future. (Benjamin journal, October 3, 2011)

**4.3.2.4 Using Rich Student Tasks**

Benjamin believes that moving away from the textbook is something that the students will positively respond to. Benjamin shares that he used to be more traditional as he would use examples from the textbook and assign many questions from the textbook for homework. Over time, he realized that the students were not interested in learning in this way and that instead they responded well to opportunities to do a variety of activities. As explained by Benjamin: “In terms
of the Grade 9 Applied, getting away from the textbook, getting away from giving them pages of stuff to do. The variety of activities that I have [since] learned about is really good” (Benjamin interview, January 31, 2012). Now, Benjamin uses a greater range of tasks that he believes will increase student engagement.

Benjamin uses the Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM) resource to provide a student-centred and constructivist learning environment. Additionally, Benjamin finds that the tasks in the TIPS4RM resource present material in a way such that tasks have overlapping topics. Thus, the tasks seem to be richer.

Benjamin describes an example of this:

The TIPS4RM booklet got away from the \( y = mx + b \). It talked about it as the dependent variable equals rate of change times the independent variable plus the starting or initial value. I really liked that. The unit overlap was really good. (Benjamin interview, January 31, 2012)

Benjamin thinks that the investigations found in the TIPS4RM resource were richer and the end result of these investigations was that the students would come up with the formulae on their own or at least recognize the relationships between the contents. The students have the dual benefit of constructing their own understanding of a concept (to be discussed in the Student-Centred Learning theme) as well as completing investigations that are rich and encompass many concepts.

4.3.2.5 Student-Centred Learning

Benjamin was introduced to TIPS4RM during the Collaborative Teacher Inquiry Project. He describes how other participants in the Collaborative Teacher Inquiry Project discuss the effective teaching strategies using in their schools:

Teachers think [TIPS4RM] is fantastic and that is what their kids like. Everything else they were talking about, we were doing, and TIPS4RM we were not doing, so I guess we felt that was the next step to take. The range of activities that they were using and that there is more investigation. (Benjamin interview, November 7, 2011)
After hearing so much about the TIPS4RM resource, Benjamin thought it was worth taking the time to learn more about the resource and perhaps implement it into his own teaching.

Benjamin believes that student-centred investigations are beneficial to student learning. He describes the investigations that are provided in the TIPS4RM resource: “I feel like the TIPS4RM ones, particularly the measurement and volume unit, they gave [the students] a little bit of ownership about where formulas were coming from” (Benjamin interview, November 7, 2011). Benjamin continues by saying that this approach is different to how he used to teach the Applied level students and that the students tend to enjoy being in control of their learning and coming up with the formulae themselves:

When we talk about it in the past, we have ended up just saying, “Here are the formulas, go use them.” Whereas now, the kids had an idea of where the formulas were coming from and I undervalued that for Applied students. (Benjamin interview, November 7, 2011)

Benjamin’s students seemed more interested in learning when they were the ones generating the information, elaborating that:

TIPS4RM really stressed that they spend time understanding where they are coming from. I felt like our kids were much more comfortable using formulas because of it. Through investigation, they felt like they discovered it. And I guess therefore they have got ownership so they care about it rather than just, “What formula do I use” and then try to plug it in and have not comprehension of what the variables were or why a cone is related to a cylinder in terms of its volume. (Benjamin interview, November 7, 2011)

Benjamin reflects that, for the Applied level students, coming up with the formulae on their own is a valuable part in their learning. Additionally, he notices that the students seem to retain the information far longer than they would had he provided the formulae to them.

4.3.2.6 Using Technology

In regards to the use of technology in the Grade 9 Applied Mathematics classroom, Benjamin says, “The kids like it. They are more engaged” (Benjamin interview, November 7,
In discussions with Benjamin regarding why the students seem so interested in technology, Benjamin says:

They are on computers all the time, they understand computers. The kids are visual learners. Particularly with Geometer’s Sketchpad. And how quickly they learn with Geometer’s Sketchpad. How quickly they learn how to use it and how to measure things is awesome. It takes me longer to go through the lab than it takes them a lot of the time. At least the good ones. I think the fact that it is on their terms, it is huge. Not to always have me speaking. (Benjamin interview, November 7, 2011)

Benjamin believes that his students are thirsty for technology to be used in their learning environment. Benjamin says his students are never seen without their cellular phone and iPods or other electronic devices, thus it would be unnatural for them to be deprived of technology for that one hour and fifteen minutes.

Benjamin also says that the use of technology creates variety in his course and prevents his students from having to listen to him speak all the time. Benjamin believes that his Applied level students find technology to be appealing and if they do not have a chance to use technology in the mathematics classroom, they will not be as interested in learning the material. He believes that his students are technologically inclined and that their learning will be much more efficient and engaging if they have the opportunity to use technology in the classroom.

Benjamin notes that students in his Grade 9 Applied level class are tech-savvy and more often than not, more comfortable with technology than Benjamin is himself. Benjamin notices that his students are more willing to experiment with the technology and even if they do not immediately know how to use it, they will persevere and learn how to use the technology very quickly. He writes, “A number of the students surprised me with their technological capabilities” (Benjamin journal, October 27, 2011). When reflecting on the class earlier that day in which the students were in the computer lab using Geometer’s Sketchpad to investigate shapes, Benjamin is surprised by how engaged the students were in their learning. He writes in his journal, “Some
of the students who are not avid workers in the classroom were really productive in [the computer lab]” (Benjamin journal, October 27, 2011).

Benjamin also believes that technology allows the mathematics content to be more sensory to the students. Benjamin feels that most of his students are visual learners who would benefit from seeing a visual representation of the concept or being able to physically manipulate objects as they would via the SMART Board technology. Benjamin shares his beliefs about the strengths of technology as a teaching tool and his observations on how his students responded to the use of the SMART Board in one particular lesson: “We were doing [the activity] on the SMART Board and using the TIPS4RM. They were making awesome connections between tables of values and graphs and equations. They can actually make the connections” (Benjamin interview, January 31, 2012).

Among the many other strengths of the TIPS4RM resource, as discussed in earlier themes, Benjamin shares that TIPS4RM can be used in conjunction with technology. He describes, in a journal entry, an example of how TIPS4RM resources can be used with SMART Board technology to allow greater student interaction:

We worked on first differences and making the connection between constant first differences and a linear graph. Being able to demonstrate the graph and flip from page to page on the SMART Board is making a huge difference in explanation. It allows the teaching to be very direct and allows for increased student interaction as they really love to come up and show their answers on the board. (Benjamin journal, November 17, 2011)

Benjamin reports that the students were engaged in their learning and enjoyed having the chance to interact with the material via the SMART Board technology. Not only did they enjoy the activity, but Benjamin was also able to see that they understood the concept as well. “Students were not allowed to leave today until they answered an exit question related to the content and all but two students were correct on their first attempt” (Benjamin journal, November 17, 2011)
Benjamin discusses another attractive quality of the use of technology in the Grade 9 Applied Mathematics classroom. In speaking about an investigation on Geometer’s Sketchpad in which the students discover various properties of triangles, Benjamin says that this technology is student-centred and, similar to other student-centred approaches, helps encourage student engagement. In a journal entry, Benjamin reminds me of his perception of the value of student-centred learning: “I think the value of investigation in mathematics is enormous, particularly as it relates to ownership and a more thorough understanding of the concept” (Benjamin journal, October 27, 2011). It is clear that Benjamin views inquiry-based approaches to learning as a way to strengthen students’ mathematical knowledge, and the use of technology as a means to facilitate this process to match his students’ affinity for technology.

Benjamin does, however, note that, although there are many benefits from taking his students to the computer lab and using the technology to allow students to learn through an inquiry-based approach, that there will always be some students in his class that do not respond well. Benjamin writes:

The challenge in [the computer lab] was keeping students on track. It is becoming apparent that there are a few students who struggle to maintain focus regardless of the environment and in a more open computer lab, there is more room for the mind to wander. (Benjamin journal, October 27, 2011)

Although the majority of students enjoyed working in the computer lab, were engaged in the mathematics investigation, and developed a richer mathematics vocabulary, Benjamin acknowledges that some students continued to be disengaged from their learning.

In Benjamin’s school, the computer lab is directly adjacent to the library in which other students, teachers, and staff members can be chatting or acting as a distraction to Benjamin’s students. Other students who are not in Benjamin’s class are also allowed to use the computers in the lab (if there are extra computers), and they too are distractions for Benjamin’s students. At
times, these students are watching videos on YouTube and this immediately catches the attention of Benjamin’s students, distracting them from the mathematics investigation that they would otherwise be completing.

Yet, despite this challenge, Benjamin still believes that technology is a valuable component of his Grade 9 Applied Mathematics program. In his journal, he writes of the positive feedback that he receives from students regarding the use of technology in the course:

It was interesting to read student feedback completed at the conclusion of the previous unit which revealed that - they had enjoyed using [Geometer’s Sketchpad] and the SMART board, they did not enjoy writing out the glossary of terms (surprise, surprise!).

(Benjamin journal, November 8, 2011)

From the students’ feedback, Benjamin is reminded that the students enjoy the integration of technology into their classroom. Benjamin’s joking personal response to his students commenting on not enjoying a more traditional means of reinforcing concepts (i.e., writing out the glossary of terms related to the unit of study) shows that he already recognized that this traditional format for learning would not be well received by his students.

**4.3.2.7 Encouraging Oral Communication**

Benjamin worked to set up a safe community in which otherwise hesitant students may feel safe to participate (as discussed in the earlier theme of *Creating a Community*), Benjamin creates opportunities for his students to practice their mathematical communication skills. These opportunities further allow Benjamin’s students to feel a part of the learning community and increase their self-confidence.

The focus of student mathematical communication is something that the entire Grade 9 Applied Mathematics team at Blessed Star School has been working on. Benjamin shares the team’s intentions:

Communication is one that we have certainly worked with. We have talked…about how this year, more than any other year, trying to get kids to ask a lot of questions, trying to
work now on using the EQAO questions, mapping responses and getting them to explain or comment on and positives in others. Ask questions whether they understand it. Write down and explain their answers. I have heard that is really moving kids along and we have had a lot of discussion in the 9 Applied team about how best to facilitate it. (Benjamin interview, April 19, 2011)

The team has come up with a variety of instructional strategies to support student mathematical communication. Benjamin says: “We are trying to get them to talk in sentences, starting to mature in their mathematics language and feel free to explain things in any words that they want” (Benjamin interview, December 20, 2011). Benjamin shares that developing students’ mathematical communication allows the students to strengthen their understanding, gives the teachers an opportunity to determine the level of student understanding, and creates a platform for students to ask questions if they do not understand the material.

In regards to strengthening student understanding, Benjamin has found that, when students write their solutions to a problem, they often make small mistakes that could have easily been caught had the student just reviewed their work. Benjamin says that his students, more often than not, do not bother taking the time to review their work. Benjamin wants his students to:

[Be] able to justify things and they were able to talk their way through things and they were able to explain their thinking and following the steps when they were doing problem solving in terms of reflecting on their, well, sometimes reflecting on their answer. (Benjamin interview, January 31, 2012)

By speaking through their ideas, Benjamin believes that the students will have to review their ideas in order to come up with a plausible oral explanation. In addition, Benjamin requires his students to answer in a thoughtful manner. Benjamin says, “You have to say full sentences and you cannot say, ‘I do not know’, you have to give some sort of answer” (Benjamin interview, January 31, 2012). This requirement encourages students to engage in the material so that they can respond with a complete answer.
Benjamin shares that he knows that students are engaged if the classroom environment is full of energy and noise. He says:

I think [an engaged] classroom [has] got some healthy noise in terms of kids communicating and using language that is interesting. With kids giving full sentence answers when they are giving answers and lots of that sort of why question to each other. (Benjamin interview, April 19, 2011)

Not only are students to talking to one another, but Benjamin also wants them to talk purposefully. Benjamin is thus motivated to provide opportunities for his students to develop their mathematical communication skills so that they can talk purposefully with ease.

Benjamin shares that it is important for students to see a model before having to perform it themselves. He noticed that his students seem to be weak or inexperienced with giving oral presentations, and thus, it is important to scaffold his students’ learning by providing exemplars of the type of work that Benjamin expects. Students can use these exemplars as a template for their own work, making the task more tangible, especially when it is something that they are seeing for the first time. Benjamin writes about these ideas:

We started with students presenting their group work from yesterday. It is something we do not do enough of as I always see a lot of nervousness with oral communication in mathematics. Giving an example of an appropriate presentation seemed to give the kids good direction today. (Benjamin journal, October 4, 2011)

4.3.2.8 Assessment – Focusing on the Large-Scale Assessment

Benjamin admits that assessment is something that he does not make a priority in his teaching of the Grade 9 Applied Mathematics course. He realizes that it is an important component of a successful Grade 9 Applied Mathematics program, however, this is just one area where he naturally does not put a lot of effort. He says:

[Assessment] is always something that is a challenge. Just finding time to do assessment. Mine is always very informal but all of this assessment for learning, as learning, of learning...that is too much for me for now. It is not a priority for me right now. (Benjamin interview, December 20, 2011).
Benjamin’s words show while that he is aware of the current trends in assessment practices, it is just not a current priority in his teaching. He expresses that, for him to feel good about his assessment practices, he will need to devote some time towards professional development in the area. He will have to attend more workshops or do some reading and then reflect upon his practice, where he uses the different forms of assessment, and how he can better his practices.

Benjamin acknowledges that the large-scale provincial exam (EQAO) is a reality for the Grade 9 Applied Mathematics course. He also notices that the Applied level students do not seem to have a competitive drive like their Academic counterparts do. Thus, Benjamin makes an effort to make the EQAO more palatable for his students and to help them to become more engaged in the process of preparing for the exam. Benjamin believes that the more his students are exposed to EQAO-style questions (multiple-choice and open-response multi-step questions), the more comfortable his students will be with the format and the more that they will be successful in exam writing. He says, “I think I will just keep working [on the] EQAO and basically, giving more and more and more questions so that they know the wording” (Benjamin interview, January 31, 2012).

Benjamin feels that, in general, his teaching is more purposeful when it includes EQAO questions. Benjamin has given his students a chance to practice answering more EQAO-type questions than he has in previous years as well as discussed with them about what the EQAO scorers would be looking for. Benjamin believes that telling his students about this will help them be more strategic in writing the exam and in turn, successful in their exams. Benjamin gives an example of how he taught his students more about how the EQAO is graded:

We included a lot more EQAO practice throughout our entire semester and also, I have always showed them one, but I think I probably showed them more than four of the examples, like the anchors. This is what 10 for this question would be, here is what a code 20 would be, mark each other’s different feedback, that sort of stuff to try to give
that idea that it is really important to put things down for open-response. (Benjamin interview, January 31, 2012)

Benjamin reiterates that leaving a question blank ensures that the student will receive no marks for the question, but by showing some work, even if the answer is not complete or correct, the student may receive part marks. By showing the students sample student responses and their respective scores, Benjamin hopes that the students will see patterns of what the scorers look for.

In an attempt to make the EQAO more accessible to students, Benjamin has tried to integrate EQAO questions into interactive activities in his lesson. He gives an example of this:

We have used the SMART Board for presenting the stuff on the SMART Board. That was really good with the plan geometry stuff. Being able to draw onto a sample question, move around the screen and talk about the angles. We have used it for review. Playing a Jeopardy game on it. Putting our EQAO questions on it and do it off of that. (Benjamin interview, November 7, 2011)

As mentioned in the theme of Using Technology, students respond positively to this interactive technology. Benjamin integrates EQAO questions using this teaching tool. In addition, the fact that the EQAO questions are presented as part of a game, Benjamin is further hoping that his students will be willing to engage in this large-scale assessment.

Benjamin also believes that the more the students have a chance to practice EQAO-type questions, the more comfortable they will become with the format. He writes of this in his journal: “We need to continue to provide opportunities to model and practice these sorts of questions” (Benjamin journal, November 7, 2011).

Benjamin notices that many of his students tend to make silly mistakes on their open-response questions. By giving his students more opportunities to practice solving these types of questions, providing feedback to the students about their solutions, and reminding the students to check their work carefully, Benjamin hopes that his students will become more careful when writing their solutions and be more successful on the exam. He writes:
I was really satisfied that there was a real improvement in students understanding today, demonstrated in their generally comprehensive answers to the EQAO questions. The mistakes were typically calculation errors more related to mathematical error than comprehension of the questions. We really need to keep working at these types of questions to improve our open-response results. (Benjamin journal, October 11, 2011)

Benjamin shares that, as the EQAO is part of the Grade 9 Applied Mathematics course, he feels a duty to prepare his students for this ‘assessment’ as best as possible and realizes that his Applied level students are not naturally invested in doing well on this exam. Benjamin notices that his students are apprehensive about taking this large-scale exam and tend to freeze in this situation. Thus, to get his students comfortable with the exam and the types of questions that they will encounter, Benjamin integrates EQAO-type questions into his teaching so that, when his students write the exam, the format of the questions will be familiar. Additionally, by teaching his students test-taking strategies, Benjamin further provides support and reassurance to his students as they prepare for this often overwhelming exam.

4.3.3 Summary of the Case of Benjamin

To increase student engagement in his Grade 9 Applied Mathematics classroom, Benjamin integrates many factors into his teaching. Specifically, these factors fall under both the social and academic domains for student engagement.

In the following quote, Benjamin describes one student whom he described as going from not-engaged at the beginning of the semester to being fully engaged by the end.

I have one student who, at the start of this semester, I thought would be a non-attender, because that is what he is in most of his other classes. But he is engaged by a number of the strategies that we have used and he does not miss class ever. [T]here is certainly a pride (sic) when I see him in the hallway and he says, “How is it going?” I think that in providing engagement and just giving him some sort of validity in the classroom has been huge. (Benjamin interview, April 19, 2011)

Benjamin’s description of this student demonstrates that he considers factors in both the social and academic domains for student engagement. Within the social domain, Benjamin mentions
that there has been an increase in this student’s self-confidence. Benjamin uses the word “validity” to explain how the mathematics class has had an effect on the student. Although Benjamin does not elaborate on this idea, it could be a result of an increased class attendance results and wanting to be part of the learning community. In the academic domain, Benjamin notes that the inclusion of a variety of teaching strategies had positive repercussions on this particular student. Again, as evidenced by an improved attendance record, Benjamin believes that the strategies that he uses in class are compelling enough for this student to make the decision to attend class more often.

In addition to creating a community that supports self-conscious students and using a variety of teaching strategies, Benjamin considers social factors such as: developing relationships with his students and providing opportunities for students to develop relationships with one another. Additional academic factors include using small group learning to meet individual’s needs and support the learning community, and using the TIPS4RM resource and technology to provide opportunities for student-centred learning, rich learning tasks, and allowing for interactive learning contexts.

4.4 The Case of Mathieu

Mathieu has taught at Newcastle School for 15 years. Prior to working at the school, he taught at an Adult Learning Center and before that, at another secondary school. In total, he has been teaching for over 35 years and acknowledges that he is close to retirement. Mathieu completed his Bachelor’s degree with a major in mathematics and a minor in science and his Bachelor of Education degree, both at the same post-secondary institution in Southern Ontario. Upon graduation, Mathieu was qualified to teach Grades 7 to 12 mathematics and science and
has since gone on to gain qualifications in computer science and an Honours Specialist in mathematics.

During his career, he has also taken on administrative positions, most recently as an Assistant Curriculum Leader (ACL) at Newcastle School. He says, however, that he did not particularly like the role and that he enjoys teaching in a classroom much more. During the semester in which this study was completed, Mathieu taught one Grade 9 Applied course and two classes of the Grade 12 Academic Advanced Functions course. He says that he has taught the Grade 9 Applied Mathematics course once a semester for the past four years.

Mathieu initially thought that he would complete journal entries as part of the study and sent me his first journal entry at the beginning of October 2011. Leading up to my first school visit the following week, I did not receive another journal entry from Mathieu. During this school visit, I asked Mathieu about the journal and he shared that he did not feel very comfortable with this component of the study. Mathieu mentioned that he would rather take additional time during teaching interviews to share all of the thoughts that he would otherwise share in journals. He felt as though our interviews were more informal as they seemed to be more like conversations.

Mathieu said that the journals seemed a little too forced and in reading his one and only journal entry, Mathieu did take the prompts that I had provided and gave direct responses to each. Thus, Mathieu opted not to write journals as part of my study. As I was already thankful for each of the three participants opening up their classrooms to me and spending time for interviews, I did not want to impose the journal component of the study on participants if they were happy to oblige with the other methods of data collection.
Although he has taught mathematics courses at all grade levels, he has only recently begun to really enjoy teaching the Grade 9 Applied course. This, however, was not the case when he first started teaching the Grade 9 Applied course. As a veteran teacher, Mathieu shares that he is comfortable in front of the classroom and was comfortable teaching the Grade 9 Applied course, but was discouraged by the lack of interest shown by the students. He found that the attendance rate of the students in the course was quite low. Mathieu had taught the course in a traditional manner and found that he was often dealing with behavioural issues in the class. He also did not find his teaching and the course itself to be very stimulating. This was both for the students and himself.

