

“To Thine Own Self Be True....”

**One Teacher’s Self-Study of the Tensions and Processes Involved in Changing
His Identity When Teaching Non-Academic Mathematics Students**

by

Andrew Hirst

A Thesis submitted to the Faculty of Graduate Studies of
The University of Manitoba
in partial fulfilment of the requirements of the degree of

MASTER OF EDUCATION

Department of Curriculum Teaching and Learning
University of Manitoba
Winnipeg, Manitoba

Copyright © 2007 by Andrew Hirst

THE UNIVERSITY OF MANITOBA
FACULTY OF GRADUATE STUDIES

COPYRIGHT PERMISSION

“To Thine Own Self Be True....”

**One Teacher’s Self-Study of the Tensions and Processes Involved in Changing His
Identity When Teaching Non-Academic Mathematics Students**

BY

Andrew Hirst

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of
Manitoba in partial fulfillment of the requirement of the degree**

MASTER OF EDUCATION

Andrew Hirst © 2007

Permission has been granted to the University of Manitoba Libraries to lend a copy of this thesis/practicum, to Library and Archives Canada (LAC) to lend a copy of this thesis/practicum, and to LAC’s agent (UMI/ProQuest) to microfilm, sell copies and to publish an abstract of this thesis/practicum.

This reproduction or copy of this thesis has been made available by authority of the copyright owner solely for the purpose of private study and research, and may only be reproduced and copied as permitted by copyright laws or with express written authorization from the copyright owner.

ACKNOWLEDGEMENTS

First and foremost I need to thank my heavenly Father. All that I am, and all that I am able to do, is a gift from Him.

For my students, who inspire and challenge me every day to become a better teacher. To those students who volunteered to share their thoughts and ideas with me, I am very grateful. You were an invaluable source of learning for me.

To Dr. Ralph Mason, who continues to be one of the best teachers that I have ever had. Your passion for students and their learning inspires me to keep searching for new and better ways to teach. Your graciousness allowed me to take the time that I needed to do my thesis.

To my committee members, Dr. Thomas Falkenberg and Dr. Kelvin Seifert, thank you for your willingness to inquire about my journey, and for the time and expertise you provided me with.

To Anne Reimer, we started our graduate programs together, completing all but two of our courses together. I cannot think of a single person who would have done a better job acting as my critical friend. Thank you.

I need to thank my parents who instilled in me a love of learning and supported me in every step of this process. To my father who would call just to see how my writing was going and understood completely when I had not written a word since his last call. To my mother who understands the way I think and write and has offered me countless words of advice and free editing services. I thank you both.

To my three boys, Isaiah, Evan, and Emmanuel, thank you for giving me up for all of those hours as “Daddy was working but not at school.” Your sacrifice of time and attention did not go unnoticed. I love you all.

Finally, I dedicate this thesis to my wife Cheryl, whose support and encouragement kept me going when I was ready to throw in the towel. You courageously kept three boys under the age of 5 busy and out of the house for hours so that I could write. You patiently supported me during this process, knowing when to ask how my writing was going and when to change the subject. Thank you.

Andrew Hirst

June 10, 2007

ABSTRACT

This research is the self-study of a teacher who began to question the frustrations and challenges that he faced when teaching in the Consumer Mathematics classroom.

This research attempts to answer a number of questions: What tensions were present and causing the teacher's frustration? To what extent does the teacher's identity factor into his ability to teach different students, in different classes? Can a teacher objectively examine his own practices in an attempt to answer questions about his own teaching?

This research focuses on a teacher's interaction with his Grade 12 students in the Pre-Calculus and Consumer Mathematics classrooms. This research includes data gathered from teacher and student writing, student interviews and interactions with a critical friend. The analysis and interpretation of the data relies on many of the techniques used in action research, including coding and memoing.

Some of the ideas and concepts presented in this research include, but are not limited to, the nature of student learning, pedagogical models and their influences in the classroom, the nature of mathematics, critical friends, models of identity, student motivation, and teachers' perceptions and their influence on current beliefs.