In Mathieu’s second year teaching the course, his school was invited to be part of the Collaborative Teacher Inquiry Project, hosted by the Learning Consortium. He recalls that he was skeptical of the opportunity and that even though his Grade 9 Applied Mathematics students did not seem engaged in the course, Mathieu was content with his approach to teaching the course. He reminisces how he reluctantly became involved in the project:

[The Curriculum Leader] dragged me into the Consortium because I became the Assistant Curriculum Leader. He figured I had a moral obligation to go down there so then I went and thought, “Let us try it, and see what happens”. (Mathieu interview, October 27, 2011)

At workshops hosted by the Learning Consortium, Mathieu heard from other teachers about different teaching strategies that they found to be effective in their Grade 9 Applied Mathematics classes. Although the other teachers reported that their students were engaged in learning, a trait that Mathieu’s students were not exhibiting, Mathieu was reluctant to make any changes to his teaching practice. Since he was content with the way that he taught the Grade 9 Applied Mathematics course, he was not convinced that changing his approach was necessary. Mathieu admits that, as an administrator in the Mathematics Department at Newcastle School, he
felt pressure to use the tactics that other teachers in the Collaborative Teacher Inquiry Project shared. He says of this:

I did not want to do it. I was the Assistant Curriculum Leader at the time, so I had to show that I wanted to play the game. I did not mind playing the game once I realized that it actually made it better, not worse. If it would have made it worse, I would have quit it. (Mathieu interview, October 14, 2011)

Mathieu says that, if these new practices did not produce a positive change in his program, he would revert back to his original approach. Thus, towards the end of Phase I of the Collaborative Teacher Inquiry Project, Mathieu began to change his practice.

The EQAO results from the end of Phase I of the project showed an increase in student results. This, in conjunction with Mathieu’s observation that students tended to be more engaged in the course, led him to continue along this trajectory and focus on the use of specific instructional strategies as a means to increase student engagement. He says, “Probably after a year then I was pretty well sold. After two semesters of it. Then I could see [the difference]” (Mathieu interview, October 27, 2011).

Although Mathieu considers some social needs of his students, these considerations are secondary to his academic focus and as I will describe in subsequent sections, many of these social considerations only came about as a result of the academic practices that he began to use in the years leading up to my study.

4.4.1 Social Engagement

As a result of the Collaborative Teacher Inquiry Project, Mathieu has implemented the TIPS4RM resource into his Grade 9 Applied Mathematics program. As lessons and activities found in this resource incorporate ideals of student-centred, inquiry-based learning and rich tasks, it forced a change in the learning environment in Mathieu’s classroom. Moving away from a teacher-centred model, Mathieu found that his role in the classroom shifted as did the manner
in which his students interacted with one another. I discuss these factors in more depth in the section about academic engagement.

Yet, these factors made Mathieu realize that there are some social factors of his teaching practice that affect student engagement. In this section, I will describe how a change in the learning environment in Mathieu’s classroom, that was precipitated by an upheaval of instructional strategies, has gotten Mathieu to be cognizant of qualities of his practice that affect students on a social level. I also discuss how Mathieu develops a relationship of trust/respect with his students, and demonstrates to them that they are a valuable part of the school community. I conclude by describing how Mathieu takes advantage of his students’ desire to be a part of a community as a means to increase student engagement for challenging students.

4.4.1.1 Creating a Familiar Environment

Mathieu aims to create a learning environment that is similar to his students’ habitual contexts and everyday life. He fosters an environment in which his students can be themselves. He says, “If it is a nice, warm, friendly, safe environment where they can get along and nobody bothers anybody and they are free to roam, they are free to talk, they like coming” (Mathieu interview, October 14, 2011).

Mathieu notes that, if students tend to like talking in their everyday lives, they will want the opportunity to do so in the mathematics classroom. This is similar to their desire to have freedom and be in control of their actions. He says, “I find the behavioural kids are not as behavioural because they can actually talk. They can move about” (Mathieu interview, October 3, 2011).

For Mathieu, the classroom environment is of utmost importance for Grade 9 Applied Mathematics. This is because Mathieu believes that students need to feel comfortable in the
classroom before any mathematics learning can take place. Mathieu’s classroom has a relaxed feel where students have the freedom to come and go as they please and talk with their peers. Mathieu’s classroom is almost like a student meeting ground in that students are able to exhibit behaviours that they can use on an everyday basis.

Mathieu knows that his approach is paying off. He says, “I find that if you [create a relaxed environment and engage the students], they seem to enjoy it. What I have noticed is that the kids actually come to class” (Mathieu interview, October 3, 2011). Mathieu’s comments point to an obvious change in student behaviour as a result of his change in approach.

When Mathieu first started teaching the course, he found that students would often skip class. Student attendance is something that Mathieu really struggled with in the Grade 9 Applied course. In fact, this is an issue that he brings up multiple times during interviews and something that he directly attributes to the relaxed classroom environment that he has created: “You are making an environment that they like. They come. Before they would skip. They would never come before, because they hated [the environment]. To me, I think, number one is environment” (Mathieu interview, January 23, 2012).

In addition to creating an environment that mimics their everyday, Mathieu fosters an environment in which his students feel relaxed and comfortable. Typically, for these students, the mathematics classroom is rigid, thus Mathieu puts his students at ease by telling jokes. I observe a lesson in which I see Mathieu making jokes. While the students use i>clicker technology to solve mathematics problems, Mathieu says: “This is an easy one. If you do not get this right, I will send you to summer school!” (Classroom observation, January 23, 2012). Although this comment seems scathing, I know it is meant as a joke because of Mathieu’s tone of voice and that he is smiling as he says it. The students know that Mathieu is joking because they are also
laughing and respond back with joking quips, themselves. Additionally, this type of behaviour by Mathieu provides the opportunity for students to act as they would with their peers outside of an academic environment. When some of the students realize that they have not answered the question correctly or that their peers have made mistakes, the students poke fun at one another and the student who is being made fun of laughs too.

Mathieu gives another example of how he jokes around with his students in describing an instance when a student came in with a new haircut:

“It looks good, man. I should get a haircut like that.” And [the student] said, “Oh, yeah?” So I tried to give him a little positive so that he did not feel so bad about it. But the other kids you can tell, they are looking at him, because a haircut, it is a big change. You have got to try to make it fun. (Mathieu interview, December 18, 2011)

Mathieu further describes how he ensures that his classroom is consistent to his students’ everyday lives. Although Newcastle School has a rule in which students are not supposed to listen to iPods during class time, Mathieu believes that this is an integral component of their regular life that he wants to keep consistent. He says of his students’ desire to listen to music, “It soothes them” (Mathieu interview, October 14, 2011).

4.4.1.2 Developing a Relationship of Trust and Respect

Mathieu’s decision to allow his students to listen to music during class not only allows his students to maintain consistency in their lives, but also demonstrates to his students that Mathieu is generous and gives the responsibility back to his students. Mathieu often allows his students to make the decisions about appropriate behaviour and trusts his students to make an appropriate decision. For example, I observe a student, sitting in the middle of the classroom, listening to his music so loudly that Mathieu (at the front of the room) and I (seated at the back) can hear the music. Mathieu tells the student that the music is very loud by saying, “I can hear it from here!”, but instead of telling the student what to do, lets the student make his own judgment
call. In the end, instead of just turning down the volume, the student turns the music off and takes his earphones out. Mathieu says of his approach, “You have got to be flexible. You have got to be soft, but at the same time, you have got to give them a break, do not hammer it. Do not pounce on them. That is not good” (Mathieu interview, December 18, 2011).

Mathieu believes that his approach is appreciated by his students and, because of this, the students will reciprocate and engage in their learning. He says, “[The students] were terrified of me [in the first year] but that is not a good learning environment. They do respect me now even more” (Mathieu interview, October 14, 2011). Mathieu also lists that his new approach has reduced classroom management problems. He says, “I find that, in this environment, kids behave. They do not really cause real problems” (Mathieu interview, October 14, 2011).

Mathieu says that getting students on his side has a great affect. His laid back approach and relaxed structure in the classroom is appealing to adolescent students who like to do what they want and when they want. Mathieu says:

I find that by them liking me, they perform for me. They want to work for me. I think that is because of the way I approach it is that I am not in your face. It is, “Why do not you try that? What do you think of that? What about doing this?” And so they like that. So it is like a really laid-back kind of approach. (Mathieu interview, October 3, 2011)

To build an additional relationship with his student, Mathieu will talk to his students about his personal experiences in order to give his students a chance to learn more about their teacher. Mathieu says of this:

[The students] like to know what is happening. I tell them my troubles sometimes. I think that means a lot to them. They actually get to know you more. It is not just you are the big teacher, giving them orders all the time and telling them what to do. I think that is good. (Mathieu interview, October 14, 2011)

**4.4.1.3 Valuing the Applied Level Student**

As Mathieu’s focus is on the academic factors for improving the Grade 9 Applied course, it is not surprising that he believes that an expert teacher should be assigned to teach the course.
This is not to say that the content of the course is difficult and requires a mathematics specialist, but that the needs of the Applied level students are so high compared to their Academic counterparts who, will probably succeed on their own efforts. Mathieu believes that a mathematics specialist is needed to focus on the instructional strategies used in the course without having to worry about the academic content as well. He explains this:

It makes sense because a specialist can go in there and see right away what is going on and know how to adapt to the situation and see what needs to be there or just do. Shoot from the hip, basically, whereas a rookie or a non-mathematics person would be just failing to try to think, “What do I say next, or what do I do next, or how do I handle this?” (Mathieu interview, October 3, 2011)

This perspective is something that he shares with his Grade 9 Applied Mathematics students. Mathieu believes that his students have a low self-confidence in their academic abilities. Mathieu believes that these students “like that they have a specialist teacher”. He tells me what he tells his students:

I teach Calculus, and I teach [Grade 9 Applied]. I teach [these students] because I know what I am doing. I am not going to steer [them] wrong, I am going to give [them] the right answers and I am going to show how to do it properly or in a way that is meaningful. (Mathieu interview, October 3, 2011)

Mathieu believes that his students feel reassured having a mathematics specialist as their teacher. Additionally, he believes that the students feel valued because their school considers them worthy of having a specialist teacher. He says:

[The students] were getting shortchanged. You would get a geography teacher or a history teacher or somebody who had to fill the slot. They always get slotted into Grade 9 Applied or General. Those kids knew right away, “We have got a bozo here, we have got somebody who does not give a crap about us and he does not know anything and we are getting shortchanged.” (Mathieu interview, January 23, 2012)

When I ask Mathieu if Grade 9 Applied level students feel devalued if they are given a teacher who is not a mathematics specialist, he says: “Of course they do. Then they cause more
trouble, because they know. In this environment, they realize that I am there to help. I am actually here to really help, try to show them something” (Mathieu interview, October 3, 2011). Thus, Mathieu acknowledges that his Applied level students are insecure about their abilities and need the support of a teacher to help them to be successful in this normally challenging environment.

4.4.1.4 Being Part of a Community

Mathieu knows that his adolescent students feel the need to fit into a community. He takes advantage of the fact that more of his students are engaged in their learning as a result of his teaching strategies, and allows the social needs of students to further help to engage the remaining students.

In my visits to Mathieu’s class, I often notice one particular student, Yannick, as being disengaged in the course. Yannick often has his head on the desk with his eyes closed or listening to a personal music device without paying attention to classroom activities.

I ask Mathieu about Yannick because he was a student that stuck out to me as often not being engaged in Mathieu’s class. Mathieu shares that, although he tries to engage Yannick in the course, he is often not very successful. Yet, because the rest of the students in the class are engaged, Yannick will sometimes feel compelled to participate. Mathieu says:

I am not going to force him [to get engaged]. Usually in the end they start partaking. Because they get bored sitting there doing nothing. They realize, how come these guys are doing stuff, I am just sitting here doing nothing. Sooner or later, they actually want to do stuff. (Mathieu interview, October 14, 2011)

Mathieu believes that all students will become engaged at some point. Just like children who stubbornly do not want to eat certain foods, after a certain amount of time and after reaching a certain point of hunger, the child will begin to eat. This is particularly true if the child sees his/her siblings eating and enjoying the food.
Mathieu believes the same thing about students in the classroom. Mathieu further explains this:

I guess sitting there and doing nothing, being bored. It gets boring doing nothing. You say, “Maybe they are having some fun, maybe I can do some stuff too”. Even the worst kids I have had in the past, they actually got involved. (Mathieu interview, October 14, 2011)

Thus, Mathieu believes that his Grade 9 Applied Mathematics students feel the need to belong to their peer group. They do not want to be the odd person out and therefore, if they see that their peers are engaged in learning, they too will follow suit.

4.4.2 Academic Engagement

For Mathieu, the focus in his teaching is in the academic domain. Mathieu is willing to try new teaching strategies that embed academic content to increase student engagement. The following quote sums up how he aims to engage his Grade 9 Applied Mathematics students and point to the fact that it is through a variety of teaching strategies that Mathieu believes that he will achieve this goal:

Hands-on, tactile, visual…they like hands-on stuff. Investigation. It gives them a different way of learning. I think the worst way to teach the Applied students is to try to talk or lecture to them. It is good for a short period of time, but you cannot keep doing that. So you have got to give them something to keep them occupied. And technology seems to do it. And that is why I always look for different things. So today was Gizmos. Soon we are going to have an i>clicker day again for the EQAO review and so on. (Mathieu interview, November 15, 2011)

The key ideas that Mathieu repeats over and over again throughout the semester is that the Applied level students like to have hands-on, interactive learning opportunities and that they need a variety of approaches so as to not have to follow the same approach throughout the entire semester. He says, “[Y]ou have got to mix it up. It is not the same every day” (Mathieu interview, January 23, 2012). Thus, as the teacher, Mathieu says that he is constantly looking for
different activities and instructional tools to integrate into his teaching to provide more variety for his students.

For Mathieu, the two focal points of his Grade 9 Applied Mathematics program are the use of the TIPS4RM resource and technology. The TIPS4RM teaching resource encompasses a variety of teaching strategies and Mathieu primarily uses the TIPS4RM as a vehicle to foster a student-centred and constructivist learning environment.

4.4.2.1 Using a Variety of Teaching Methods

Mathieu reinforces that it is important to consider what would keep the students engaged while selecting instructional approaches for the Grade 9 Applied Mathematics course. Mathieu believes that the Applied level students have shorter attention spans and therefore need a variety of approaches used in their learning. Mathieu says, “[The students] are not able to stay focused for a 75 minute period. Even 50 minutes is too much” (Mathieu interview, December 10, 2011). With this short attention span, Mathieu specifies that a variety of instructional strategies are needed to constantly keep students engaged. He says:

Individual work will not happen. They need to work in groups, find collaborative ways to discuss things, and figure it out as a group. For these purposes, I offer them manipulatives and computer technology. For manipulatives, I offer them algebraic tiles, building blocks, geometric shapes, protractors, rulers…all kind of tools. I also let them work on Gizmos for mathematics assessments. Also, we use graphic calculators every day. (Mathieu interview, December 10, 2009)

Mathieu says that it is important to use a variety of strategies right from the first day of the course. He says that the students will quickly buy in to the class because right from the first day, they are learning in more interactive and fun ways that they have been used to. Mathieu says:

I just win them over…right from day one. I get right into group work from day one and it is something fun and a hands-on kind of activity. You introduce the calculators right away, get them to use it, learn how to use it. Using the SMART Board. They get used to it and they buy in. (Mathieu interview, January 23, 2012)
Although Mathieu does use some traditional methods in his teaching (e.g., blackboard, lecture-style delivery of course material), he keeps it to a minimum in the Applied level classroom. Additionally, he uses these traditional ‘moments’ as a chance to further consolidate the students’ understanding of the material rather than as the introduction and ‘lesson’ of the content itself. Through the hands-on portion of the lesson, the students have already discovered the material and Mathieu merely repeats the main facts from the investigation as a summary for the students. He describes this: “I summarize it [at the end]. And then bang, bang, bang, this is what it is, boom, boom, boom. I do not show them that until the very end” (Mathieu interview, October 3, 2011).

Mathieu also highlights the importance of being flexible in the Grade 9 Applied Mathematics classroom. Although he enters the class with a plan of the activities that he will use and has a long-term plan to ensure that there will be a variety of approaches, Mathieu says that he needs to be able to read his students. If his students seem to not be engaged in his planned approach, Mathieu will, on the spot, come up with an alternative approach. He says:

I look at what they need and what they want. If they are bored, then I challenge them. If they are missing something, then I will teach that or go over it or demonstrate something when trying to use technology. (Mathieu interview, October 14, 2011)

Mathieu stresses the importance of variety for the Grade 9 Applied Mathematics learner. Although Mathieu talks at length about his use of technology, investigation activities, manipulatives and group work, he admits that “some days I even just teach a Socratic lesson, 10-15 minutes, give them some seatwork, give them some assignments to do or some problems to do” (Mathieu interview, October 27, 2011).

Although this traditional model of teaching is something that Mathieu says does not tend to work well for the Grade 9 Applied Mathematics student, Mathieu says that, because he does not use it often, on the rare occasion that the students are presented with a traditional mode of
learning, they will follow suit. As Mathieu uses this strategy so rarely in his teaching and the students are used to the other more engaging modes of learning during the majority of the course, the students lessen their negative attitude towards the traditional approach and see it as just another learning strategy, or the strategy of that particular day, knowing that there will be a different strategy used the next. Mathieu says that it is important to, “Mix it up!” (Mathieu interview, October 27, 2011). Changing the type of teaching and learning approaches that the students experience is important to keep Grade 9 Applied Mathematics students engaged.

4.4.2.2 Setting up the Learning Environment

As I discussed within the theme of Social Engagement, Mathieu believes that creating a learning environment in the mathematics classroom that is familiar and similar to that of his students’ everyday lives is crucial for increasing student engagement. Mathieu reminds me:

[The students] have the freedom to move around, they can go to the bathroom, they can talk to each other, they can discuss things, they are not glued to their chair. It gives them the freedom. They can look out the window. As long as they are not doing anything bad. Because everybody needs a break. And socializing is a big thing. (Mathieu interview, October 3, 2011)

Cooperative learning is an integral part of Mathieu’s Grade 9 Applied Mathematics program. During almost all classroom observations, the students were seated in groups of 3 or 4 and working together on a rich task worksheet taken from the TIPS4RM resource.

Mathieu believes that the success of group work for the Grade 9 Applied Mathematics student is the fact that the students have a chance to work with peers. He believes that working in groups allows students to have a chance to socialize and become more comfortable in a normally sterile learning environment. This ability to socialize and act as they would outside of the mathematics classroom is something that I discussed within the theme of Social Engagement.
4.4.2.2.1 Cooperative Learning

Mathieu advocates for cooperative learning in the Grade 9 Applied Mathematics classroom. He believes that students want to work with their peers and enjoy learning in a collaborative environment. Although at the beginning of the year, the students may be uncomfortable working with other students whom they do not know or are not friends with, Mathieu sees that, over the course of a semester, they get used to working in a group. The students develop stronger relationships with their peers and form friendships with these students who were initially strangers. Mathieu speaks of his perspective:

As long as [the students] are willing to work together and stay in their groups and talk to each other [that is the most important thing]. At first, sometimes the groups do not want to talk to each other. They do not particularly like each other and then after awhile they start to like it. They have to get used to each other and now the groups are used to each other. They cooperate, they work and they collaborate. (Mathieu interview, October 14, 2011)

Mathieu says that the students are quick to pick up on new learning strategies. For example, he says that, prior to his class, the students say that they have never done cooperative group tasks in a mathematics classroom. He says that, for the first couple of times that the students are asked to work in groups, they find it awkward and are unsure of how to proceed and how to interact with their peers (some of whom are not their friends). Mathieu says that, very quickly, the students become familiar with the structure of cooperative learning and thus the students will be concentrating on the mathematics tasks and mathematics learning rather than the strategy of cooperative learning. He says:

They are doing a good job. They are improving. They learned the routines and now they know how it is done and they know what is expected of them and they know how to play the game, so things are happening. I do not have to coerce them too much, manipulate them. It seems to be happening. They come every day. It is amazing. (Mathieu interview, October 27, 2011)
Mathieu sees that, once the students have gotten over their unfamiliarity with the teaching strategy itself, they concentrate on the mathematics learning and enjoy the process. As a result, the students come to class on a regular basis as they know that each day they will be presented with engaging tasks and activities.

Mathieu says that the students are placed in the same groups for the entire semester. He creates the groups so that they are heterogeneous in terms of the academic performance of the students. When I ask Mathieu if this is indeed the case, he says:

Yeah. And talent. Personality, whether they get along and brains. I want somebody good and somebody weak and some in between. Like I said, the first time I did it, I had all the four smart kids all together and they just zip through it and then you have got the four Level 1s (the lowest achievement level), the bad boys and they do nothing. That is no good. That is just dynamics. (Mathieu interview, October 14, 2011)

Mathieu indicates that, when he first started using cooperative learning in his class, he let the students self-select their groups. As a result, he would have students who would group together based on friendship groups and academic prowess. Mathieu found that these types of groupings were difficult to manage from a classroom management standpoint. The groups would work at different paces and with varying degrees of focus and success. From those early experiences, Mathieu realized that the groups needed to be mixed so that academic abilities and personalities would balance each other out and each group would perform to about the same speed and ability.