TABLE OF CONTENTS

Acknowledgements	2
Abstract	4
Table of Contents	5
Figures and Tables	8
Chapter 1	
Introduction of Thesis Topic	9
High School Mathematics in Manitoba	9
Parker Palmer and Identity	10
My Thesis Question	12
Chapter 2	
Theoretical Foundations	14
Mathematics for All	14
Curriculum Concerns	24
Writing in the Mathematics Classroom	30
Palmer Identity and Integrity	40
Connelly and Clandinin	45
Helms Identity and Subject Matter	50
Returning to my Question	55

Chapter 3

Methods and Methodology	57
Proposed Methods and Methodology	57
Coding	66
Metaphors	68
Bias	71
Research Methods and Methodology	73
Retrospective Data	74
Pre-Calculus Data Gathering	75
Consumer Data Gathering	77
Data Not Gathered	79
Data Analysis	80

Chapter 4

Data Interpretation	85
Retrospective Data	85
Analysis of Data	86
Pre-Calculus Student Sketches	87
Pre-Calculus Teacher Sketches	95
Consumer Student Sketches	100
Consumer Teacher Sketches	109
Critical Friend Summary	115
Achievement	117

My Peers	119
My Job	120
Love of Learning	121
Conclusions	122
Chapter 5	
Conclusions	125
Tensions	126
Tensions Summary	137
Processes	140
Process Summary	141
Final Remarks	147
Epilogue	150
References	151
Appendix A	
Educational Autobiography	157
Appendix B	
Beliefs and Values Statement	169

Appendix C

Journal Prompts	182
-----------------	-----

Tables and Figures

Table 1: Manitoba High School Curriculum Goals	27
Table 2: Palmer and Livsey's Identity Questions	43
Table 3: Blankstein's Identity Questions	44
Table 4: Johari Window	64
Figure 1: Helms Model of Identity	50
Figure 2: Theory of Teaching Mathematics	174
Figure 3: Positioning of High School Mathematics within my View of the Nature of Mathematics	176

CHAPTER 1

Introduction of Thesis Topic

I am a teacher. I love being in the classroom; I love the energy the students possess. I derive great satisfaction from that moment in time between misunderstanding and understanding. This thesis was born out of my love of teaching and the persistent frustration I experienced while teaching the Consumer Mathematics course. What follows is my attempt to better identify and explore those frustrations.

High School Mathematics in Manitoba

In Manitoba, high school mathematics curriculum is divided into three separate streams: Consumer Mathematics, Applied Mathematics and Pre-Calculus. Consumer Mathematics is a set of courses designed to give students a solid foundation in the everyday use of mathematics. The Consumer Mathematics course is not sufficient to prepare students for postsecondary mathematics. Applied Mathematics is a set of courses that stress the integration of technology and communication in mathematics. It is my belief that this course is also not sufficient for the majority of postsecondary mathematics courses. Pre-Calculus courses are a set of courses designed to prepare students for the rigours and demands of university calculus. Each of these courses possesses its own strengths and weaknesses.

Identity and Palmer

In his 1998 book *The Courage to Teach*, Parker Palmer describes teaching as a profession that exists in the intersection of public and personal lives. “Good teaching cannot be reduced to techniques; good teaching comes from the identity and integrity of the teacher” (Palmer, 1998, p. 10).

According to Palmer (1998), “identity is a moving intersection of the inner and outer forces that make me who I am” (p. 13). Britzman (1992) describes identity as a “. . . role [that] can be assigned, the taking up of an identity is a constant social negotiation that can never be permanently settled or fixed, occurring as it necessarily does, within the irreconcilable contradictions of situational and historical constraints” (p. 10). Both authors describe identity as a negotiation. Palmer uses the notions of inner and outer forces. Britzman is more specific when she names the constraints of situation and history. Both authors write about identity as a dynamic sense of self that can be changed or altered and never rigid.

In all aspects of my life I shape my identity based on a set of rules or beliefs. These may be explicitly set out before us or they may be tacit. The rules may be the same in all situations or they may vary depending on the setting. When I shift identities I am making adjustments to these rules or beliefs. In some cases the adjustments may be very large or they may be very minor. Regardless of the size of the adjustment, if I am to successfully shift my identity I must in some way adjust my beliefs.

The second component of good teaching according to Palmer is integrity. Integrity is all about maintaining a personal wholeness. As I experience life’s forces I have one of two options: shift my identity or maintain it.

Regardless of the choice I make, my choice should allow me to maintain my integrity as a teacher. When I choose to shift identities and I do not readjust my beliefs, I will inevitably violate my old set of beliefs and damage my integrity. Good teaching cannot come out of a place that is not integral. The poet Rumi (1207-1273 A.D.) says, "If you are here unfaithfully with us, you're causing terrible damage." Teaching out of a place that is not integral for the teacher is teaching unfaithfully. If I do this, intentionally or not, I will cause damage, to myself and worse yet, to my students.

How does Palmer's (1998) integrity play itself out every day in the classroom? Perhaps an example will help me frame this concept more fully.