Mathieu further elaborates why when the students selected their own groups, the groups that resulted were often homogenous in terms of academic ability: “When I let them pick their own groups, I had the Level 1 group. They clung together because they were friends. They all thought the same [way]” (Mathieu interview, October 14, 2011). Mathieu noticed that the students who struggled academically were friends with one another. The students seemed to group together out of comfort.
Thus, Mathieu decided to create the groups himself after seeing their performance in the first couple of weeks of class. Mathieu talks about the fact that once he determines the groups, they are set for the rest of the semester:

These are the groups, they are set. So they are stuck with the same people for the whole semester, unless they specifically ask to be switched because they cannot get along with somebody then I will say, we will make a switch, but that generally does not happen. (Mathieu interview, October 14, 2011)

Mathieu’s words show that, although students may not be placed with their friends as a result of making heterogeneous groups, the students are quite tolerant with working with other peers. Mathieu also indicates that personality and ensuring that students feel comfortable working in their groups is important. He believes in his heterogeneous groupings and the fact that, although the students in these groups may not have already been friends, they will form relationships with one another during the semester and work well together. Yet, Mathieu acknowledges that this is not always the case and places the social needs of the students first, thus changing groups around if students are not interacting well with one another.

The individual accountability component of cooperative learning is something that Mathieu enforces with his students. Knowing that individual accountability is an integral part of successful cooperative learning, Mathieu tells the students that their individual contributions to the group work will be noticed and that students will receive marks as individuals rather than uniformly within the group. He says:

I try to motivate them to partake. I tell them that I do not give a group mark. Everybody does not get the same mark. I look at who does what. I know who is goofing and who is not. Just because your group got Level 4, you might get a [Level] 2. I want to see some action. You just try to make them perform. (Mathieu interview, October 14, 2011)

To further support the idea of individual accountability, Mathieu tells the students that in addition to being marked individually on their contribution to the group work, each member of the group will have a chance to speak when doing group presentations.
We talk, I try to get them to verbalize but when we do presentations, they are very weak. Usually you have one person in the group that does all the talking and the rest just stand there, “Uhhh.” I do not know. But I try to make it happen by doing group work and presentations. Because normally they would never present. The old way, you ask them to present, they say, forget it, we do not do that. But now, they will do it because I do the groups and they are there together. (Mathieu interview, December 18, 2011)

Mathieu’s reflection on how individual students participate in group presentations indicates that he encourages students to participate for many reasons. First, he wants to ensure that each student was engaged in the learning and can demonstrate their knowledge about the mathematical task. Secondly, Mathieu wants all students to have a chance to improve their presentation skills. Mathieu knows that there are some students who are nervous about presenting, thus having the rest of their group members stand with them as they present can calm some of their nervous energy as they know that they have other students who are physically there to support them and can chime in if they get stuck with their explanations.

Mathieu reiterates that the social dynamic of a group is the number one concern to determining whether or not the group will be successful. At the beginning of the semester, when creating the groups, Mathieu is never sure how the group will fare socially. He knows that academically, there is a mixture of skills levels represented in the groups, and each member of the group will benefit from this situation and balance each other out. The weaker students will learn from the stronger students and not feel as insecure of their abilities because they have other group members whom they can work off of. The stronger students will also enjoy the experience as they will feel more confident in their abilities as they have group members whom they will have to support. With these academic differences, the social interplay is important. Mathieu describes why, after one particular incident in his class during which emotions ran high in one of the cooperative groups:

What happened is you have got [Henry] who is smart and knows a lot so he wants to take control and dominate. He knows all of the answers and of course the other ones who are
not so smart, they do not like him dominating and taking control so they rebel. And then they get conflict. And then he feels bad because they do not listen to him, so he is hurt, you saw he was actually crying. He was very upset and the others are ticked off because he is not communicating. You have got these group problems. Dynamics problems.

(Mathieu interview, October 27, 2011)

In this situation, Henry was not able to share his knowledge with the other students in a way that the weaker student did not feel inadequate. As a result, instead of the weaker students feeling supported by the stronger student, they felt even more insecure about their abilities and disengaged from the task. Yet, Henry was still concerned about how his group members perceived him and was hurt by the way that they responded to his actions. Henry’s own insecurities of not having his peers accept him for the contributions he could make to the group affected his ability to engage in the task and as a result he needed to step away from the situation for a moment as his emotions got the best of him.

Mathieu continues to describe how he dealt with the situation after noticing that this group was not working well together: “I told them to separate into two groups. ‘You three now work together and try to come up with something and you can compare to what he did and then see if there is any common ground’” (Mathieu interview, October 27, 2011). At that moment, Mathieu knew that the students were too emotionally charged and could not successfully work together. Mathieu decided to let the stronger student continue on with the task individually because the student had already completed most of the problem himself. Henry was having problems communicating his intentions with the rest of the group members, thus working individually would give him some personal space to not worry about how his peers would react to his approach for working in the group.

Mathieu acknowledges that not all students enjoy working with peers and mentions that this student sometimes does have conflict with his peers when working in a group because he is academically stronger than the rest of his group members. Mathieu says that Henry gets
frustrated when his peers may not be following along with his attempts at explaining how to go about solving the problem. Mathieu says that his students are slowly developing the communication and social skills to work with group members, but that sometimes certain tasks are more difficult than others, and for those tasks that are less hands-on and merely require students to solve a written problem, his students tend to struggle to work as a group. Mathieu talks about different students having different personalities and how this can impact their abilities to work in a group:

The personality issues. You know, group dynamics. Some people are not good in groups. I was never a group person. When I was in a group, I would just make fun of everybody and do bad stuff and try to ruin it. I knew I could do it all myself very quickly, so that is me. I do everything myself. So that is sort of the same thing, except [Henry] did not know how to handle it. Instead of making fun of the others and amusing himself, he gets upset. That is something that you have to deal with. Most of the time there are no problems with groups, but today for some reason, there was. (Mathieu interview, October 27, 2011)

Thus, Mathieu says that, depending on the task, it may be more or less difficult for certain groups to work together. With certain types of tasks, a student who is more comfortable working individually, yet is being asked to work in a group may find group work more challenging. For that particular lesson where students had to solve the mathematics problem without the use of manipulatives or an interactive activity to visualize the mathematics, Henry needed to support his peers more intensely to help them understand the problem and what it was asking. This meant that there was more pressure on Henry to interact well with his peers and this was something that he was not ready to do that day.

In these situations, Mathieu tries to support the student and coach their social and communication skills. Mathieu talks of this:

I talked to [Henry]. I said, “You have got to try to work together. Do not dominate. Let them talk too. Do not just tell them my way or the highway” because that is really what he is doing. He is saying, “I know the right way, I know what is right. First listen to me, agree with me and then I will let you talk.” It is a problem. It is like in any committee. Somebody knows it all and they just run the show. (Mathieu interview, October 27, 2011)
Mathieu once again reiterates that group dynamics are the most important component to a successful cooperative learning environment. Thus, if he knows that a group of students cannot work well together no matter the type of task or amount of support that they receive from the teacher, he will change the groups. When I ask Mathieu how he would deal with this unfortunate situation, he says:

I would have to rearrange or something. I would have to transfer. That is why when I do the groups; I try to go from high to low so that there is a mixture. But the mathematics does not always work. It will blow over, it is just today. Tomorrow I am sure everything will be back to normal. We do not do group work every day. Sometimes we do individual [work], so he gets a chance to shine. Show how good he is. (Mathieu interview, October 27, 2011)

In this last quote, Mathieu once again acknowledges that not all students enjoy working together and while most of the time, group work in his class is successful and enjoyed by his students, Mathieu allows opportunities for students to work individually. This strategy allows those students who like to work alone, a chance to be in a learning environment in which they are comfortable and to give them a chance to shine.

Allowing all students in the class an opportunity to work in groupings in which they will thrive is important to Mathieu. In addition to working in groups of four and individually, Mathieu allows students to work in pairs. Mathieu describes one such task:

Yesterday we did another task. The sunflower. They worked in pairs on that one. In pairs they had a table of values, a graph and there was also a description and words. And again, they put it on chart paper, up on the blackboard and we looked at it, everybody went through and chatted about it. Again, it was very hands-on, group activities. Small, not full groups, but pairs. (Mathieu interview, October 27, 2011)

This allows the students who like to work individually, a chance to practice working with peers but in a more intimate setting and only needing to work with one other peer rather than in the larger groups where they need to consider working with multiple students. This also gives a chance for the students who may be a little bit more hesitant to participate in groups a chance to
feel comfortable sharing their ideas with just one other group member. Working in pairs also allows the students who want that support that a peer can give some reassurance.

**4.4.2.3 Masking Mathematics Learning**

Mathieu says that rich problems are a strategy to increase student engagement. With these types of problems, Mathieu believes that the students are so engaged in the context of the problem that they do not realize that they are doing mathematics at the same time. Mathieu uses an example of students calculating their mark on a test as a perfect case of this. When Mathieu returns a graded quiz or test, the students are very interested in finding out how they are performing in the course and how they compare to their peers.

Mathieu divides each assessment into four categories based on the Ministry of Education’s Achievement chart (Ontario Ministry of Education, 2005a). On each assessment, the student is awarded a level for each of the four categories of Knowledge and Understanding, Thinking, Communication, and Application. Mathieu does this instead of assigning one overall mark. The students then scramble to calculate an overall averaged level that they would receive on the assessment and sometimes want to convert their leveled mark into a percentage.

As Mathieu guides them through this process of mark conversion, the students do not realize that they are completing multiple mathematical calculations and dealing with the concept of percents. The students are so motivated to find out their mark and to have an accurate representation of their mark to compare with their peers that they are not preoccupied with the fact that they are doing mathematics at the same time.

To add to the many strengths of TIPS4RM, Mathieu says that the activities are inquiry-based and that multiple mathematics concepts are explored in one activity. Mathieu finds that the activities span across strands thus embedding the idea that strands (and mathematics concepts in
general) are all interrelated. He says, “[TIPS4RM] is indirect. That holistic kind of nebulous way. [The learning] sort of happens” (Mathieu interview, October 14, 2011).

Mathieu also says that, in completing the explorations in the TIPS4RM resource, the students are often doing mathematics concepts although not being fully aware of it. Mathieu believes this to be yet another strength of TIPS4RM as his students are generally fearful of mathematics and would often become disengaged if they were doing mathematics so explicitly. He says of TIPS4RM. “It is all integrated. You are not doing one specific thing, you are doing a bunch of things by doing a certain assignment or problem or whatever. And so they get it, but they get it without knowing it” (Mathieu interview, October 3, 2011). The TIPS4RM’s activities are rich tasks that encompass many concepts.

4.4.2.4 Student-Centred Learning

Mathieu says that his role in the classroom has shifted. Before, he would always be in front of the classroom, teaching all of the information, trying to address all of the students’ needs and confusions, whereas now, Mathieu is more a facilitator of students’ learning. Mathieu summarizes his current approach to teaching the Grade 9 Applied Mathematics course as compared to the approach that he used to use:

[The students] do all the work. Everything used to be teacher-centred. You were the big star, standing at the front, showing how smart you are. Now you are more of a facilitator, you just give directions. Let them figure it out. I think it is better for the kids. Especially Applied kids. (Mathieu interview, October 14, 2011)

In this section, I describe how Mathieu values a student-centred approach for the Grade 9 Applied Mathematics course and how he sees his role in this learning environment.

Mathieu believes that he can provide evidence for his students thriving in a student-centred environment. He speaks about the change in student behaviour when they are suddenly expected to learn in a traditional way such as they did before entering Mathieu’s class: “If I am
away then I will have to leave worksheets or whatever because the thing is that supply teachers
do not know how to run [the activities]. [The students] find it boring and they do not like it”
(Mathieu interview, October 3, 2011).

Mathieu’s belief that active learning is more engaging stems from his own experiences as
a student. Mathieu shares that he was most engaged in learning when it was active and student-
centred. He describes his experiences as a student in university and how the different teaching
approaches affected his engagement in the courses:

What I enjoyed in university was the labs. Because you are actually doing something.
Lectures, forget it, they were just dry. I think the more hands-on, the happier everybody
is. Would you rather play hockey or watch hockey? I would rather play. I do not want to
watch. Watching is boring. Any sport, I would rather do it than watch it. (Mathieu
interview, October 3, 2011)

Once again, Mathieu mentions the TIPS4RM supporting his teaching practice. He says:
“TIPS4RM causes [students] to be engaged and it is student-centred and it always revolves
around them doing stuff. To me, that is the primary reason, is to try to get them doing something
every day, as much as possible” (Mathieu interview, October 3, 2011). Mathieu believes that the
activities from the TIPS4RM resource get the students to be active participants in their learning.
As he says, the students are the ones “doing stuff”.

Mathieu uses one particular in-class activity taken from the TIPS4RM resource to
describe the many benefits of this resource and to illustrate his approach to working with the
Grade 9 Applied students. First, Mathieu describes the activity:

Today’s lesson was a hands-on, experimental day where they did four different
investigations, rotating from post to post, four times, about 18 minutes per session. In
each session they did a different experiment: one was a bag stretch; one was a ball
bounce; one was a pendulum swing; and one was measuring the diameter and height of
cylinders. They were collecting the data as groups and then they were going to do a table
of values and then they were going to do a scatter plot and then they had to determine
what kind of a relationship, if there was a relationship and what kind of relationship it
was. (Mathieu interview, October 14, 2011)
The students worked in groups of four (the same groups that they would be working with for the entire semester) to carry out each of the four investigations. As I watched the students, I saw that, indeed, the activity was interactive in that the students had to take different measurements and record data that resulted from each of the four investigations.

Mathieu says that, by “doing an actual real life investigation to see if there was a relationship between two variables” (Mathieu interview, October 14, 2011), the students complete the investigation themselves, have more of a connection with the concepts and want to take ownership of their learning. They can adapt and modify their understanding based on multiple repetitions of the investigation. The students can test out their hypothesis and if there is confusion or debate amongst the group, they can repeat the investigation once again to confirm the results.

Mathieu further elaborates on one of the activities to describe how interesting learning can arise as a result of the way that a student might be developing their understanding or look for intricacies within the activity. In one activity, the students graph the relationship between the amount of books and their respective weight as measured on a spring balance and are to discover the type of relationship the variables have with one another (e.g., linear, non-linear, no relationship). Mathieu reflects on the activity:

We talk about, “How come you did it this way?” And then all these things come out and they come out naturally. It is not like everything’s pre-planned. It is all, what happens, happens. And the interesting thing with the bag stretch, because the stretchiness hit its limit, then the graph will stop decreasing and most likely it will become horizontal, which is kind of interesting to talk about. “Well, why did that happen?” (Mathieu interview, October 14, 2011)

As mentioned in an earlier section, Mathieu uses cooperative learning to increase student engagement and strengthen student mathematical understanding. The use of cooperative group work pulls the focus of the classroom away from a teacher-centred approach to one where the
students are working together and solving mathematics problems with their groups. Thus, it is
only natural that another focus of Mathieu’s Grade 9 Applied Mathematics program is how his
role in the classroom as a facilitator can support this student-centred, inquiry-based model. As
demonstrated in the task where students are weighing books, the students are the ones carrying
out the investigation and Mathieu asks guiding questions to keep the students’ interest.

Mathieu continues his description of the day’s events by sharing the next steps that the
students take after completing the investigations and having collected all of the associated data.

We have not finished it. Today, they did the data collection. I guess Monday, what I will
have them do in groups is do a group chart paper for each investigation. So in the end we
will end up with 16 chart papers and then we are going to post them on the wall. Each
investigation, we will post four…and then four. And then we will see if there are any
commonalities between them and they will discover what it was and then we will talk
about it. (Mathieu interview, October 14, 2011)

In this component, Mathieu highlights that each group will generate the results of each
investigation on different pieces of chart paper. He hopes that the exercise of the groups needing
to demonstrate their understanding of the investigation on chart paper and then having to display
their work will encourage the students to discuss with one another how they want to present their
data and to consolidate their understanding of the data to ensure that they are accurately
representing the mathematical phenomenon that occurred.

Additionally, once each group is done their work, Mathieu would like the groups to look
at each other’s contributions and compare their work with their peers. He wants to encourage the
students to see how other students might present their understanding of the material, whether or
not they are presented in the same way and whether they demonstrate the same mathematical
concept.

In this next part of Mathieu’s description, he highlights the appeal of this particular
activity and describes his role during the process:
I was just the facilitator. I had to set it up…keep them on task. The kids were totally engaged. They were working together, they were talking, they were collaborating, they were actually doing the experiments and I think they were actually getting some decent results, so I think it was a total success in that sense. And the kids seemed to be having a good time. (Mathieu interview, October 14, 2011)

Mathieu says that, as a result of the activity being so interactive, all of the students were engaged thereby allowing Mathieu to take a backseat during the lesson and only step in to encourage the students to think more deeply about the investigation and the mathematics that was happening as a result.

Mathieu does not just get the students to report on their findings, but “Why” the investigations unfolded the way that they did. Mathieu asks questions to his students such as, “Did you know notice anything?” Mathieu says that his questions are meant to “facilitate the direction of the conversation [to] see what comes up” (Mathieu interview, October 14, 2011).

Mathieu says of his approach:

I just let them do what they want. As long as they stay on task and they are doing what they are supposed to be doing, but how they do it, I do not care. Let them be creative. It is open-ended, it is fun. (Mathieu interview, October 14, 2011)

Mathieu believes that this approach increases student engagement because the open-endedness of the students’ learning keeps them interested in seeing what they will come up with. Mathieu says, “The kids come up with some really neat stuff. It is all open-ended so you never know what is going to happen. That is what actually makes it fun” (Mathieu interview, October 14, 2011).

Mathieu elaborates on this:

The kids are in groups, they are actually talking mathematics. I am just floating around half the time, I am just wandering. When I go in, I go to the office and get a coffee, I go back in, I walk around the room, I just chit chat with them, I give them hints. (Mathieu interview, January 23, 2012)

Mathieu gets his students working in groups and carries out his role as a facilitator of discussions and a guide as students work on student-centred activities.
Yet, a concluding thought relating to his role in the classroom has Mathieu saying: “I actually have conversations with the kids one on one. I build a rapport with them. I build a relationship with these kids. We are talking” (Mathieu interview, January 23, 2012). This demonstrates that, as a result of his efforts in the academic domain, Mathieu finds that he is able to get at social factors for student engagement as well.

**4.4.2.5 Prioritizing the Use of Technology**

Technology is a key focus of Mathieu’s Grade 9 Applied Mathematics program and at Newcastle School. Mathieu tells me that his school has been chosen as a pilot and model school to implement and demonstrate the use of technology in the classroom. As a result, the school has received extra funding for additional technological resources that other public schools may not have. Mathieu speaks of many considerations that he takes into account when deciding how to implement technology into his teaching:

> We are always trying to incorporate new technology. That is our focus here. I am trying to work it in any way I can. It has to be meaningful. I do not want to do it just for the sake of doing it. I want to do something that the kids are actually going to enjoy and help them to learn and something that pertains to exactly what they are doing in class. (Mathieu interview, October 14, 2011)

For Mathieu’s students, the use of technology in the mathematics classroom is just an extension of their everyday lives. He says, “These kids are in the computer world. Look at them, they have all got their Smartphones and mini tablets and this is the world they live in. This is what they like” (Mathieu interview, January 23, 2012). Mathieu highlights that this can be used to his advantage. He says that sometimes the use of technology masks the fact that he is actually trying to teach the students mathematics. He says:

> They think I am not teaching anything and you are just playing. And I say, “Yeah, I am playing. We are playing. You are actually learning something.” And they say, “I do not believe it.” They see the experiments, all the calculators and the iPad and using the SMART Board, they think it is all a way to amuse them or entertaining them. (Mathieu interview, January 23, 2012)
Mathieu believes that technology is not just a tool that engages students due to personal interest, but that it will foster a deeper understanding of mathematics concepts. Mathieu says, “I believe that technology gives students more hands-on activities. It helps them to investigate and collaborate. It gives them a concrete example and a direct path to follow” (Mathieu interview, December 10, 2009). In this quote, Mathieu describes how technology directly aligns with other approaches in his teaching practice that increase student engagement, namely: student-centred learning and cooperative learning.

Mathieu describes one of the benefits of technology to be that it brings mathematics to life. He says, “It is all-visual. They like that. They see it. Instead of you just talking about it and telling them, they see it in real life. Animation, whatever. Anything that works. That is interesting” (Mathieu interview, October 14, 2011).

Mathieu believes that his students are visual learners. He believes that they are so used to computers, the Internet and their cellular phones that they need constant visual cues to support their learning. Recently, Mathieu’s school acquired a class set of iPads. In speaking of why he would like to use this technology in his class, Mathieu says: “Maybe because [the iPads are] visual, the diagrams.” (Mathieu interview, October 3, 2011). In general, Mathieu believes that his students like to learn through visual representations, thus he tries to draw diagrams to support his students’ learning. When I ask if it is the particular piece of technology that makes an impact on student learning, Mathieu is undecided. He says, “Maybe. It is just boring, copying the blackboard. Maybe it is more the novelty of it rather than the content” (Mathieu interview, October 3, 2011).

Mathieu says that his students are constantly looking for what is new and cutting edge. They are interested in getting their hands on the newest iPhone and chat about the newest gadget
The variety of technologies that Mathieu uses in his teaching parallel his belief that Applied level students need to be presented with a variety of learning strategies to remain engaged in their learning. Mathieu says that sometimes he uses different technologies “just [to] introduce them to a new thing. Because, I think with these guys you always have to constantly change it up. You cannot do the same thing every day” (Mathieu interview, November 15, 2011). As he says, “Anything to be different” (Mathieu interview, October 14, 2011).

Yet, Mathieu says that even the most engaging teaching strategy can only be used in moderation. He truly believes that variety is the key in the Grade 9 Applied Mathematics classroom. Mathieu speaks of this constant need for variety:

> I think they like them all. [But] I cannot do i>clickers every day. I have been doing it now for three days and they are already getting…they are still doing it, but they are losing it. “Enough of this.” You have got to do something different. They all work, but you have just got to mix it up. There has got to be a change. (Mathieu interview, January 23, 2012)

Mathieu uses different kinds of technologies in his Grade 9 Applied Mathematics course. They include: graphing calculators, Gizmos, SMART Board, and i>clickers. In the following sections, will provide a more rich description of how Mathieu uses i>clickers and Gizmos to increase student engagement.

### 4.4.2.5.1 i>clickers

Mathieu often uses i>clickers, an immediate response device, on days that he is doing review prior to a unit test. Mathieu also uses these opportunities to let students practice multiple-choice questions that the students will encounter on the EQAO exam. When using i>clickers in class, each student has their own device, but Mathieu invites students to discuss their answers with one another during the lesson. Some students naturally work independently while others
will talk about how to solve the problem before they key in their answer. Others still, will wait until after keying in their answer to discuss their solution. In this way, Mathieu uses i>clickers to support the fact that he gives students choice to work independently or in groups (as discussed in the theme of Setting up the Learning Environment).

The multiple-choice question that the students are to answer is projected onto the SMART Board. Mathieu will give the students time to solve the problem and key in their selection using i>clickers. i>clicker technology includes a timing function so that all members of the class can see the time elapsed for the question. Mathieu uses this timer to gage how long students take to solve problems and also to remind students that the EQAO is a timed exam. Mathieu encourages his students to try to solve each question within a reasonable amount of time.

At the beginning of the semester, students are assigned a particular i>clicker and they are to use the same one throughout the semester. These personalized i>clickers have been set up such that, during the lesson, the names of the students will appear on the screen and all members of the class can see, in additional to the amount of time elapsed, who has answered the question. As the timer is running, the students know when each person has made a choice, but they cannot see the answer the person has chosen. This is a piece of information that can be used for formative assessment for Mathieu to determine which students tend to work more quickly on the problems. I will elaborate on how Mathieu uses assessment as a way to increase student engagement in a subsequent section.

There is a sense of competition that also occurs in the classroom as the students can see who answers each question quickly and who might be the last person to answer. This is one of the reasons why Mathieu refers to lessons using i>clickers as games. He says,
They see their name on the list, they get to press the button, and they are interacting. They see exactly who got it right, who got it wrong. They find that very amusing. They like it, it is fun. It is non-threatening, I do not mark them. It is just to see what we know. (Mathieu interview, October 3, 2011)

Mathieu says that the students enjoy this competitive, yet safe atmosphere. I regularly saw students yelling across the classroom about the problems and jokingly goading students who have or have not already answered the question.

Once all students have made their selection, Mathieu stops the timer and displays the correct answer to the problem. Sometimes, in his “facilitator role” in this interactive classroom, Mathieu will discuss the solution to the problem before showing the correct answer, while other times he will show the answer first. Sometimes, Mathieu will also discuss the incorrect answers. He may mention test-taking strategies and get students to describe why some of the other answers can be immediately ruled out. Sometimes he will also get students to talk through their process of how they decided on their answer. This process of debriefing, however, is relatively quick. Mathieu reminds me that the students have a short attention span and too much time spent discussing the solution will lead to the students becoming disengaged. He says, “They do not tend to stay focused” (Mathieu interview, January 23, 2012).

The use of i>clicker technology also allows Mathieu to show a graphical representation of the students’ selections. Via a colourful pie chart, the students (and Mathieu) can see the breakdown of which answer was most selected by the students and the distribution of selections. This visual representation of the answers can provide useful feedback to Mathieu and his students. As the selections of the individual students are displayed, the students who made a correct selection are shown at the top of the screen. This format is similar to that of a video game in that the “top scorers” are displayed at the top of the “leader board”, even further feeding into the students’ enjoyment of games.
These multiple-choice, practice/review classes allow students of all abilities a chance to participate. Students who are struggling can still make a selection and if they are incorrect, they are not singled out for it by the teacher. The students will invariably get a question right at some point in the class because the class discusses so many questions in one lesson, and students do have a chance to discuss their answer with a peer and potentially key in the same answer as someone else. Students can always find a reason why their keyed in answer was wrong. “I pressed the wrong button!” or “Henry said this was the right answer!” (Classroom observation, January 23, 2012) are commonly heard. Additionally, students can choose not to key in an answer if they so wish. Although Mathieu encourages all students to make a selection, after a certain amount of time has elapsed, Mathieu will stop the timer and thus students who want to opt out can do so without a fuss.

Stronger performing students can, of course, participate to the same extent. I saw one of the stronger students working ahead in his question booklet as the other students were still trying to solve the current question to which the stronger student had already keyed in his answer. The i>clicker technology along with the fact that Mathieu has provided a complete set of questions to all students is a way in which Mathieu is meeting the individual needs of the students in his class. The stronger students can work ahead, and the students who need more time are given the opportunity to work at their own pace. Yet, all students are able to participate in the “game” and get feedback about their performance.

Mathieu again points to some of the characteristics of an Applied level student as a reason why i>clickers are so successful in the Grade 9 Applied Mathematics course. He says of the technology:

They get immediate feedback. It tells you right away. And they see it on their i>clicker. They get right back what they got. They like it, because, “Oh, what did I get?” “100.”
“Oh, I got 100.” So it is that instant gratification. That seems to be the way things are these days. I guess that is what computers are based on these days. There is no waiting. (Mathieu interview, January 23, 2012)

The short attention span of the students is something that i>clicker technology will counteract. In a world where students can immediately Google something for which they do not know the answer, i>clickers will also provide instant answers for students.

Yannick, the student whom on almost every other occasion that I have visited Mathieu’s class, is not terribly engaged in learning. In a lesson using the i>clicker technology, Yannick seems like a different student. I took field notes about this occasion:

Yannick, a student who in every other class, is not paying attention and basically sleeping, is engaged today. He is sitting at the table of six [students]. He still has an ear bud in his ear. He gets made fun of by the teacher. He laughs. The students make fun of him. He laughs. He is chatting about non-mathematics things, and the teacher needs to remind him to key in his answer. Sometimes he gets the answer right. Sometimes he gets the answer wrong. He is one of the students that the teacher makes fun about summer school. The student laughs and responds jokingly. When he gets the answer wrong the students bug him and hit him jokingly. For awhile he laughs and hits back. I guess after awhile he got tired of it and moved to another desk. At this new place, he does not have anyone to talk to and he is playing music. But still working on the questions. He will make comments about whether he gets it right or wrong. Sometimes commenting to the teacher that he got it right, and therefore should not go to summer school. (Classroom observation, January 23, 2012)

There are two components of Mathieu’s classroom that seem to engage Yannick: the classroom environment and the thrill of a game/competition. As discussed in an earlier section, Mathieu’s classroom environment, filled with playful joking of both the students and teacher was something that Yannick enjoys. Although jokes are made at Yannick’s expense, he is able to laugh at them, and when given the chance, he also jokes back. When Mathieu jokingly threatens Yannick about having to go to summer school as a result of his poor performance that day, Yannick is able to laugh at the comment. And only moments later when he gets an answer correct, Yannick refers back to the previous joke, therefore showing that he is engaged in the class and following the discourse that had happened.
Yannick seemed to be so engaged in the activity that he needed to move away from the students who were chatting with him and goading him. Yannick moved to a different table where he could concentrate on the activity. Based on what I observed, the classroom environment of Mathieu joking with him about summer school got Yannick engaged in the material where he could prove Mathieu wrong as well as the fact that the i>clicker activity itself was something that Yannick seemed to enjoy.

4.4.2.5.2 Gizmos

I observe one class in the computer lab in which the students are using Gizmos. The students are left to explore the Gizmos individually. I ask if it would have been helpful for the students if Mathieu had led a demo of the Gizmos so that the students would know how to proceed. Mathieu says:

I could do a demo but then they get itchy and antsy. [Instead.] I would just let them go and see what happens. Most of them figure it out. And then I just circulate around, see what they are doing. (Mathieu interview, November 15, 2011)

I observe as the students do, indeed, start to play with the activities. With the Gizmos, they can play with one of the three activities that Mathieu has pre-selected, thus there is some choice for the students to decide which of the three Gizmos is most interesting to them. I notice that most of the students end up playing with the same activity after speaking about their discoveries with their peers. After having heard a peer speak in an excited voice about one discovery, the students all seem to quickly switch over to that activity so that they can join in on the conversation. Some of the students are chatting with one another about the activities. They are talking about what is on the screen, what results they have found and how to answer the questions that are associated with the activity.

The most popular Gizmo during this lesson investigated distance-time graphs. In this activity, distance-time graphs are created for two runners who are competing against one
another. The students can manipulate the paths that the runners take, the direction in which the runners run, how far they go and in what time.

I see the students change the course of the runners and I hear the students talk about who can “create the craziest graph” (Classroom observation, November 15, 2011). I see a student ask the student beside them to look at their “crazy graph”. They are laughing, pointing at the visual of the runners on the track and how they are going forward and backwards and changing speeds. Clearly, the students are enjoying this interactive learning opportunity and the chance to be in control of the mathematics, a trait that Mathieu mentions when discussing the importance of student-centred learning as a means to increase student engagement in the Grade 9 Applied Mathematics class (discussed in an earlier section).

During the lesson, I hear Mathieu pipe up jokingly, “What kind of race is that?” (Classroom observation, November 15, 2011). Mathieu also wants to be part of the conversation and encourages students to share their discoveries. He does this in a way that is not demanding the students to present their mathematical work, but to describe the “cool” things that they have discovered. As the mathematics is embedded within the activity, the students will invariably make mathematical discoveries and use mathematics terminology. As mentioned in a previous section, Mathieu sees his role in the student-centred classroom as that of a facilitator, and even when using technology to create this student-centred environment, Mathieu continues with this role.

Mathieu also shares that, as Gizmos is an online program, the students have access to this learning tool outside of the classroom. In fact, Mathieu will encourage his students to go home and continue to experiment with the Gizmos that they have used in class. He says:

I can just give [the Gizmos] to them and they can do them at home…I am going to give each kid their username and password and their class code and say, “Now login at
The students enjoy the flexibility it gives. (Mathieu interview, November 15, 2011)

Mathieu says that he knows that most of the students do not use the Gizmos outside of the classroom, but those who do, Mathieu is happy that they are so engaged in their learning that they continue to experiment outside of the class.

It is clear that Mathieu uses many different technologies in his Grade 9 Applied Mathematics course. In fact, they are so often used in his teaching that his students expect it to be part of lessons and look forward to using them. Mathieu speaks of one of the few lessons that he did not have the graphing calculators available to the students and immediately the students picked up that something was missing from their learning environment. Mathieu recounts this lesson: “Last day was funny. They said, ‘We really miss the graphing calculators’ when we were taking up homework …. So right away I realized how much [they] rely on the calculator. I think they enjoy it” (Mathieu interview, November 15, 2011).

4.4.2.6 Encouraging Student Mathematical Communication

As previously mentioned, Mathieu believes that the “investigations” in the TIPS4RM resource encourage students to really consider their understanding of the mathematics concepts. Additionally, knowing that the students will interact more readily in smaller groups is the reason why Mathieu often has his students engage in cooperative learning. During this group work, he notices that students “do ask interesting questions and they argue…they were talking!” (Mathieu interview, October 14, 2011). Mathieu believes that students will stay engaged and strengthen their mathematical understanding through discussing ideas about the investigation and in listening to peer’s contributions.

Mathieu believes that the quality of the talk contributes to the learning. He says that students “ask interesting questions and they argue” (Mathieu interview, October 14, 2011) and
this purposeful talking is the key. Mathieu assumes that since the students are thinking critically about the material, they are going below the surface of the mathematics concept.

### 4.4.2.7 Supporting Student Success

In a previous section, I discussed how Mathieu uses i>clicker technology for formative assessment as a means to increase student engagement. In this section, I further elaborate on how Mathieu uses formative assessment and describe how Mathieu frames assessment in the Grade 9 Applied Mathematics course to show his students that they are capable of being successful.

Mathieu believes that, for the Grade 9 Applied Mathematics course, assessment should be used as a means to support student learning and encourages students to continue to be motivated to engage in classroom activities, rather than as a punishment and gate-keeper for future studies. For these Applied level students, they have struggled with their mathematics achievement. Thus, Mathieu provides many opportunities for students to gain marks in his course. He does not want anything in the course to be weighted too heavily as it will put too much pressure on the students to perform well on that particular assessment.

In Mathieu’s Grade 9 course outline, he identifies seven unit tests, each comprising 6% of the final course mark. In-class tasks (including quizzes, worksheets and other activities) are worth 22% of the final mark and the multiple-choice portion of the EQAO and the final exam, 10% and 20% respectively. For the in-class tasks portion of the assessment, Mathieu provides many opportunities for students to demonstrate their mathematics understanding and to give students a chance to develop their confidence in a subject where they general tend to struggle.

Mathieu uses the Ontario Ministry of Education’s (OME) 4-leveled system to assign marks for every possible assessment that the students complete. This system (OME, 2005a) correlates a Level 1 with a range of 50-59%, Level 2 with 60-69%, Level 3 with 70-79%, and
Level 4 with 80-100%. The OME deems Level 3 to be the standard of performance that student should aim for. In order to achieve a Level 3, students should demonstrate a considerable degree of performance within four categories: Knowledge and Understanding, Thinking, Communication, and Application. If a student’s achievement is below 50% at the end of the course, they will not receive credit for the course.

Mathieu’s practice contrasts to the practices of many teachers in the province, so, in one interview with Mathieu, I want to learn more about this process and find out how this leveled system, in fact, gives the benefit of the doubt to the students and helps foster some self-confidence in their mathematical abilities. Mathieu and I talk about assessment in an interview immediately after a class during which the student completed an online quiz as part of a Gizmos activity. He says of his interpretation of the Ministry of Education’s leveled system:

I go by the descriptors. If you do a direct translation of percent, if a kid gets 55% on a quiz, they get Level 1. That is not how it was meant to be done. You are supposed to look at their body of work and then according to the [descriptors in the] achievement chart, come up with a level. And then the computer changes the level to a mark in the end. I put no percents into the computer. I do nothing by raw marks. I do everything by levels.

(Mathieu interview, November 15, 2011)

Mathieu sets his student up for success and uses the leveled system to give the benefit of the doubt to his students.

Mathieu’s stance for the Grade 9 Applied Mathematics course is that teachers should be encouraging these students to continue with their academics and that they are capable of learning the mathematics material not necessarily to perfection (as this is not a priority for the Applied level students) but to an acceptable level of comprehension. This is reinforced when Mathieu mentions that he does not have the same outlook towards Academic courses. In the Academic courses, he asks the students to perform well and to strive to achieve good results on each and every single assessment.
Mathieu truly wants each of his students to succeed and that his goal for his Grade 9 Applied Mathematics students is not to demonstrate a refined and comprehensive understanding of the mathematics concepts for the course, but rather to support them through their academic career and encourage them to continue to put forth their best effort in their academics. In speaking of a struggling student in his class, Mathieu says:

I just do what I can to help him along. He will end up with a level probably 2-. So he will pass. As long as he keeps handing in stuff and doing and trying. He will pass. But you are never going to…he is not going to turn into a Level 3+ or a 4. It is not going to happen. Student success. [If a student really is not understanding the material] then you give them Level 1-. (Mathieu interview, November 15, 2011)

With this exchange, it is clear that Mathieu is giving students opportunities to be successful in the mathematics course. He also puts value in any effort that a student puts forth even if the student is struggling to fully understand a concept. That being said, Mathieu still maintains a standard for the course. If he sees that a student is not grasping the material, he would have no choice but to assign the student a level that would be at the borderline of meeting the requirement necessary to pass the course. Then, in discussion with other staff members at the school who may be working with the student, Mathieu would decide if, in the student’s best long-term interests, whether or not to deem the student as being successful in the course.

Mathieu reiterates that, for the Grade 9 Applied Mathematics course, students are generally not striving for perfection nor should that be the goal of the teacher. He says:

With [Grade] 9 Applied [students] it does not matter. We are trying to give marks away with those guys, anything to try to make them successful, it is not a punishment. These are not Academic [students], we are not here to see who is the true 80%. (Mathieu interview, December 18, 2011)

Mathieu assures them that passing the course is not difficult. That he will support them to be successful in the course and he tells the students exactly how the course will run, and the types of activities that will take place. For Applied level students, who usually struggle in mathematics
(or with their academics in general), being told from the start that if they try, they will pass the course sets a very different tone for the year. It creates an environment that Mathieu is on their side and rooting for them to succeed. It puts the onus on the students so that it is up to them whether or not they will pass the course.

As Mathieu sets his students up for success, he creates assessment opportunities where the students are not being assessed on their test-taking skills, but rather their understanding of mathematics concepts. Mathieu does not want to risk having students struggle on assessments because a question is being presented in a way that they may not be used to. Instead, Mathieu gives students questions on quizzes and in-class tasks that will be similar to those that they will face on culminating tests. Additionally, Mathieu is transparent about his intentions and tells the students that the question that they have seen will be similar to those that they will see on later assessments. He says of his approach when reviewing a quiz:

[When] I take it up (the quiz)...we go through it. And they have their answers and I say, “Keep that paper now. Do not lose it because you can use this.” So they are already prepped for it. So now when I give them the final, the individual, they know. They look and they say, “This looks very familiar” (Mathieu interview, January 23, 2012).

Mathieu encourages his students right from day one and bluntly tells them that are capable of being successful. Mathieu explains what he tells the students on the first day:

I do a little lecture on how to pass the course. I lay out the program, “This is what we are going to do and this is how we are going to do it” and I say, “If you do this, this, this and this, there is no way you can fail.” (Mathieu interview, December 18, 2011)

Mathieu says that this introductory talk, “reassures them, so they feel good, they are going to pass, they are going to be successful” (Mathieu interview, December 18, 2011). Right from day one, Mathieu gets the students to believe that is possible for them to achieve success.
4.4.3 Summary of the Case of Mathieu

Mathieu believes that his students are responding to his approach. Two and a half years ago, he changed his teaching approach as a result of the Collaborative Teacher Inquiry Project. Since then, he has noticed a change in the engagement of his students, something that he directly attributes to his reformed teaching methods.

Mathieu describes his current approach as a way to increase student engagement:

In my class, we use the new methods, which are working in pairs, student interaction and group work. The kids are always engaged and do the richer type problems where they have to collaborate, work together, try to come up with a solution so it is mostly student driven. So the teacher is more or less just a facilitator who gives directions. We try to get the kids engaged every day. So they are doing stuff. Hands-on. So they are not sitting the being bored. (Mathieu interview, October 3, 2011)

Through Mathieu’s description, we can see his focus on factors within the academic domain. These teaching strategies allow students to become interested in learning the material and support their developing mathematics understanding.

4.5 The Case of Nadia

Nadia has been teaching at Blessed Star School for 12 years. During this time, she has taught a variety of mathematics courses at all grade levels. Attending post-secondary institutions in Southern Ontario, Nadia completed her Bachelor’s degree studying both mathematics and French then went on to complete her Bachelor’s of Education, where she received qualifications to teach Grades 7 to 12 mathematics and French. Since then, Nadia obtained her Honours Specialist qualification in mathematics.

Nadia chose to type her journal entries and e-mailed each entry to me immediately following completion. Nadia would e-mail me a journal entry every two to five days. Some of these entries would be written before she taught that day and others would be afterwards. Sometimes Nadia would write two entries in a day. In this situation, the second entry would
always comment on or follow up with something mentioned in the first entry. Sometimes in these second entries, Nadia would mention that she had forgotten to write something in her first entry thus needing to contact me again later that day. For the most part, Nadia’s journals were written as though Nadia was speaking to me about what was on her mind. This included reflections on the day’s lesson, the behaviour of her students, or her own emotions about teaching the course.

Nadia says that, in order to increase student engagement in the Grade 9 Applied Mathematics class, the students’ social needs need to be met. Nadia says, “I do not care what the strategy is, you have to deal with the [social] first” (Nadia interview, January 23, 2012). In the case of Nadia, I will show that, although she uses instructional strategies that appeal to her students’ academically, Nadia’s main focus in her teaching is the social domain. Although a teacher may use exemplary instructional strategies to foster a deeper mathematics understanding, Nadia believes that these strategies will not be successful if the student is not first socially engaged in the class.

4.5.1 Social Engagement

At the heart of Nadia’s teaching practice is her care and compassion for individual students. This, however, may seem surprising to even Nadia herself, as she believes that her primary focus as a teacher is that of an academic mentor. She says:

I am here mainly for their academic success. I am not their counselor and I am not their parent. Okay, I can give them that moral support and that stuff, but I want the academic. They come here mainly for their academic. If they do not do well on their academic, I am going to be very upset. (Nadia interview, December 20, 2011)

Although Nadia says that she wants to maintain an academic relationship with her students and keep the learning environment structured, Nadia’s actions and show that, in fact, this is a key reason why her Grade 9 Applied Mathematics students are engaged in the course. In
this section, I describe how her natural connection with each of her students, her intent in getting to know her students for herself, her respect for all students, and her sense of care appeals to her students’ social needs.