Imagine Katherine is a new teacher right out of university. She believes in the benefits of constructivist education and has tried very hard in her pre-service experiences to hone her skills. Her first teaching assignment has her teaching a variety of mathematics courses. In her Grade 10 Consumer Mathematics class, Katherine uses her constructivist teaching methods and finds great success for both herself and her students. She believes she is making a connection with the students and that they are learning the material. In one of her other classes, Grade 10 Advanced Pre-Calculus, despite all of her best efforts, she is unable to effectively apply her constructivist methods with these students.

Katherine decides that in order to be effective for these students she must take on a more teacher-centred identity in the classroom. The class reacts well to her new teaching style and the course moves along. While the students are doing fine, Katherine is somewhat dissatisfied with her own teaching. Katherine has changed who she appears to be in the classroom for a particular group of students; she has attempted to make an identity shift.

This shift took place without her adjusting what she believed good teaching and learning to be. Katherine violated her own personal beliefs about the nature of teaching and learning. While she is able to switch to a more teacher-centered style of teaching, she still believes that the constructivist approach is a better method. Katherine is not remaining integral in her teaching; the damage is, therefore, done to her.

It is important to understand that in this thesis when I use the word *integrity* I am referring to Palmer's (1998) use of the word. When Palmer uses integrity he does not refer to the virtues of honesty and trustworthiness that are so often associated with the word. Palmer uses the word integrity to mean unaltered, in its original state, whole. Palmer does not speak of possessing integrity; he instead encourages his readers to maintain their integrity. Integrity in and of itself is neither positive nor negative; rather, the act of maintaining integrity is positive, and losing integrity is negative.

My Thesis Question

When people ask me what I do for a living I usually respond, "I am a math teacher." I have recently been trying to tell people that "I am a teacher," since I believe that in my classroom I do more than teach mathematics. However, in terms of the mathematics that I most identify with, I should tell them that I am a "Pre-Calculus math teacher." This is how I see myself and it has been my identity for the last seven years of my teaching career. Palmer (1998) writes that we "teach who we are" (p. 15). There seems to be a contradiction in Palmer's writing when he describes identity as dynamic and constantly being negotiated and yet he boldly claims that we teach who we are.

“Teaching who we are” sounds rigid, but I believe that Palmer would allow for “who we are” to be in constant flux. In other words, we teach our identity.

When I first started teaching I spent a number of semesters working in Pre-Calculus Mathematics classrooms. With the addition of new mathematics teachers to our staff I have begun to teach courses other than Pre-Calculus (academic mathematics). What I found was that although I was teaching different courses with different mathematical concepts, different types of students and, indeed, different end goals, I was not different. I approached the Consumer class as if it was a Pre-Calculus course, and my manner of teaching and evaluation did not significantly change. When I tried to change methods or expectations I have come to the conclusion that I did so without the necessary changes to my beliefs and thus the integrity of my teaching suffered.

When I began this process I did not believe that I needed to change my views on mathematics or my overall stance on pedagogy. I was convinced that I needed to be able to change my beliefs and thus my identity as I moved to and taught in different courses. If this were possible I believed that I would be a more effective and authentic teacher in all of the courses that I taught. This thesis describes my engagement with the tensions and processes involved in a teacher changing his identity as he engages in fundamentally different courses with fundamentally different student intentions. In other words, what barriers (tensions) keep me comfortable in period 5, Pre-Calculus Mathematics, while making me so uncomfortable in period 6, Consumer Mathematics? Can I determine what these barriers are and can they or I be altered to allow me to feel integral in the Consumer classroom?

CHAPTER 2

Theoretical Foundations

Introduction

In this chapter I begin by examining the prevailing North American perspectives on mathematics education as set out by the National Council of Teachers of Mathematics (NCTM). I then move closer to home and look at how Manitoba has attempted to address some of the many issues that arise from the NCTM's positions. From there I will move into the classroom and look at how student and teacher writing in the classroom can be used as both a valuable teaching resource and a rich source of data for research. Next I will examine three different perspectives on teachers' personal and professional lives. I finish with the work of Jennifer Helms (1998), which provided me with the scaffolding around which I built a majority of my research and analysis.

Mathematics for All

In 2000 the National Council of Teachers of Mathematics (NCTM) published a book entitled *Principles and Standards for School Mathematics*. This was written to serve as a guide for provincial and state educators as they create and implement kindergarten to Grade 12 mathematics curriculums. The NCTM had previously published other guides for teachers and administrators on *Curriculum and Evaluation Standards for School Mathematics* (1989), *Professional Standards for Teaching Mathematics* (1991) and *Assessment Standards for School Mathematics* (1995).

Principles and Standards for School Mathematics was written to replace the earlier *Curriculum and Evaluation Standards*.

It is important to note that *Principles and Standards for School Mathematics* was written by mathematics teachers and postsecondary educators in the United States and Canada and is intended for anyone involved in the mathematical education of a student.