4.5.1.1 Supporting Emotional Students

Nadia acknowledges that, for some of her adolescent students, emotions can run high. By getting to know her students, Nadia knows which students may get emotional and in response, Nadia knows that she needs to show a calm demeanor to soothe these students. Nadia says: “That is something. A big one, actually. I have to cool down, myself. Because sometimes when you are angry, it becomes worse. You just have to calm down and calm them down” (Nadia interview, January 23, 2012).

Nadia gives an example of how her calm manner helps an emotional student during a stressful situation. Nadia says that as a result of her actions, with his newfound sense of calm, the student was able to engage in the lesson. She speaks of this student, Murphy:

He has anger problems. The first time he talked to me, actually, gave me the chance to talk to him. And then he was fine. They have to have a relationship with you. I have never heard any bad words from them. He never yells. Nothing. It is not like he even tried. He did not do it. He just calms down. He looks at me and he sees me smiling at him, he smiles [back] and [then] he is fine. (Nadia interview, January 23, 2012)

As Nadia’s example with Murphy shows, a teacher’s care can make all the difference. Though Murphy’s behaviours and emotions might not be the most desirable in the moment, Nadia’s smile reassures Murphy so that he is able to move forward with his learning.

Nadia is proud to talk about Murphy in our interviews. This is a student whom the school has identified as having anger management issues. Nadia explains that she tries to speak with Murphy and has developed a positive relationship with him outside of the mathematics class. Throughout the semester, Nadia has noticed that Murphy has begun to open up and become more involved in classroom discussions. Nadia sees that Murphy is engaged in the course and also
better interacts with his peers. In a journal entry written close to the end of the semester, Nadia cannot help but brag about Murphy’s progress. She writes:

I have something in mind that I am very proud of so I will start talking about it first. Murphy came yesterday ready to write the test and there was another mathematics teacher with me for supervision. I noticed his anger building up, so I just called his name and said: “Murphy, please” so he answered, “But Miss” then looked at me and you should see him, Limin, he was calming himself down and became very respectful towards that teacher! I just have to say how proud I am of Murphy, he was able to control his anger and work without any emotional disruption. I really hope he continues this way, his future will be much more successful. He is a very smart kid. (Nadia journal, January 26, 2012)

Nadia’s journal highlights that her efforts and modeling of how to remain calm in stressful situations has helped Murphy learn how to self-regulate his emotions.

4.5.1.2 Minimizing Student Insecurity

Nadia says that classroom management, student academic achievement, and student engagement are all related. She says that, when her students are struggling, she has more behaviour problems in her class. She also says that, when students demonstrate rowdy behaviour, they are not engaged in the course. She says:

The behaviour happens because [the students] do not [understand the material]. When you do not understand, you are frustrated, your behaviour gets worse. And if you do understand what you are doing, you want to know more. “Oh, I get this. How about if I do this?” (Nadia interview, January 23, 2012)

Nadia gives an example of this in her class. She uses Murphy once again as an example of how a student’s behaviour can change when he understands the material. Nadia says “When he understands a concept, he keeps on working and working. He does not stop” (Nadia interview, January 23, 2012).

Nadia says that Murphy’s behaviour is not unique. Nadia says that her students act up when they do not understand the material because of their insecurities. When her students do not understand the material, they shut down and are not resilient. They will not take the time to work
through their difficulties and instead turn to other things that lead to disruptions in the mathematics class.

[The students] flounder especially when they are frustrated. They do not get it, they do not even try to begin [to understand the material]. They know that they are not going to get it and then they start, you know, “You were not here, Miss, I do not understand.” “Yeah, but you know what, you have to try.” (Nadia interview, January 23, 2012)

Nadia says that Applied level students need to feel that they are capable of being successful in the mathematics classroom in order to take risks and participate in their learning. For many of these students, self-confidence in the mathematics classroom is low. The students may have consistently struggled with the mathematics content, whereas in other situations, the students struggled in the mathematics learning environment as a result of social challenges. Nadia explains that for the Applied mathematics student, a teacher needs to nurture and encourage growth of student self-confidence. She says: “To give them success so that they feel like they are confident. It is so important” (Nadia interview, April 19, 2011). In a later section (Setting High Expectations for Students), I describe how Nadia increases student self-confidence through her belief that all students are capable of being successful in the course. Nadia also believes that, if she communicates to the students that she has faith in their abilities, then they will reciprocate and work to make Nadia proud. We will see this theme again throughout the case of Nadia.

4.5.1.3 Developing Student-Teacher Relationships

As Nadia develops a relationship of trust and respect with her students, they are willing to work so they do not let Nadia down. Nadia says, “I have one kid that is giving me a hard time. I tell him, ‘I am going to have to call home because of this.’ He said, ‘Okay, give me a chance.’ I did and he worked much better” (Nadia interview, October 28, 2011). The gesture of Nadia
giving the student a second chance strengthens the relationship between the two as it further demonstrates to the student that Nadia is caring and has faith in the student.

Nadia shares that she believes that her students open up to her because they trust her. Nadia talks about trust being a key factor in the change of attitude for one of her students in the Grade 9 Applied Mathematics course from this semester. Nadia says that, on the first and second day of class, this student would come late, not be engaged during class time and would often show up not in the proper school uniform. Nadia describes the student’s change in behaviour:

Now, [he] is perfect. He comes, he works. He goes [for a walk], he comes back and he actually sits and he talks to me even after the bell rings. He starts talking to me about rugby and about other things in his life. When you have their trust, that is when you get them to work. And that is what is happening this year. This year, I am starting to have their trust; they want to do the work. They want to show you. (Nadia interview, October 28, 2011)

In addition to Nadia saying that the development of trust is key to a positive behaviour of students, Nadia mentions that she is often seen smiling at students.

Nadia is respected by her students. Although from time to time, she gets frustrated by her students’ behaviour, Nadia admits that they must be fond of her or else they would not behave the way that they do. Nadia tells me about her students’ reaction once she told them that I would be coming in for a classroom observation the next day:

They said, “Oh, do not worry Miss, we will be good tomorrow.” I responded, “It is not about her coming, it is just that you guys work so well and I say that you work so well so do not show me that I am wrong.” “We do this because we like you. We do not do this in other classes.” “You like me so you scream?” It makes no sense. They are laughing, they are happy. They do not want me to be upset. I like them. (Nadia interview, December 14, 2011)

Nadia’s reflection of this incident is further proof that she is respected by her students and that a good student-teacher relationship has been developed. Her students know that I, an outside observer, will be coming to her class to make notes on her teaching, thus the students want to put Nadia in the best light possible and promise to be on their best behaviour.
If the students did not respect Nadia nor care about how I would view her teaching, they would not have thought twice about the way that they acted in class. In addition to garnering respect from her students, Nadia’s relationship with her students makes them feel safe and comfortable. The respect that Nadia earns from her students is not out of fear, but rather out of caring. The behaviour that Nadia’s students exhibit in her classroom is endearing and the students tend to push Nadia’s buttons in a childish, endearing way, rather than with malicious intentions. Although Nadia says that she finds her students frustrating, her body language and reflections demonstrate and articulate Nadia’s awareness that her students mean no harm by their silly behaviour.

Nadia’s personality and caring manner towards her students is the hallmark of why her students feel socially engaged in Nadia’s mathematics class. The students know that Nadia cares about them as people and thus, the students feel like they are a part of a caring community. The students know that, with Nadia at the helm looking out for their best interests, their community is a safe environment. The following dialogue between Nadia and I shows that Nadia’s caring nature shines through no matter how frustrated she seems to feel.

L: At one point, when something had happened, you had a big smile on your face.
N: I know, I should not have.
L: Delilah even called you on it. [She said,] “You said it was not funny, but you are smiling.”
N: I know. I should not be. I do not know. I do like them, so when she said that, she was right.
L: You were trying to be so stern.
N: But it is so hard. I should not do that. I like them. (Nadia interview, December 20, 2011)

Nadia’s true emotions often contradict any attempts to discipline her students. Nadia gives one example of having to reprimand a student, Fumio, for his poor behaviour in class:

I said, “You have to do this”, and he was like…just looking at me. I should have been upset, but I started laughing. “Why are you laughing Miss?” “I am laughing because you remind me of my daughter. She does the same thing. When I tell her to do something that
she does not like, she makes the same face.” He started laughing. (Nadia interview, December 20, 2011)

Ultimately, the students cannot help but feel cared for in an environment in which they usually feel neglected, or cast aside due to their weak academic abilities. Nadia summarizes this situation best when she compares it to her relationship with her daughter:

It is like me when I am hard on my daughter, she says, “You are hard on me.” You have to discipline them but at the end of the day she is my daughter and she loves me and she wants mom. That is the same kind of idea as the teacher. Yes, they know I care about them, that is why they are not worried about their work because they know that I worry about it. They give me a hard time because they know that I am taking care of them. If I was not then they would be scared and they would have to worry about it. (Nadia interview, December 20, 2011)

Although it makes her uncomfortable, Nadia knows that many of her students are engaged in the course because of the personal connection that they feel with her. The students feel like they can trust Nadia with their personal issues and therefore also trust Nadia to guide them through the mathematics curriculum. Nadia speaks of one such student:

She is actually getting engaged. It is just because of her relationship with me and so far, I am doing my best to say take it easy, she is just a kid. It is like you are her mother. You are not going to go crazy on her. You are going to try to teach her. And I am trying to do that and so far, it is working. It feels good. (Nadia interview, April 19, 2011)

Nadia likes to learn about each of her students for herself. She wants to get to know their personalities, their goals and their dreams. In the professional development opportunity organised by Benjamin to strengthen relations between Blessed Star School and its feeder schools, Nadia had the chance to meet teachers who had taught her students when they were in Grade 8. Some of the students’ former teachers tried to share their negative opinions about the students. Nadia was resistant to this because she did not want the teachers to skew her judgment about her students. Nadia is determined to think highly of her students and to set high expectations for all. These goals are fundamental to Nadia’s teaching practice, thus hearing negative perspectives about the students may cloud Nadia’s judgement. Nadia says:
I like to have my own opinion about the students. Sometimes when you hear the opinion of other teachers, you do not see the kids the way you want to see them, you see them “Oh, he is going to be a troublemaker.” I already have that thought in my head before I start and I do not like that. (Nadia interview, December 14, 2011)

Nadia stresses that she gives all students in her classroom a clean slate. She says, “I do not judge anybody. If they have a problem, I say, ‘I can help you.’” (Nadia interview, January 23, 2012). Nadia acknowledges that students’ emotions during their adolescent years are constantly in flux and that, as their teacher, she needs to be cognizant of these changes and do her best to support them through this emotional time. Nadia writes a journal entry as follows, “Patience is very important when dealing with kids. Their emotions are like a rollercoaster, and the only way to get to them is by being supportive and very patient” (Nadia journal, November 9, 2011).

Nadia describes one such student whom she has heard struggles in other classes and causes problems with other teachers.

I overheard that the kid is not good. He lies, he does not do anything, he is lazy, and he is disrespectful and so on. I did not see all that. I did not see him as horrible as he has been described…Apparently he is failing most of the classes because of his attitude. (Nadia interview, December 14, 2011)

Nadia continues by saying that, if she had listened to the other teachers’ opinions, Nadia might not have given this student the chance to shine and prove everyone else wrong. She says of this student:

If I had known [about the bad behaviour] from the beginning, I would not have approached him the way that I have been approaching him. I approach him differently. I think that is why he is working with me better. He has an opinion, [but] I do respect it, and I do look at it. I talk to him. Whenever he screws up a bit, I try and get him back on track. And he is working fine. (Nadia interview, December 14, 2011)

Thus, Nadia does not pass judgment on this student as a result of what colleagues have said. To her encouragement, Nadia sees that the student responds in a positive manner. She knows that the student is appreciative of Nadia’s approach. Nadia re-emphasizes that each student deserves
individual attention and that each student who enters her classroom should be treated with respect and optimism regardless of their previous experience in other classes or with other teachers.

Nadia also shares that talking to students individually will help students feel comfortable in the classroom. Because the students will get to know the teacher and vice versa, they will feel like the mathematics classroom is a more familiar space filled with people whom they know as opposed to a room full of strangers. Nadia says:

You go individually, I like to go around and actually talk to each one of them. So they know that I am actually interested in them. An individual person. So I try to get them more comfortable, more confident, and more personal. Because it works better if they know that you care about them individually. So that is what I try to do. (Nadia interview, April 19, 2011)

As a result of getting to know her students individually, Nadia is able to draw from this knowledge and let them shine. Nadia describes one experience in which she knew that two students were musically inclined and invited them to share their interest with the rest of the class.

Two of the kids in my class put a musical performance that they made in their spare time on YouTube. To ease the kids' stress around the test and midterm marks, I decided to show the video in class. It was really nice! They were proud but shy of their performance. The class was interested in the song and the way they performed it. I was able to see a side of these kids that I do not normally see. This could eventually lead to a connection between us that will hopefully enable me to teach them and them learning better. (Nadia journal, November 3, 2011)

This example shows that even components of the students’ lives can be used in the mathematics classroom as a way to demonstrate talents and give reason for students to feel proud of themselves. Nadia reflects that any connection that she can make with a student, mathematics or otherwise, can be a powerful tool in developing a closer relationship.

Nadia believes that each student needs to be treated differently depending on their needs. Nadia describes her students as either needing academic encouragement or emotional support. She describes these two types of students by using examples:
Someone like Marty, he does not need that personal [support] because he has that at home but he needs the confidence in mathematics. As soon as he saw that mark of 100%, he actually had a happy face. Since then, I have got him. And that is all it was, academic work. Someone like Carmen, she has other problems. Personal problems. So…when she talks to me about [her problems] and she sees that [I view the problems as] important, you have this kind of trust between them. Then she starts looking at the mathematics. At least just to satisfy you. (Nadia interview, October 28, 2011)

This is an idea that I will return to in a section about academic engagement. In the theme of Meeting Individual Needs, I will further discuss how Nadia believes that each student needs to be treated differently. Nadia says that, for some students, she needs to use strategies that help the student socially (e.g., Carmen), while for others (e.g., Marty) it is academic strategies that will help with student engagement.

4.5.2 Academic Engagement

For Nadia, academic strategies for engagement are not the hallmark of her teaching practice. Nadia shares that she is relatively new to the Grade 9 Applied Mathematics course and successful instructional strategies for this course are different from the other courses that she normally teaches. Nadia says that she is developing her comfort level with the instructional strategies that she knows will increase student engagement for her Grade 9 Applied Mathematics student, but that it will take some time before they become a more prominent component of her teaching. Before I describe the factors within the domain of academic engagement that Nadia considers, I first provide more background about why this domain is in its infancy in Nadia’s teaching practice.

Nadia teaches the Grade 9 Applied Mathematics course in a different way than she does her other mathematics classes. Nadia says that her Grade 9 Applied Mathematics course is more interactive, uses group work, student-centred and hands-on learning. These are teaching strategies with which Nadia is still becoming familiar. Nadia feels as though she needs to put in extra effort as she prepares for her lessons to feel confident with these strategies.
Nadia uses an example to describe her learning process:

I have never used Alge-Tiles (a manipulative) before. And I am looking at them and I am thinking, I do not know what I am supposed to do. I started reading to understand. I will learn the Alge-Tiles to teach with them. But it will take me time and after I know the kids, I will start and understand some of the Alge-Tiles, maybe give it to them slowly or one part of the lesson this time. (Nadia interview, October 28, 2011)

Nadia acknowledges that it takes her time to feel fully comfortable with a new teaching strategy. Thus, while Nadia is still becoming familiar with these new instructional strategies, the academic domain is not her focus for increasing student engagement. Nadia also reiterates that she will first get to “know the kids” and reinforces her focus on developing student-teacher relationships and meeting her students’ social needs. Nonetheless, in Nadia’s teaching practice, there is still evidence of teaching practices to promote academic engagement in the areas of meeting individual needs, assessment, and the use of student tasks and technology.

4.5.2.1 Meeting Individual Needs

Nadia emphasizes that her students have different needs and as such, she needs to respond to each student differently. Nadia says:

Every kid is different. Basically the idea is that you need to know your class and you need to know what they need. And whatever they need, you try your best to satisfy their needs. Eventually you get them. And that is what I am trying to do. (Nadia interview, October 28, 2011)

As making personal connections with students is a key component of Nadia’s teaching practice (discussed earlier in Developing Student-Teacher Relationships), it is not surprising that Nadia is cognizant of the needs of individual students when selecting teaching strategies. For Nadia, this often means trying to understand if students need more social or academic attention.

Nadia uses examples to describe the various needs of her students. First, Nadia describes a student, Carmen who is strong academically, but struggles to engage in the class because of emotional insecurities and other issues outside of school:
For [Carmen], it is the emotional side. For her, all I have to do, I teach her the way I teach my Academic [students]. Pencil and paper, fast. It is done, no problem. But [her head] has to be fine. Her brain. Her emotions. (Nadia interview, January 23, 2012)

To meet this student’s needs, Nadia knows that she can use any instructional approach in order for Carmen to be successful. On the other hand, Carmen struggles emotionally and Nadia focuses on this factor for student engagement. Once Carmen is engaged in the class, Nadia knows that she does not need to worry about using varied and complicated instructional strategies to support Carmen’s learning.

By contrast, for other students who are emotionally secure but academically weak, Nadia needs to use varied instructional strategies to help the students understand the material and see the value of learning mathematics. Nadia needs to find out the instructional strategies to which each student will respond. She says:

With other kids, it is more the CBR (Calculator-based Ranger), they need the other stuff. Like Marty, he does not need that hands-on. Primo, the quiet one, he needs the hands-on. When he gets the hands-on, he understands better and then he talks more. Now, he actually talks to me. Which is amazing. Ritchie, is another one. He is the same thing. He was not so sure and now he is doing better because of the use of manipulatives. (Nadia interview, January 23, 2012)

Nadia summarizes that she cannot use one approach and expect it to be successful with all students in her class. She says, “It depends on the kid” (Nadia interview, January 23, 2012).

Nadia says that the majority of her students in the Grade 9 Applied Mathematics class have Individualized Education Plans (IEPs). This is in contrast to the few with IEPs in her Academic classes. She says:

I have 23 kids [in Applied]. More than half of them [have IEPs]. Maybe 65-70% of them. I have only a few who do not have IEPs. [In Academic]…maybe 2 or 3 out of the whole group which is 27 of them. (Nadia interview, October 28, 2011)

This disproportionate number of students with IEPs requires Nadia to be more purposeful in her teaching. Nadia knows that the needs of her Applied level students are more varied than in her
Academic courses thus she needs to have a richer variety of approaches and tasks to use in her
Applied level class.

4.5.2.1.1 Providing Additional Individualized Attention

With a greater diversity of needs in her Grade 9 Applied classroom, Nadia believes that
giving her students more individualized attention will help with student engagement. Working
one-on-one with student will allow Nadia to change her approach depending on whether the
student needs social or academic support. Additionally, Nadia will be able to better support her
students with IEPs.

Nadia shares that, this past semester, she has been very fortunate to have both an
educational assistant (EA) and a peer helper (a senior mathematics student from the school) in
her class every day. Nadia shares that having these two individuals allows her students to receive
more individualized attention than they would if it was only Nadia in the classroom.

Nadia says that not just any additional adult in the classroom will benefit the students.
Nadia believes that these extra individuals should have a strong mathematics background and be
able to communicate well with the students. With a strong mathematics background, the helper
can support the students academically, and good communication skills align with Nadia’s
conviction that speaking with students and developing a relationship with them has social
benefits.

The EA in Nadia’s class this semester is Amelie. Nadia describes how lucky she is to
have Amelie:

Amelie is a resource teacher. She is one of the best, actually. She knows her mathematics
and she is very good with managing the students. She speaks to them, she understands the
mathematics, and it is very difficult to find one who does. She is very comfortable with it
and she has experience with those kids. (Nadia interview, December 14, 2011)
Nadia knows that she can count on Amelie to step in and support the students both emotionally and academically. When Nadia describes her EA, Amelie, Nadia says that she “is like an extra teacher.” Nadia mentions that this is important because the students need another adult with whom they can seek academic guidance. Nadia says:

[Amelie is] not just an extra body because she does the teaching. Not just in the class, but in groups. When we went downstairs and [the students] were talking about slope, the rise... they were actually talking to her. She knows the right method to use. That is because she knows her mathematics. (Nadia interview, December 14, 2011)

Nadia believes that, for these students who often struggle at learning the mathematics concepts, the individualized attention will not be beneficial unless the additional support can provide academic support.

At Blessed Star School, peer helpers are senior students who, for school credit, are placed in a classroom to support student learning. Most often peer helpers work with students one-on-one during class time, but peer helpers’ classroom involvement may vary depending on the expectations of teacher and mutually agreed upon responsibilities. For the duration of the semester, Nadia has a peer helper, Max in her Grade 9 Applied Mathematics class. Max is a first-time peer helper and does not have much experience working with peers in a mentoring capacity. Thus, he is not as comfortable moving around the class and responding to student cues that show level of engagement. Nadia has suggested to Max that he sits with specific students (pre-selected by Nadia as being students who have missed a large number of classes, are struggling with the material, or have a difficult time focusing in class) to work with them one-on-one. Nadia says that this one-on-one academic attention helps with student engagement because the student is getting individualized attention.
Nadia insists that her Applied level students need more individualized attention than their Academic peers. Nadia says that she needs the extra support that Amelie and Max provide to help her students to succeed. She says:

That kind of support, I need. Having Amelie and Max are a big benefit. They are a lot of support. Honestly, you do need it. Some of [the students] need that one-on-one [attention] and I cannot give it to them because if I do, I will lose the rest. (Nadia interview, December 14, 2011)

Nadia explains that she tries to give her students individualized attention but that, in a whole-class setting it is impossible to give students the individual attention that they crave. She says, “I try to go around and make sure that everyone is working and they know you are on top of it. I cannot sit for a second in that class. You have to be with them all the time” (Nadia interview, December 14, 2011).

In order to further meet the needs of individual students, Nadia and Benjamin created an opportunity to provide extra support to students who are struggling in the Grade 9 Applied Mathematics course. The Numeracy Program is an afterschool program that happens twice a week at Blessed Star School during which pre-identified students meet to do remediate basic mathematics skills. Nadia describes the goals and structure of this Numeracy course:

[Benjamin and I] want to do this Numeracy course twice a week. We want to get all of those kids who are getting 65% or less to come after school and basically we teach them. We do this Gap Closing work with them. (Nadia interview, October 28, 2011)

Gap Closing resources were designed by the Ontario Ministry of Education for students who need additional support in mathematics. Gap Closing materials exist for students in Grades 4 to 10 in the area of number sense. For students in Grades 7 to 12, Gap Closing materials focus on number sense, measurement and algebra. The Gap Closing materials consist of diagnostic assessment, student booklets and facilitator’s guides.
Nadia says that the Numeracy Program provides extra enrichment and a chance for students to see that they understand the concepts. The program helps the students develop their self-confidence in mathematics. Nadia says that she sees the self-confidence exhibited by the students in the Numeracy Program transfers into the regular Grade 9 Applied Mathematics class. Additionally, the concepts that have been reviewed in the numeracy class are being retained by the students. Nadia proudly shares:

[The students in the Numeracy Program] understood the concept because when we looked at ratios, they were the first one to understand it even though I have taught it to the whole class, they should know, but these two, they did get it, because of the numeracy class afterschool. (Nadia interview, December 14, 2011)

The Numeracy Program is another chance for students to get more individualized attention in a smaller group setting.

4.5.2.2 Linking Mathematics to Real Life

Nadia describes that, for her Grade 9 Applied Mathematics students, teachers need to be strategic about the mathematics tasks they use in class in order to increase student engagement. She says:

You trick them into learning. You make it enjoyable for them. It has to be interesting for them and that is always the problem. I have been working on music, how music is involved in mathematics in some of the concepts. The idea of slope...What is it exactly? I plan on taking them out, checking out the stairs and get them to look around. How come the ramp here is sloped lower? (Nadia interview, April 19, 2011)

Nadia says that the use of mathematics tasks that are embedded in real-world contexts and allows students to incorporate their personal interests can increase student engagement.

Nadia brings her own real-life mathematical situations into the classroom as a way to engage her students. As a more inviting way to get students to think about mathematics as being relevant to their lives, Nadia offers her own stories to get her students involved in their mathematics learning. She tells me about this: “They do not think about [math in their life,] so I
give them some stories, I tell them, ‘I went to Best Buy…and I wanted to buy a camcorder for my husband.’” (Nadia interview, January 23, 2012). The students are able to imagine the situation because they are facing similar situations in their lives, and begin to see that mathematics does have a place in their life.

Nadia gives another example of a personal, real-world story that she uses to engage her students:

I tell them about the insurance. They tell me, “Buy the extra insurance.” “Why? I do not want to buy it.” They force you. “Why do not you do it?” And they start showing you numbers and say, “Oh, look at this.” And I am like, “Okay, fine. Show me the numbers.” (Nadia interview, January 23, 2012)

The students are personally invested in the scenario that Nadia presents to them and as a result, work on the associated mathematics without complaint.

Nadia gives an example of how connecting with students’ personal interests can make a positive impact on student engagement and academic learning. Nadia uses music as a hook and targets her students’ propensity to memorize song lyrics as a way to reinforce mathematics content. Nadia writes about this in her journal:

I was speaking to [another teacher] yesterday about the music that some of my students are making, so he showed me a website about mathematics rap. I loved it! I showed it to the kids today. The one I showed was about the distance formula, I know they did not study it yet but I cannot wait! The kids loved it and they listened to it only once! By the end of the period they were singing part the lyrics, which is basically the formula! It is a way to see mathematics as fun and to actually enjoy learning it. (Nadia journal, November 4, 2011)

Nadia says that it is possible to include both real-world contexts and students’ interests into student tasks. She describes an assignment with a focus of slope in real-life situations. Nadia hopes that the assignment “will be fun as well as permit the students to understand in depth the concept of slope” (Nadia journal, December 12, 2011).
To introduce the assignment to the students, Nadia presents a PowerPoint presentation that shows different pictures and videos of slope in the real world. One of the videos that she shows from YouTube is an event from an aerial ski jumping competition. Another is a humorous video of a race that happens every year in the United Kingdom during which wheels of cheese are rolled down a steep hill and competitors run down the hill, chasing after the rolling cheese. The students howl with laughter as they watch the competitors trip, fall and roll down the steep slope.

Nadia describes the power of these real-life examples:

It is not just that you are telling them that mathematics is very useful, you need mathematics in your life. I am showing specific [examples]. Now, they remember it because of the skier and the skateboard guy falling down, but why did he fall down? Because of the slope. (Nadia interview, December 14, 2011)

Nadia uses YouTube videos that appeals to her students as a vehicle to teach mathematics concepts (slope). Nadia knows that her students will not only remember the humourous videos, but also the related mathematics.

After the videos and pictures of various slopes (e.g., rooftops, ramps outside of hospitals), Nadia presents the assignment of students finding their own examples of slope in the real world. For this assignment, the students are tasked to describe the function of the slope (e.g., to allow patients in wheelchairs access to the hospital) as they relate to characteristics of the slope (e.g., not very steep).

The students then have to present their examples in a format of their choosing (e.g., PowerPoint, poster) and by looking at student work, it is clear to me that the students enjoy searching for examples. For some students, finding an example of slope that is the most common in their lives is meaningful while for others, finding the most outlandish is of great enjoyment.
In addition to being able to choose examples that connect to the students’ interests, Nadia encourages her students to present their work in a form of their choosing. This choice also brings students’ interest into the assignment. Nadia describes this by using examples from a similar assignment about symmetry from her Grade 10 Applied Mathematics course:

The videos [the students] made, they had so much fun with those videos. They were relating it to real-life situations. They were able to make videos of stuff that they like...fashion, art, tattoos, and cheerleading. Things that are important to them. They were able to show you the mathematics in it. (Nadia interview, December 14, 2011)

Nadia concluded by describing the academic benefits of a meaningful task such as this: “They love this kind of stuff. And they still remember it. Now [the Grade 10 students] have finished high school and they come back. They still remember what I taught them” (Nadia interview, December 14, 2011).

4.5.2.3 Integrating Technology

Nadia shares that her Applied level students want to feel in control of their learning. She relates this to why her students are so engaged in their learning when using technology:

We went [to the computer lab] and they were playing by themselves. They were taking the bounds, they were going, “How big is the triangle? How small?” They were looking at the angle. They were having fun with the colours. It was entertaining. The animation. They have control over it. (Nadia interview, October 28, 2011)

Nadia takes her Grade 9 Applied Mathematics class to the computer lab in the library when wanting to use computers for a lesson. This computer lab is connected to the library by doors that tend to stay open and the walls between the lab and rest of the library have large windows. The movement of individuals walking by the lab, speaking just outside of the lab or working on their own tasks in the lab are a distraction to Nadia’s students. Additionally, Nadia often finds that the computer lab is double booked or that “half of the computers are either taken by other students or are broken” (Nadia interview, October 28, 2011).
Even with these logistical challenges, Nadia says that once finally settled in the computer lab, she sees the degree to which her students are engaged in learning. The positive results make Nadia believe in the power of technology. Nadia says that, in addition to her students being engaged in the activity because they are the ones controlling the program and investigating the concepts, she knows that her students are learning the material. Nadia is assured that the computer programs are not just a game that keeps her students entertained. She says, “When [the students] do have control even if they are just playing, they are learning. Because at the end when I am asking them questions, they know. And the ones who are very weak, they still know” (Nadia interview, October 28, 2011).

Nadia further illustrates how technology allows her students to be hands-on with their learning with an example of the Calculator-based Ranger (CBR) device that measures motion. “With the CBR…they were running and it was crazy actually, but the point was actually taken. They understood the concept of it. They looked at the graph” (Nadia interview, December 14, 2011).

Nadia tells me that, days later, the students still remembered what they had done with the CBR technology and remembered not only the activity but also the accompanying mathematics. She says:

I asked those questions at the beginning of the class just to make sure that they know it. So I stood still and I said, “What do you think?” It was cute. “Oh, what do you think it was? What do you think when we stood still?” So everything that they did last week, they still remember it. (Nadia interview, December 14, 2011)

I ask Nadia to give an explanation as to why her students are able to retain this information when, for the most part, she finds that her students tend to forget concepts they have learned only days prior. She hypothesizes:
It is because they had to do it themselves using their hands, using the CBRs, running around the corridor here was something else! But it works! It is the culmination of the whole unit. It seemed like they grasped it. (Nadia interview, December 14, 2011)

Nadia believes that, for her students, the opportunity to learn through interactive, hands-on learning strategies is meaningful and helps students to retain the information longer. Days later, when Nadia is leading discussions in class about the mathematics concepts, the students imagine themselves carrying out the situations and describe the outcomes.

Nadia says that technology is something that is engaging and accessible to all of her students. She says:

Each one of them will come up to the SMART Board, which they like and then they touch and then they are able to, especially the ones who are weak and not too confident, it is something that they can do. (Nadia interview, April 19, 2011)

Nadia says that her students enjoy interacting with the SMART Board and highlights interaction as an essential component of effective technology. Nadia acknowledges that the SMART Board is not efficient in its interactive capacity. She describes that students can only interact with the SMART Board one at a time and realistically, she is not able to give each of her students a chance to participate. Instead, Nadia often models the activity for students to observe. She says: “When I use the SMART Board…I am the one who is doing it. I am the one up there working on it” (Nadia interview, October 28, 2011). This is in contrast to amount of student involvement that occurs when students work individually in the computer lab.

Nadia shares that Geometer’s Sketchpad activities that students interact with in the computer lab give students a chance to have control over their learning as they are manipulating the shapes for themselves. Although the SMART Board is visual and allows the students to see the same concepts that they would on the computers, the physical act of changing the shapes themselves (as opposed to watching a peer or Nadia change the shapes) is more meaningful to the students.
Nadia shares another benefit to using technology in the Grade 9 Applied Mathematics classroom. She says that technology increases student engagement because students can learn concepts more efficiently as a result of the immediate feedback that they receive from the learning tool. Nadia writes of this in her journal, “They loved working on the activities and seeing the result on the spot. They also liked the explore part of it” (Nadia journal, October 14, 2011). By both giving her Grade 9 Applied Mathematics students a chance to explore on their own terms and the technology’s capacity for immediate feedback, students remain interested in the task. Additionally, Nadia observes that self-guided experimentation facilitates quicker consolidation of mathematics concepts. Nadia provides another example of the benefit of immediate feedback for her students. Nadia writes about how the use of a graphing computer program, Fathom, quickly allows her students to complete mathematical tasks as compared to traditional paper and pencil forms of representations.

Today they had to investigate [linear] relationships…To summarize their findings we used Fathom. They love the program, I think too much, because now they do not want to graph using pencil and paper or even the graphing calculator, they are asking me to use Fathom because it is quick! (Nadia journal, November 17, 2011)

Nadia also shares that students enjoy using technology in the mathematics classroom because technology is something that is a part of their everyday lives. Nadia writes of this in a journal entry:

The kids loved [Fathom] and actually understood the concepts more in-depth. The best part is that it took me a while to work with Fathom, for my class this is the first time they used it and they [were able to] show me new tools to use that would make using the program easier! I was in their territory! It is amazing what they can do given the right motivation. (Nadia journal, November 11, 2011)

Nadia claims that her students will learn more efficiently if they are motivated to do so. Nadia says that a technology, such as Fathom, engages the students because they use technology so
regularly outside of the classroom and the programs used in the mathematics class are yet another new program that they can explore.

Nadia even shares that she does not need to feel fully confident in using the technology before she introduces it to the class. She says that her students are used to experimenting and learning how to use new pieces of technology that they will pick up how to use the program potentially more quickly than Nadia could. As someone who admits that she is tentative to use new and unfamiliar instructional strategies, the fact that her students so readily use technology is a reason why technology is a prevalent strategy in Nadia’s teaching practice.

**4.5.2.4 Setting High Expectations for Students**

Nadia believes that setting high expectations for her students and getting them to believe that they are capable in mathematics will reap great rewards. As Applied level students, the students in Nadia’s class have either struggled academically or have caused problems in classes such that teachers assumed that these students were not academically capable. Many of these adolescent students have not had a teacher that has had faith in their academic or personal abilities.

In setting high expectations for her students and making them believe that they deserve to be successful, Nadia develops students’ self-confidence and she sees that students begin to engage in class and push their potential. Nadia’s proud recount about a formerly struggling student, Delilah, illustrates this change in student behaviour. Nadia first provides some context for me:

[Delilah] is a bit weaker and does not have any [confidence] when it comes to mathematics. From the beginning, she was trying. But no confidence whatsoever. She failed [the course] the first time and she thought that she was going to fail it the second time. (Nadia interview, January 23, 2012)
Nadia says that Delilah does not struggle with mathematics, but with the motivation and self-confidence to demonstrate her knowledge. In further discussions with Nadia, I find out that Delilah appreciates Nadia for expecting her to achieve more and has set her sights on joining the Academic stream.

Now [Delilah] is going for summer school. She is going to take the Grade 9 Academic course and she is going to come back to Grade 10 Academic [Mathematics]. In her case, it is the attitude that is improved (not the marks). She said it is because she understands, because I am teaching her. For the first time, she is gotten a mathematics teacher who teaches her. So she wants to continue. (Nadia interview, January 23, 2012)

Although Delilah says that Nadia is “teaching her”, Nadia asserts that she is not focusing on Delilah’s through a specific teaching approach, but instead focuses on encouraging Delilah and her ability to be successful even at the Academic level.

Nadia says that her students’ fear of failure gets in the way of their chance for success. If a mathematics task looks daunting, instead of the students trying their hand at it, they will simply be disinterested and disengage from learning. These students need the support and encouragement of their teacher to want to be involved in their learning. Nadia says the important thing for her students is that “there is always hope.” Nadia continues by saying that her students will put forth a genuine effort at learning the material “as long as you give [hope] to them” (Nadia interview, January 23, 2012).

Many of Nadia’s Grade 9 Applied Mathematics students have struggled in mathematics, so Nadia feels that it is important to let her students experience success at least once in the mathematics classroom. Nadia believes that developing students’ self-confidence can lead to increased motivation. Nadia describes this:

Last week [the student] had his homework 100% right. I put it as 100 just to show him that he can do it. I wanted to put it so it is not a big deal so you give him that kind of confidence. He is working every day. It is nice to see that. I am happy with him. (Nadia interview, October 28, 2011)
Nadia describes another student who, through Nadia’s positive reinforcement, is engaged in the course:

I have one [student] who is very bored. She knows all of this stuff. I am trying to challenge her with other things. [I tell her]: “I am going to see you next year in my Academic class.” She puts her hand up when I am asking questions. “No no no, I am not asking you, you know [the answer]. Somebody else.” So that kind of Academic comment, she gets so happy. (Nadia interview, October 10, 2011)

Nadia’s high expectations for her students are evident in the way in which she speaks about her goals for the course. She says:

First of all, I want to get them all. I do not want to get most of them. I want them all. Until I get them all and I get them into a level high enough, like Level 3, then I am good. (Nadia interview, January 23, 2012)

Instead of merely speaking about getting her students to achieve to the best of their abilities, whatever that may be, or to have a goal for her students to try their best throughout the semester, Nadia bluntly says that she wants each and every one of her students to achieve at the Ministry of Education’s Level 3 standard. Level 3 represents “the ‘provincial standard’ for achievement of the expectations in a course” (Ontario Ministry of Education, 2005a, p. 18). As Nadia says, “I think I am greedy. The fact that most of the kids are doing well is not good enough. I want them all [to be successful]!” (Nadia journal, October 20, 2011).

Although Nadia sets high standards for her students and tells them that they are capable of being successful, she takes great caution in ensuring she does not put too much pressure on her students. While some high expectations encourage students to work harder to meet those expectations, the pressure of too-high expectations may cause students to withdraw. Nadia says:

I find if I push them too hard, it becomes a struggle. I do not want that power struggle. That is not the point. By the end of the day, they will have work done. Sometimes it does not look like that though, and that is the thing that is hard. You have to know your students. (Nadia interview, April 19, 2011)
As discussed in Developing of Student-Teacher Relationships, Nadia indicates that students should be dealt with on a case by case basis. Thus, her focus of speaking with students, developing student-teacher relationships and understanding their individual needs allows Nadia to gage when to put pressure on her students such that they will rise to the occasion. Nadia must also be aware that the same sort of pressure applied to one student may cause another student to retreat.

4.5.3 Summary of the Case of Nadia

For Nadia, student engagement extends beyond students being interested in the mathematics content. Nadia explains that, especially for Applied level students, students show their engagement on a personal level. If students are engaged, they will connect with their peers and their teacher on a personal level. Even after students have completed the mathematics work for the class, Nadia says that students who are engaged will linger. Engaged students will socialize with their peers and develop a stronger relationship with the teacher. Nadia says that, she can tell if a student is engaged based on their communication in the classroom. During the lesson portion of the class, Nadia says that a student is engaged if there is active communication (verbal and non-verbal). Students will remain engaged throughout the class regardless of whether or not mathematics learning is happening. Nadia explains what student engagement means to her:

When I think about student engagement, all I can think about is [students’] communication with [the teacher]. Talking to you. It could be about their work. That is my hope, usually, but it is not always the case and sometimes it is just about their life, or religion, the way they think about the religion or so on. Sometimes it is just about their life…with the Grade 9 Applied, they become more personal. A personal level, than the Academic. (Nadia interview, April 19, 2011)
In addition to this, Nadia says that she is still relatively new to the Grade 9 Applied Mathematics course and the instructional strategies shown to increase student engagement. She says:

Everything is new. I cannot do everything. I need my own time to do well. I need to be comfortable and to be comfortable, I need to be able to put in my own time. As a teacher, you need to be comfortable first. And it has to be your style. (Nadia interview, October 28, 2011)

In addition to Nadia’s belief that social engagement is the key priority for student engagement for the Applied level student, it is not surprising that Nadia’s tentativeness with certain instructional strategies further emphasizes Nadia’s focus in the social domain.
Chapter Five: Discussion and Interpretation of Findings

5.1 Introduction

In this chapter, I revisit the research questions posed in Chapter One and explore how the three case studies of Benjamin, Mathieu, and Nadia answer those questions and describe common themes that emerged across all three cases.

5.2 The Research Questions

My thesis focuses on the research questions posed in Chapter One. Those questions were:

1. What factors increase student engagement in the social and academic domains?
2. What is the relationship between the social and academic domains for these teachers?

I will examine each research question based on the findings from the case studies of Benjamin, Mathieu, and Nadia.

5.3 Discussion of Each Research Question

5.3.1 Question 1: What factors increase student engagement in the social and academic domains?

There are many different domains to student engagement (e.g., Fredricks et al., 2004; Janosz et al., 2008; Willms et al., 2009). For my study, I used a combination of the frameworks suggested by Janosz et al. (2008) and Willms et al. (2009) to examine how Grade 9 Applied mathematics teachers increased student engagement through social and academic domains.

From the three case studies of Benjamin, Mathieu, and Nadia, we see that each teacher considers factors of social and academic domains for social engagement. Within these domains, the teachers are cognizant of characteristics of the adolescent learner. All three teachers share that their students are in a developmental phase of their life where insecurity is prevalent and the strategies (whether they be social or academic) that the teachers use to increase student
engagement specifically helps to support this characteristic. The three teachers’ concerns parallel the work of Archambault et al. (2009) in that adolescent students are in an at-risk phase of their development.

The teachers share that their focus on student engagement has implications for student academic success. The teachers describe that, when students are engaged in the mathematics classroom, there is an increase in student attendance and a more consistent effort is put forth. These findings are consistent with Alexander et al.’s (1997) previous research about adolescent students and the repercussions of academic disengagement. Alexander et al. stated that, if students are not interested in learning, students will not be successful in their academics and more drastically, may be more inclined to drop out of school.

Each of the three teachers consider factors of both social and academic domains in their teaching practice and, in this section, I will discuss some of the common and varied ways that the teachers do so.

**5.3.1.1 Social Factors**

Williams et al. (2009) emphasized a sense of community and belonging as an integral factor of social engagement. Janosz et al. (2008) focused on student-teacher relationships as a means to increase student engagement. I use these two ideas to frame my findings of the social factors that my participants considered in their teaching practice. First, I present student self-confidence as an important factor for the Grade 9 Applied Mathematics learner.

**5.3.1.1.1 Student Self-Confidence**

Each teacher remarks on the low self-confidence in their Grade 9 Applied Mathematics learners and how this would impact the students’ willingness to be involved in the course. Due to their placement in Applied level classrooms, these students have been segregated from their
former Grade 8 peers. This labeling of lack of ability after having been one of the struggling students in the Grade 8 class only reinforces the low self-confidence these students possess. Archambault et al. (2009) wrote that, during the early adolescent years, students are already hesitant to take risks and show signs of weakness. Thus, in a learning context in which they believe that they will make mistakes, students will naturally not want to engage in classroom activities.

All three of the teachers take measures to develop the self-confidence of their students, but each in their own way. Benjamin follows his natural instinct as a coach, and developed self-confidence in his students through encouragement and praise. This parallels the findings of Murray (2009) in that positive reinforcement can strengthen a student-teacher relationship.

Mathieu’s confidence in his abilities as an educator shine through as he asserts that his Applied level students deserve a mathematics specialist as a teacher. Mathieu believes that his Applied level mathematics students are emotionally vulnerable and, when the students see that they have a mathematics specialist as a teacher, Mathieu believes that his students will feel valued as learners and that the school has thought of them as being mathematics capable and deserving of such a strong mathematics teacher. Mathieu believes the Grade 9 Applied Mathematics students can be inspired by their teacher and that these students will appreciate that their teacher will not look down on them but instead speak to them as equals. Mathieu’s beliefs are similar to the findings of Eccles et al. (1991) in that students appreciate being valued by their teachers.

Nadia believes that she needs to encourage her students to help develop their self-confidence. Nadia incorporates students’ personal interests into her lessons so as to ground the unfamiliar subject material in contexts that are more comfortable. Nadia also gives her students
the chance to excel and demonstrate their strengths in the mathematics classroom. She does this via non-mathematical opportunities such as a musical performance. This is similar to the strategy adopted by Benjamin and echoes the work of Jenkins (1997) in that students need to have the opportunity to demonstrate success in an area of interest to them.

5.3.1.1.2 Community and Belonging

As indicated by Hoge et al. (1990) and as described by the three teachers, increasing student self-confidence can support feelings of belonging. Additionally, creating a classroom community can increase student engagement. All of the teachers advocate for making their classroom a community of which students can feel a part. Teachers enact this idea in their own ways. Benjamin displays an unwavering conviction that community is developed through interpersonal relationships, a sense of belonging to a group and capitalizing on school-based structures to model this sense of community. Mathieu gradually realized that he could create a classroom where students and the teacher could have freedom and enjoy a relaxed, light-hearted and non-judgmental environment. Nadia has an innate feeling that the classroom needs to be controlled yet overarching actions of care and compassion lead students to feel at ease in the classroom.

For Benjamin, a community is one in which students feel safe to participate in discussions. Benjamin wants his classroom community to be accessible to his students and ensures that, at all times, the students have a teacher to turn to for support. Benjamin reinforces to all of his students that his classroom is a respectful environment. Benjamin also believes that modeling his own successful membership in different communities will demonstrate to his students the benefits of working as a community. Benjamin actively participates in co-teaching with Carol, team-planning with the rest of the Grade 9 Applied Mathematics team, and
collaborating with teachers from feeder schools. Benjamin’s participation in a variety of communities is consistent with the work of Neild et al. (2004). They reported that schools that model communities for their students reinforce the importance of community and can increase the chance that students engage in the school community themselves.

For Nadia and Mathieu, their notion of the Grade 9 Applied Mathematics classroom environment has evolved. Both teachers initially created what sounded like a cold and rigid classroom environment. Based on previous experiences and anecdotes from colleagues, Nadia and Mathieu felt as though acting as the authority figure in the Applied level classroom would be an effective means to control student behaviour. While this approach seemed to generate a positive response from some of the students, neither teacher felt that it resulted in a strong sense of genuine engagement on the part of the students. As reported by Solomon et al. (2000), the students did not feel an emotional connection to the learning environment that the teachers had created. Though pressured into behaving according to the teacher’s prescriptions, students did not feel connected to their teachers who maintained an air of control and distance. This is similar to the findings reported by Rosenfeld et al. (2000). This controlled classroom environment also did not feel natural to either teacher and each felt tense while they were trying to maintain their respective classrooms.

After Mathieu listened to colleagues who shared the positive effects of using a student-centred approach and giving students flexibility and freedom in their learning, he decided to try this approach. However, using these student-centred approaches meant that he had to give up control of his classroom and allow students to work together and move around the classroom. Mathieu recognized the positive change in behaviour in his students and that they were more enthusiastic and vocal in the classroom. He saw the attendance level increase, contradicting
Kerr’s (2003) concern that secondary schools create contexts that lead to decreased levels of student attendance. Additionally, Mathieu observed that students’ mood, while in the classroom, could be more positive and upbeat.

Thus, Mathieu currently aims to create a community by making a learning environment that is familiar to the students. He believes that his students are comfortable in their social and personal communities and wants to mimic these in his Grade 9 Applied Mathematics classroom. Mathieu makes jokes, gets the students to make jokes about one another, lets his students come and go from the classroom as they please, allows students to listen to music and have off-topic conversations. Echoing findings of Hoge et al. (1990), the non-judgmental and fun learning environment that Mathieu creates supports student self-esteem in an environment that would usually cause them stress.

Mathieu also realizes the strength of peer pressure for the adolescent students. In a class in which most students are engaged, Mathieu says that the remaining students will quickly follow suit so that they too can claim to belong to this ‘engaged’ learning community. This is consistent with the work of Kalil and Ziol-Guest (2008): students want to feel like they belong with their peer group for fear that they will be excluded and alienated.

5.3.1.1.3 Development of Relationships

Each teacher takes measures to develop a positive relationship with his/her students. The ways that this is done, however, vary from teacher to teacher. Benjamin uses a variety of strategies to develop a personal relationship with his students. He relies on previous interactions with students, finding common interests, and the relationships developed via extra-curricular involvements at the school. Benjamin is involved in a summer program for incoming Grade 9 students to develop their numeracy and literacy skills. During this summer session, Benjamin
begins to get to know the students, some of whom are enrolled in his Grade 9 Applied Mathematics classroom. Once in his class, Benjamin talks with students and expresses an interest in their personal interests. He chats with students about their hobbies, sports teams, sometimes even his own personal life as a way to connect with his students.

Benjamin also sees some of his students outside of the mathematics classroom as a coach of sports teams. Benjamin and the students both feel that seeing each other outside of the mathematics classroom is beneficial. Benjamin likes it because he can see the students in a context in which the students have intentionally become involved. The students have also chosen to join the sports team because it is an enjoyable context in which the student potentially thrives. Benjamin is seen to have more facets of his life on top of as a mathematics teacher and the students appreciate this insight as they can find out more about his family and hobbies. The students see Benjamin as someone more than just a mathematics teacher. As described by Voelkl (1996), schools need to provide opportunities for students to get involved in extra-curricular activities. These activities allow students a chance to participate in communities of personal interest and give students a chance to interact with teachers outside of the academic environment.

Mathieu’s community is not only a way to let his students feel a sense of belonging but also strengthens his relationship with them. Mathieu says that his actions show his students that he is respectful of their interests and he believes that, in turn, the students will reciprocate and engage in other components of the course in which they might not have otherwise been willing to participate.

Nadia feels it is important for her to develop a relationship with each of her students as individuals. Nadia says that each of her students has a different set of social challenges and needs. Some students have anger management issues while other students need advice about
personal issues. Nadia shows her students that she cares for their well-being by taking the time to listen to them or just by giving them a smile when they walk into the class. Nadia’s actions parallel the work of Rosenfeld et al. (2000) in that student engagement will increase if they feel as though their teachers care about them. Nadia’s students trust her and in turn are willing to reciprocate and engage in the course that Nadia presents to them. Patrick et al. (2007) shared that students are willing to invest more in their learning when they feel a strong connection with their teachers.

5.3.1.2 Academic Factors

Although each of the three teachers strive to support student academic success and describe student academic success to be an integral goal of their teaching, they implement practices to foster this in different ways, based on personal comfort and values. In this section, I will further elaborate on each of the factors used by the teachers and how they compare to the existing research.

5.3.1.2.1 Purposeful Planning

The focus on purposeful program planning stems from the fact that these teachers believe that the Grade 9 Applied Mathematics classroom has greater student diversity as compared to their Academic counterparts. Additionally, the teachers believe that their students struggle to stay focused in class for long periods of time. For example, Benjamin believes that his students crave a variety of strategies and teaching approaches and thus Benjamin reviews his course content to ensure that any repetitive activities or approaches are removed. Mathieu also believes that variety is important for Applied level students, but specifies that this relates to their short attention span. Mathieu also says that it is important for him to be flexible in his teaching. Through student observation and picking up on student cues, Mathieu can determine when his students disengage
from their learning, thereby signaling to Mathieu that he needs to change tactics and use a different approach. These findings are consistent with the work of Erlauer (2003) who wrote that teachers should vary their teaching approach at regular intervals due to the limited attention span of adolescent students.

5.3.1.2.2  Support for All Students

In order to meet the needs of individual students, Benjamin believes that it is important to get to know his students as best as possible. Benjamin does this by giving his students a survey at the beginning of the year that he reviews throughout the semester to gage whether or not his teaching practice matches his students’ preferences. Benjamin shares that his Applied level class has a greater range of ability as compared to his Academic class; thus, he knows that he will have to work harder to meet the needs of his Applied level students. The work of Karp and Voltz (2000) also indicated that teachers should vary their approach to meet the needs of each student in the classroom.

In addition to the varied strategies that Benjamin uses, he takes advantage of having a co-teacher and a peer helper in his classroom to give students more individualized attention. Such attention allows the teacher (whether it is Benjamin or someone else) a better opportunity to adapt their teaching for the particular student whom (s)he is working. Additionally, in the Applied level class, Benjamin finds that there are many students with Individualized Education Plans (IEPs) and Benjamin knows that these students need extra individualized attention.

Nadia shares similar sentiments about her Educational Assistant and peer helper. For Nadia, meeting individual needs directly feeds into her belief that she needs to get to know each student and treat them differently. Nadia believes that each student has their own set of social and academic needs, and without developing a relationship with each student, she is unable to
know how she can best support individual students. Nadia says that many of her students have IEPs and have more specific and demanding needs than the average student. Much like Nadia’s intent to speak with students individually and build relationships with them one-on-one, she believes that the students’ academic needs will be better met on an individual basis as opposed to the attention that the student would receive in a whole-class teaching approach. Teaching in a whole class setting does not allow Nadia to personalize her teaching to the extent necessary to best support her students.

Benjamin also says that, with the diversity of needs in the Applied level classroom, he is thankful that the administrators in the school keep the class sizes relatively small. Both Nadia and Benjamin mention the Numeracy course as another way to give students more individualized attention. The Numeracy course at Blessed Star School reinforces the work of Neild et al. (2008) that indicated that remedial and extra support programs can help students be more comfortable in the mathematics classroom and increase student self-confidence.

5.3.1.2.3 Classroom Environment

Benjamin believes that the physical layout of his classroom can affect student engagement. Benjamin is strategic in the types of students he seats together and where in the classroom they are located. He wants to ensure that the shy students feel included and those students who enjoy chatting but tend to get off-task are seated in a location where they will stay engaged and contribute to classroom discussions. Simon et al. (2003) presented that student engagement is affected by students’ interactions and associations with peers. Benjamin changes the physical classroom environment to allow for a more focused interaction.

Similar to the work of Isik and Tarim (2009), Benjamin says that cooperative learning can support student engagement by allowing students to work together and develop relationships
that strengthen the classroom community. To ensure that his students are successful when working cooperatively, Benjamin reinforces to his students that they are a vital member of the classroom community and that all members have something to contribute. Additionally, Benjamin shares that, by giving individual students specific roles, students will be more focused and engaged in completing the task. Benjamin’s teaching practice takes into account the individual accountability component of Johnson et al.’s (2006) five elements of effective small-group learning. Benjamin assigns roles to students to promote individual accountability.

Mathieu also integrates individual accountability into his teaching practice by assigning students’ grades individually. He notices that his students, regardless of their ability, will be more engaged if they know that they will be graded individually.

The interpersonal and small group social skills advocated for by Johnson et al. (2006) for effective group work is a priority for Mathieu. Mathieu develops the skills necessary for his students to be successful during cooperative tasks by modeling proper behaviour. Relating back to the work of Karp and Voltz (2000), Mathieu is also cognizant that different students have different tendencies when it comes to working in groups. In addition to understanding that some of his students have various skill levels for group processing, Mathieu knows that not all students will naturally want to work in groups. Mathieu provides variety to his students by giving them various opportunities to work in various groupings. Sometimes the students will work individually, while at other times in pairs or small groups. Mathieu will leave it up to the individual student to decide the type of grouping they would like to use. Skinner and Belmont (1993) reported that students who feel that they have an opportunity to be in control of their learning are more engaged in their learning.
Mathieu’s students feel comfortable in the familiar and enjoyable mathematics community that was created by Mathieu and they feel as though it is a community in which they would like to belong. For Mathieu, cooperative learning provides his students another opportunity to ‘hang out’ with their peers and socialize just as they would outside of the mathematics classroom. To ensure that his students are productive in their cooperative groups, Mathieu creates the groups himself. Mathieu believes that heterogeneous groups will be more successful because the stronger and more motivated students will encourage the other students in the group.

Prior to setting the groups himself, Mathieu let his students select their own groups and found that students tended to create homogeneous groups by achievement level. This finding is consistent with the work of Slavin (1990) and Webb et al. (1997). Mathieu found that the high-achieving students were able to function productively, but the low-achieving students, although enjoying working together, were not academically productive. Mathieu’s experiences directly parallel the work of Webb (1991) regarding heterogeneous groupings. Thus, teacher selected student groupings may be more beneficial for students as teachers will be able to create more effective groupings ensuring that students of different abilities work together. In the Applied level classroom in which students’ abilities are so varied, Mathieu believes that heterogeneous grouping would be more generally advantageous compared to homogenous groups in Academic settings in which most students are more medium- or high-achieving.

Although Mathieu indicates that there was a variety of abilities in his classroom, perhaps his Applied level class does not have the mixture of abilities as compared to the entire Grade 9 cohort. Thus, while Mathieu believes that he placed his students in heterogeneous groups, in fact the groups are relatively homogeneous. Additionally, one particular student who seems to be of
higher-ability than his group members, Henry, does have instances in which he has conflict with his peers. This heterogeneous group does not seem to benefit Henry. The ambiguity of the findings of this study along with the conflicting research about the homogeneous versus heterogeneous groups indicates that more research regarding student groupings may be required.

Although not significantly heterogeneous by ability, Mathieu’s groups are heterogeneous in terms of familiarity with one another. The students work with other students whom they had not originally been friends with and, as reported by Slavin (1990), this heterogeneous grouping may have strengthened students’ attitudes towards one another.

5.3.1.2.4 Rich and Meaningful Student Tasks

Sullivan et al. (2009) stated that tasks that encompass a broad range of ideas are more engaging to students. Benjamin believes that tasks from the TIPS4RM resource (Ontario Ministry of Education, 2005b) do exactly this and he finds that he is using the textbook less as a result. The richness of the TIPS4RM tasks and their benefits for student engagement will be further discussed in Development of Students’ Mathematical Knowledge.

For Applied level students who generally are not interested in mathematics, Mathieu believes that the type of tasks that they undertake can have a huge impact on engagement. Mathieu believes that his students do not enjoy mathematics so if Mathieu can entice his students into doing mathematics, the students will be less likely to disengage from their learning. Tasks in which the students are preoccupied with the bigger picture of the topic of the task can distract students from the mathematics. Nadia also says that enticing her students into learning mathematics is an effective strategy to increase student engagement. Davis (2006) advocates for student tasks that are worthwhile and Mathieu and Nadia’s enticing their students into doing the
mathematics is effective because the students find the task worthwhile rather than just a mathematics exercise to complete.

Many researchers state that students are more engaged when they see the material as being personally interesting and relevant to their lives (e.g., D’Amato, 1993; Pintrich & De Groot, 1990; Tate, 1995). Mathieu and Nadia use tasks that connect to the students’ lived experience or allow for students to incorporate their personal interests into their mathematics work. As indicated by Kidwell (2010), the students engage in the task because they are interested in the broader implications of the mathematics problem instead of focusing solely on the mathematics they are using to solve the problem.

Nadia also brings her students’ personal interests to bear on mathematics tasks. The approach of integrating students’ personal interests focuses the students on something that is of interest to them rather than the mathematics that is taking place. As previously mentioned, this tactic also allows for the students to feel a stronger sense of self-worth. Nadia knows that students will have positive associations with music and YouTube videos as compared to worksheets and memorizing formulas.

5.3.1.2.5 Construction of Students’ Mathematical Knowledge

Benjamin shares that the TIPS4RM resource reinforces a student-centred learning environment. Benjamin sees that his students are more engaged in their learning because they are the ones constructing their understanding of the mathematics concepts, generating knowledge and developing formulae. Benjamin sees that this type of learning has academic benefits in that his students are able to retain the information longer than they otherwise would. Benjamin’s beliefs align with the work of Marzano (1998). With the TIPS4RM tasks, the students are able to
construct their own mathematical knowledge through hypothesis, and investigation of mathematical concepts.

Webb (1991) said that, in the student-centred learning environment, teachers should guide students but not directly give answers. As a result of using the TIPS4RM resource, Mathieu’s perception of his role in the Grade 9 Applied Mathematics classroom has shifted. Formerly always at the front of the room for a teacher-centred lesson, Mathieu now finds himself walking amongst his students acting as a facilitator as the students construct their own understanding of the mathematics content. Boaler (2002) indicated that students in reform-oriented classrooms, similar to that of Mathieu’s, have more positive results. Mathieu says that, as a facilitator, he will prompt the students to consider different components of the task on which they are working that they may not have noticed.

Additionally, Mathieu will ask open-ended questions to encourage his students to clarify their understanding about the concept. This is precisely what Reinhart (2000) advocated to support higher-order thinking. Wimer et al. (2001) said that thoughtful questions can also support student learning by encouraging students to communicate. Similarly, Mathieu prompts his students to present their work to each other, thus providing an opportunity for students to learn from their peers and demonstrate to the rest of the class their own progress.

5.3.1.2.6 Use of Technology

All three teachers use technology in their Grade 9 Applied Mathematics courses and voice that the use of technology is an effective teaching and learning tool for today’s technologically connected student. These teachers reflect the work of Gee (2003) and understand the importance of using a component of their students’ everyday lives in their teaching practice.
Benjamin sees that his students are comfortable using technology. He says that, outside of the mathematics classroom, the students are using various technological devices and seem to be more willing to persevere and experiment with their learning if technology is involved. Although Solomon et al. (2000) discussed student perseverance relative to students feeling membership to their learning community, a similar notion may apply to the use of technology in the classroom because technology is so integrated into the student’s world that a learning community without such tools may feel foreign to the student. Mathieu’s beliefs that providing technology in his classroom mimics the context of his students’ everyday lives could further reinforce this notion.

Nadia is less varied in her academic approaches in the Grade 9 Applied Mathematics course as she is still developing comfort with some teaching strategies. Nadia’s tentative approach to new teaching strategies is similar to a finding of Holmes (2009) in which teachers who have not been given enough time to fully understand instructional strategies may not be as successful with these tools or refrain from implementing them fully in their teaching practice. Ozel et al. (2008) advocated for increased professional development in order for teachers to feel more comfortable with technology in order to increase the chance they will effectively use these tools in the classroom. Technology, however, is an area in which Nadia is willing to step out of her comfort zone. This is attributable to Nadia knowing that her students are so comfortable with technology that they are willing to step up and support Nadia through any challenges that may arise. Nadia also sees her students immediately responding to the technology in a positive manner.

Similar to the work of Cholmsky (2003) and Holmes (2009), Benjamin and Mathieu both notice that technology can be visually appealing and can allow students to physically interact
with their learning. Nadia adds that technology lets the students feel in control of their learning and invariably the students retain the information learned longer. Nadia’s beliefs relate to previously discussed ideas that student-driven learning can better support construction of knowledge.

Mathieu believes that the i>clickers are appealing to his students because keying-in responses and watching interactive histograms is similar to a video game. This immediate and interactive component of the i>clickers echoes the work of Martyn (2007). In addition to using a variety of teaching strategies to cater to his students’ short attention span, Mathieu shares that the i>clickers suit his students because they provide a source for immediate response and feedback. Additionally, the i>clicker technology can be incorporated with other strategies to increase student engagement, for example, group work and encouraging student communication. Premkumar and Coupal (2008) also found that combining technology with other teaching strategies is an effective way to increase student engagement. As Raphael et al. (2008) suggested, the quality of strategies a teacher uses in his/her teaching can increase student engagement, and this combining of strategies is unsurprisingly successful.

Mathieu shares that Gizmos allow students to be in control of their learning, something that appeals to the Grade 9 Applied level student. The Gizmos are hands-on and interactive and Mathieu appreciates the fact that students are able to access the Gizmos outside of the mathematics classroom and continue to explore mathematical contexts on their own time. Although Bartlett (2002) found that technology was not easily accessible to students, other research (e.g., Watson, 2001) shows that technology is more prevalent in today’s society. Not only is technology able to be used in more forms in the classroom than in previous years, but
students will also have access to these tools in their own settings. The fact that Gizmos are Internet-based increases the accessibility of this technology.

Although Benjamin believes in the many benefits that technology offers, he voices that sometimes the logistical challenges of technology, such as the distraction that arises as a result of working in the computer lab beside the school’s library, are barriers to the use of technology. Nadia shares similar frustrations as a result of computer lab double bookings. Benjamin and Nadia’s logistical frustrations are a reason why Ozel et al. (2008) found that teachers used technology in their teaching practice less than they would have ideally liked.

Mathieu’s school has a focus on technology and allotted extra funds to create more computer labs and provide equipment that resides in Mathieu’s Grade 9 Applied Mathematics classroom. Thus, logistics are not an issue to him. Mathieu’s teaching practice shows the greatest use of technology and greatest variety of technological tools amongst the three teachers. It is clear to see how the lack of logistical concerns can positively impact the ability to use technology in the classroom.

5.3.1.2.7 Students’ Mathematical Communication

In conjunction with Benjamin’s desire to create a classroom community in which students feel that they belong and can participate in classroom activities, Benjamin encourages all of his students to practice communicating their mathematical understanding and misunderstandings. This goal is directly aligned with Benjamin’s attempt to have his students perform better on the open-response questions on the EQAO exam. Benjamin believes the more opportunities that his students have to practice communicating mathematics, the more comfortable they will be to communicate their understanding when writing the exam. Patrick et al. (2007) emphasized that students will not be willing to communicate in the classroom if
teachers have not already set up a safe environment. Thus, Benjamin’s focus on classroom community, then encouraging student communication after the community has been set, is wise. In addition to practicing their communication, Benjamin gives his students tips on how to better communicate and model proper mathematical communication. Anderson (1989) reported that modeling is an effective way to support a student’s development.

5.3.1.2.8 Assessment Practices

Assessment is a reality in all secondary school courses. As such, it is not surprising that each of the three teachers considers how they can use assessment to support student engagement. Additionally, as students taking the Grade 9 Applied Mathematics course will be writing the provincial large-scale assessment (EQAO) exam, teachers strategically incorporate EQAO preparation into their teaching practice. Benjamin, in noticing that his students do not seem keen about the EQAO exam, integrates specific strategies into his teaching practice aimed to help students feel as though they are capable of being successful. These strategies include increasing exposure to EQAO-type (multiple-choice and open-response) questions, teaching test-taking strategies, and desensitizing students to this large-scale exam. As Tobias (1985) reported, students who have test-anxiety will disengage in a testing environment. Thus, Benjamin’s actions increase students’ comfort with the format of the EQAO exam thereby increasing the chance that in the testing environment they will be more at ease and can perform to the best of their ability.

Mathieu’s focus on assessment and how it can increase student engagement occurs throughout the course as opposed to being EQAO-specific. Mathieu’s stance on assessment for the Grade 9 Applied course is that students need to feel supported and that they are capable of being successful. He believes that it is important to validate the students’ ability especially in a subject area in which they have previously struggled. Mathieu’s belief is in line with the work of
Maheady et al. (2001) who stated that students will disengage from learning if they do not feel as though they are capable of being successful.

Using the Ontario Ministry of Education’s four levels on the achievement chart, Mathieu tells his students that, if they try their best, they will be able to be successful in the course. Knowing that students may struggle, Mathieu provides many assessment opportunities for his students so that they have more opportunity to gain marks. Mathieu does not want to make assessment in his course a component of which students are fearful nor does he want his students to think that success is unattainable.

Nadia’s assessment practices are embedded in her actions to support her students socially. This is similar to many other areas of Nadia’s teaching practice that benefit students within the domain of academic engagement. Nadia is cognizant of the insecurities of her adolescent students. Just as Pintrich and De Groot (1990) found that students who believe that they are capable show an increased engagement in their learning, Nadia too believes that boosting her students’ self-confidence will be beneficial. Nadia tells her students that they are capable of being successful as mathematics students and gives them positive reinforcement when they are successful on assessments.

5.3.1.2.9 Summary

Within the academic domain for student engagement, all three teachers use a variety of factors including issues of program planning, meeting individual needs, programs to support student learning, cooperative learning, student-centred approaches, student mathematical communication, student tasks, technology, and assessment. These factors parallel many of the dimensions found to increase student achievement as reported by McDougall (2004). The sheer
variety of strategies used by the teachers is consistent with the work of Raphael et al. (2008) that indicated that a variety of teaching approaches encourages student engagement.

5.3.2 Question 2: What is the relationship between the social and academic domains for these teachers?

The cases of Benjamin, Mathieu and Nadia show that, although each teacher considered factors within both the social and academic domains for student engagement, this was done in different ways. Additionally, each of the teachers consider these factors within the context of the early adolescent learner.

Benjamin shows a relatively balanced focus in his teaching. He uses specific teaching strategies to improve student achievement (academic domain) and also considers creating a learning environment that support his students’ social needs (social domain). This balance can be attributed to his desire to integrate new teaching strategies and improve upon those that he already used. Through professional development opportunities and in working with colleagues, Benjamin seeks out new student tasks and activities or discuss adaptations and modifications to existing strategies.

Benjamin personally values building a community as a learning environment, thus ensuring that he creates a positive, supportive and inclusive space for his students. These social and academic domains intersect via specific strategies that support the notion of community (e.g., cooperative learning). Similar to the work of Sullivan et al. (2006), all of the factors demonstrated by Benjamin’s practice take into consideration the characteristics of the early adolescent, especially developing positive relationships with peers and the influence that they have on one another. Figure 1 is a visual representation of the interaction between the factors considered by Benjamin to increase student engagement.
Mathieu is focused on the academic domain of student engagement. As a result of a new initiative at his school to invigorate the Grade 9 Applied Mathematics program and use different teaching approaches for this course, Mathieu implemented the TIPS4RM resources and a variety of technologies into his teaching. Although initially skeptical of how much this approach would impact the students, after seeing his students’ attitudes towards mathematics change and seeing the increase in student engagement, Mathieu continued to use these teaching approaches. At the same time, he realized that, to best implement these practices into his teaching, he needed to step back from his formerly authoritarian stance in the classroom. Although this authoritarian approach may not have resonated with his personality, he saw that his students were used to this environment from other mathematics contexts and he found it easy to maintain.

With these new student-centred approaches during which students often engaged in cooperative learning, Mathieu’s role changed as he had to let the students work together and construct their own knowledge. This immediately appealed to Mathieu in that he did not need to maintain control of the learning situation and thus could sit back, not worry about always having something happening at all times, and just support the students when they needed him.

As a result, Mathieu began to consider the factors within the social domain of student engagement, for example, by creating an environment in the mathematics classroom that was
similar to the students’ regular environment so that the students felt comfortable in the mathematics classroom and so that it could be a community in which they could belong. Thus, the emphasis on belonging to a community as discussed by Solomon et al. (2000) was only realized after Mathieu implemented academic factors to create a student-centred environment. This environment demonstrated to Mathieu the benefits for a community on his students’ social needs. The relaxed classroom environment that Mathieu created allowed students to feel a sense of independence. Eccles et al. (1991) stated that independence is appealing to early adolescent learners. Figure 2 is a visual representation of the interaction between the factors considered by Mathieu to increase student engagement.

Figure 2: Interaction of Mathieu’s factors for student engagement. This figure illustrates the interaction between the factors considered by Mathieu to increase student engagement.

The semester during which my study took place was a chance for Nadia to further develop her comfort with the Grade 9 Applied Mathematics course. Nadia is comfortable with the course material, but is uncomfortable with the teaching strategies and approaches that are different from those that she uses with the Academic stream and upper year courses. Although Nadia is eager to integrate new approaches into her teaching (e.g., manipulatives), she shares that she needs time to process how to use the strategy herself as a learner and then considers how to present it and facilitate its use in the classroom.
Thus, as many of the factors within the academic domain align with characteristics exhibited by students in early adolescent students, Nadia’s consideration of the social domain for her students’ engagement shines. As Murray (2009) described, a trusting relationship between a teacher and student has positive benefits on student engagement. Nadia’s personality and obvious care of her students is the foundation of the relationship that she develops with her students. Additionally, as Nadia cultivates her arsenal of teaching strategies, these new teaching practices are often guided by being able to strengthen the student-teacher relationship and to provide support for these learners who may have wavering self-confidence. Archambault et al. (2009) also indicated that increasing student self-confidence can support student engagement. Figure 3 is a visual representation of the interaction between the factors considered by Nadia to increase student engagement.

![Figure 3: Interaction of Nadia’s factors for student engagement.](image)

The visual representations of the relationship between the social and academic domains for Benjamin, Mathieu and Nadia show that each had their own manner of addressing their students’ needs. To increase student engagement in the Grade 9 Applied Mathematics course, we can see that, while a teacher may focus their efforts towards one of the domains more so than the other, the domains are not discrete and factors within one domain can inform the other. The three
cases also underscore that all decisions that these teachers make, take into account attributes of the early adolescent learner.

5.4 Major Findings

This study investigated how teachers increase student engagement in the Grade 9 Applied Mathematics classroom through various factors framed within two domains: social and academic. There are six major findings for this study relating to student engagement in the Grade 9 Applied Mathematics course as suggested by the cases of Benjamin, Mathieu, and Nadia:

1. Developing student self-confidence is a critical component of increasing student engagement for early adolescent learners. Each of the three teachers’ practices show evidence that developing student self-confidence is a factor within the social domain for student engagement. Additionally, each of the teachers foster developing student self-confidence within their teaching practices targeted for academic engagement. This is particularly prevalent within the teachers’ assessment practices.

2. Although student engagement can be examined through two domains (social and academic), some teachers may focus on one domain more than the other as a means to increase student engagement. One reason why a teacher might focus on one domain as compared to the other is a result of their personal comfort with that domain. Nadia’s teaching practice, for example, focuses on the social domain as a result of her developing comfort with new academic instructional strategies such as technology and manipulatives that have been found to be successful for the Grade 9 Applied Mathematics course. Mathieu, on the other hand, is comfortable with technology and personally values a hands-on and interactive approach to learning. Thus, Mathieu focuses on developing these academic factors in his teaching as a means to increase student engagement.
3. Domains for student engagement and the factors found within these domains are not independent. Mathieu’s original focus solely on the academic domain for student engagement and incorporating investigative activities and rich tasks shifted Mathieu’s classroom towards a student-centred model. This model encourages classroom discussions amongst peers and takes control away from Mathieu. The increased peer interaction, initially intended for academic gains, is also socially beneficial to the students. Nadia creates strong teacher-student relationships to support her students socially, yet finds that her relationships are of benefit to her students academically as they value her personal support and encouragement that they can be academically successful. The rich tasks found in the TIPS4RM resource have multiple benefits across academic factors. For example, Benjamin uses these student-centred tasks to allow his students to learn across a range of concepts as well as to help support construction of knowledge.

4. TIPS4RM is a resource used by all three teachers and should be considered by Grade 9 Applied teachers as being an effective way to increase student engagement. As stated in the previous finding, TIPS4RM encompasses many factors and all teachers say that it is a quality resource that is easy to implement, comprehensive and its activities are well-liked by students. Although Benjamin, Mathieu and Nadia specifically use TIPS4RM, the qualities of this resource of value to these teachers suggest that other reform-based resources may also have a similar effect on student engagement.

5. Similarly, Grade 9 Applied Mathematics teachers should implement technology into their teaching practice. Although the three teachers use technology to varying degrees, all three are adamant that technology is an integral part of their students’ world and that it should be part of the learning environment. While there continues to be some logistical barriers
to the use of technology, the teachers continue to use technology whereas barriers to other strategies may result in the lack of the use of technology. Examples of technology being used in the Grade 9 Applied Mathematics course include interactive whiteboards, graphing calculators, virtual manipulatives, immediate response devices, and motion-sensor devices.

6. For teachers looking to focus on the academic domain for student engagement, they may turn to the Ten Dimensions of Mathematics Education (McDougall, 2004). Teachers may use the Ten Dimensions as a framework for additional support for factors within the academic domain. This research-based framework has been found to increase student achievement and, as many of the Ten Dimensions comprise many of the factors of the academic domain, can be used to support student engagement as well. There are two dimensions that do not explicitly appear in my study as factors to support academic engagement: Communicating with Parents, and Teacher’s Attitude and Comfort with Mathematics.

Although communication with parents is not integral to the teachers’ practices, each teacher mentions that parents do have an impact on student engagement. There is much research that gives evidence to the impact that parents and home life have on students (e.g., Bandura et al., 1996; Hill & Tyson, 2009). While the teachers in this study do not actively follow through with their beliefs, it would seemingly be beneficial to teachers to consider this dimension in their teaching. The dimension of Teacher’s Attitude and Comfort with Mathematics may not have shown to be a factor of concern as my study focused on teacher’s beliefs and actions for student engagement. I did not focus on how my participants felt about their mathematics abilities. Yet, this dimension is
raised by each participant. Mathieu alludes to the importance of a teacher’s attitude and comfort with mathematics talking about the value of a specialist teacher in the Grade 9 Applied Mathematics course. Nadia and Benjamin want students to like mathematics and see it as being useful in the world because they themselves see mathematics in that light. Perhaps this dimension is not as strongly prevalent in my study because all three of the teachers have a high level of comfort with mathematics.

Additionally, the teachers see mathematics favorably thus teacher’s attitude and comfort with mathematics is not a focus of their teaching practice and therefore is not raised in teacher interviews and journals. Nadia’s slight insecurity with new instructional strategies do, however, come to light further reinforcing that perhaps only areas of concern or focus for teachers are represented in the findings of this study.

5.5 Implications for Further Research

This study shows various ways that teachers can increase student engagement in the Grade 9 Applied Mathematics class. Teachers can consider characteristics of their early adolescent learners, and factors for social and academic engagement. Teachers will favour approaches that parallel their personality and values. Although there is much to learn from the cases of Benjamin, Mathieu and Nadia, further research is needed to develop a more comprehensive understanding of teaching practices to support student engagement and how a teacher can develop their understanding of self and how it factors into their teaching practice. The related area of holistic mindfulness (e.g., Miller, 1993) can guide a study about teacher reflection and how self-awareness impacts teaching practice.

Teacher perception and teacher beliefs have been shown to be strong indicators for effective practice (Bruce & Ross, 2008). Nonetheless, when determining the teaching strategies
that increase student engagement, a student voice would be of benefit. The data from my study was mostly comprised of transcripts from teacher interviews and teacher journals. Although the teachers reflected on their perception of how their students responded to the teacher’s practice, it is based solely on the teacher’s opinion. Additionally, while I observed classes and made notes of both teacher actions and student’s reactions, this was my own judgment of how I thought the students were responding to the situations. It is important that students’ voice regarding their own engagement is sought out. A future study in which Grade 9 Applied Mathematics students are interviewed or surveyed about their experiences in the course would support how these strategies that the teachers view as being engaging are truly received from the student’s point of view.

Research has shown that student engagement has many domains. My study combined the frameworks of Willms et al. (2009) and Janosz et al. (2008) to investigate the factors within the social and academic domains that Grade 9 Applied Mathematics teachers considered to increase student engagement. Nadia asserts that, unless a student’s social needs are met, academic factors will not support student learning. Further research could investigate whether this is true or, whether there is one domain that is more influential for student engagement than the other. Taking this further, is there a factor within a domain that is more important than the others? Are all factors required to increase student engagement? To what extent does each factor and domain need to be realized?

From this study, we see that there are different factors that teachers can consider to increase student engagement and teachers may choose to focus more on one domain over the other. Additional research could determine the domain (social or academic) that yields a higher level of student engagement. Should teachers focus on one domain over the other? This idea has
implications for pre-service and in-service professional development. Since the domains are connected, is it better for developing teachers to simply concentrate their efforts on one domain first?

Similarly, the visual representations created to illustrate the interaction between the factors considered by the three participants of my study were not to scale. Could I have shown the relative size of the circles (domains) in each of the three cases and across cases? Which teacher’s ‘circle’ would have been the largest? How much should the domains have overlapped?

My study comprises three case studies for teachers of the Grade 9 Applied Mathematics course, all within the same geographic region of the Greater Toronto Area. Although these three cases provide a rich description of how these teachers increase student engagement in their classrooms, it is just three cases. Future studies involving more teachers would provide a more comprehensive description of how Grade 9 Applied Mathematics teachers can increase student engagement. Similarly, are the findings of this study transferable to other geographical regions? How specific were these findings to the Grade 9 Applied Mathematics context? Would a focus on the factors described in my study result in equal success in the Grade 9 Academic course? In other Applied level courses? In elementary schools? Would the visual representations of these three teachers be the same in other courses?

To increase student engagement at the Grade 9 Applied level, the cases of Benjamin, Mathieu, and Nadia demonstrate that mathematics teachers need to understand characteristics of early adolescent learners and appeal to social and academic factors of student engagement. Further research in this area can increase our understanding of these factors and how a teacher’s personality affects their practice. Research in this area is important as we endeavor to keep students interested and engaged in their education.
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Appendix A

Collaborative Teacher Inquiry Project – Teacher Questions

Background questions
1. What is your name?
2. What courses are you currently teaching and what is your role in the school?
3. How long have you worked at this school?
4. Where did you teach before and what courses have you taught?
5. How many years have you been teaching?
6. Where did you go to university?
7. Why did you become a teacher?

1. Versions of success
   For you, what counts as success for students in this school?
   What are your goals for students in education?
   How widely accepted are your goals with other teachers in the department? The school?
   Among parents?
   In what ways do you see your goals for students reflected in your school improvement plan?
   How does your school improvement plan incorporate your goals for students?
   How is the school improvement plan created in this school?

2. Student engagement
   How would you define student engagement?
   What can teachers do to increase student engagement?
   To what extent do you consider student engagement when planning your lessons?
   What components of student life do you believe are affected by low and/or high student engagement? How are they affected?

3. Challenging circumstances
   What are the most challenging things for you in this school as you go about your work?
   Do you think this school is different from other schools in its challenges?
   How would you describe the community of parents with whom you work?
   How has the school context changed over the past few years, and what changes are going on now?

4. Mathematics
   How would you describe your goals in mathematics?
   How widely accepted are these views in the department? In the school? Among the parents?
   How would you describe the provincial ministry’s vision of mathematics?
   Which of the Ten Dimensions has your department selected for your school improvement plan? Why did you select those dimensions?
   Which of the Ten Dimensions have you selected for your personal growth? Why were those dimensions selected?
5. School culture
   How do you create an environment, which supports success in mathematics?
   What challenges have you faced in trying to create a culture that supports student
   achievement in mathematics?
   How do you work with staff and administration to develop the goals/vision of the school?

6. Overall
   What programs or resources support success in mathematics outside of the classroom?
   What do you think we should say in our report about how schools can be more effective
   in supporting mathematics improvement?
Appendix B

Teacher Journal Prompts

Today’s date is…

**If completed before the lesson:**

For today’s lesson I plan to…

I will use the following strategies/activities/tools…

I have chosen these strategies/activities/tools because…

I think the students will respond by…

I hope that the students will…

**If completed after the lesson:**

Today’s lesson felt…

This lesson worked/did not work because…

Today’s lesson used the following strategies/activities/tools…

Student seemed to respond to the lesson by…

From today’s lesson, the students are able to…
Appendix C

Classroom Observation Follow-up Questions

1. How did today’s lesson go?

2. I saw you use _________ as a teaching strategy:
   a. Why did you choose this strategy?
   b. Did it have the effect that you had intended?
   c. What is the most challenging part about using this strategy?
      (Repeat questioning as needed)

3. Do you believe that the students were engaged throughout the lesson? (At what point do you believe they were the most engaged? Least engaged?)

4. What would you do differently next time?
Appendix D

Letter of Consent

Dear ________________.

I am a PhD student at the Ontario Institute for Studies in Education, University of Toronto, and am studying the practices of teachers of Grade 9 Applied Mathematics for the purposes of my thesis. I think that your knowledge and experience will provide insight into this topic. My thesis is about exemplary teaching practices of teachers of Grade 9 Applied Mathematics and will specifically focus on the teaching strategies that teachers use to increase student engagement. I believe that an increase in student engagement will lead to an increase in student achievement.

My research data collection consists of three stages: 1) A preliminary interview; 2) Classroom observations; and 3) A final interview.

1) Preliminary interview – This is a 45-minute interview that will be tape-recorded. I will ask you a series of questions about your teaching background, beliefs, goals and ideas about student engagement and success.

2) Classroom observations – I will observe lessons on a weekly basis and take notes on the teaching strategies used and student reactions. Prior to the lesson, I will ask you about what you plan to teach and the strategies that you will incorporate into your lesson. After your lesson, I may ask for clarification and reflections on the lesson that was taught. I will also ask that you keep a journal for the duration of the study.

3) Final interview – This is a 30-minute interview that will be tape-recorded. I will ask you a series of questions about your involvement in the study, reflections on your own teaching and final thoughts about student engagement and success.

I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the research has been presented and/or published which may take up to five years after the data has been collected. There are no known risks or benefits to you for assisting in the project, and I will share with you a copy of my notes to ensure accuracy.

If you have any questions or concerns about your rights as a research participant, please contact the Office of Research Ethics (ethics.review@utoronto.ca, 416-946-3273).

Please sign the attached form, if you agree to be part of the study. The second copy is for your records. Thank you very much for your help.

Yours sincerely,

Limin Jao

Thesis supervisor: Dr. Douglas E. McDougall
Consent Form

I acknowledge that the topic of this research has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by Limin Jao and agree to participate in the study the purposes described.

Signature: ______________________________________

Name (printed): ________________________________

Date: __________________________