In the first chapter of *Principles and Standards for School Mathematics*, the writers lay out their vision for school mathematics. This vision is to be the driving force behind the principles and standards found later in the book. In their vision the NCTM (2000) asserts that “The need to understand and be able to use mathematics in everyday life and in the workplace has never been greater” (p. 4). According to the NCTM (2000), “Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed” (p. 5). The assumption in this last statement is that without a good mathematics education students will have to face an unproductive future. The NCTM goes on to talk about the importance of students learning that mathematics is a life skill that should be appreciated on both a practical and aesthetic level. The NCTM vision statement cites the increased demand for mathematical knowledge in the work force and in the science community as an important reason for all students to learn mathematics.

The NCTM Standards make a number of broad statements about the learning of mathematics and who should be involved. As you read through the vision and principles chapters you come across many statements that begin with “All students.” In fact, in the preface the writers declare that their recommendations are made

“with the belief that all students should learn important mathematical concepts and processes with understanding” (p. ix).

Other examples of inclusive language in the NCTM (2000) documents include: “Principles and Standards calls for a common foundation of mathematics to be learnt by all students” (p. 5). “All students should have the opportunity and the support necessary to learn significant mathematics with depth and understanding” (p. 5). “All students need an education in mathematics that will prepare them for a future of great and continual change (p. 8)”. Each of these statements rests on two common foundational ideas.

First, no student should ever be denied, for any reason, the opportunity to learn mathematics at the highest level with the best possible instruction. This is an equity issue and is the first principle laid out in chapter 2. The Standards make it very clear that there should not exist in this or any other democratic country a systemically tiered mathematics education program. The second foundational idea is that all students should learn a “common foundation of mathematics . . . with depth and understanding” (NCTM, 2000, p. 5). Whenever a group of like-minded people come together to try to effect change it is important that they believe that change can, in fact, occur. Part of believing that change can take place is first to set forth an idealized version of the world after the change has occurred; this is what the vision statement in the NCTM document has done. I agree that no child should ever be denied a chance to learn in anything less than an optimal environment. I do not believe that it is possible for all students to learn the same mathematics with the same level of understanding, regardless of the adaptations that are made. The writers of this document are making an important statement in this principle, that equity does not necessarily mean equal.

In order to achieve equity it is recognized that some students will need different types of teaching and strategies to be successful. In the equity principle the writers of this document try to address this issue of adaptations.

I would argue that if adaptations involve limiting or restricting any of the content being taught, then “math for all” is not a true or attainable goal. The writers of this document make a very bold statement when they claim that “Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed” (p. 5). If this statement is accurate then equity without equality is not enough. I do not see equality as part of the NCTM plan, nor do I believe that it is possible for the following reasons.

I believe that there are three obstacles outside of natural student ability and desire standing in the way of this second foundational idea becoming a reality. First, education as a whole seems to be a system prone to move to and fro following trends or political agendas. Second, we have a system that is not providing a proper foundation for our students. Finally, in North America we have a negative cultural bias towards success in mathematics.

Pedagogy has always had an element of uncertainty built into it; for example, what makes one person a more effective teacher than another? In faculties of education teachers in training may talk about the art of teaching versus the science of teaching. As teachers we are always chasing the silver bullet of teaching, looking for new approaches to help us in our daily teaching lives. Visit an educational book fair and you will find countless new teaching methodology books promising amazing results. I believe that it is this facet of teaching that makes us as a profession so prone to following trends.

I do not believe that any past, present or future trend in education is ever undertaken unless those in the classroom truly believe that what they are doing is in the best interest of the learners. However, change takes time and improvement takes even longer, and teachers who do not see results often start looking for new solutions too soon. Less common than individual teachers changing methods, is a systemic shift in mathematics education. I believe we are in the midst of the third major shift in 50 years.

After World War II the Soviets and the Americans became engaged in the Cold War, in which the two superpowers armed themselves and competed for supremacy on the world stage. When the Soviet Union became the first country to launch an artificial satellite (Sputnik) into space in 1957, the American government reacted in a number of dramatic ways. In 1958 the National Defense Act allocated almost \$1 billion to educating American children in mathematics and science. This led to a change in the way mathematics and sciences were taught in the elementary and secondary schools across the country. New mathematics curriculums were written in the hopes of sending more students into postsecondary mathematics and science studies. William Kilpatrick's "project method" of learning had inadvertently caused a drop in enrolment in high school algebra. These new curriculums emphasized the importance of knowing why not just how the math was done. Problem solving and application became more important in mathematics curriculums. There was a move away from the rote learning that had dominated mathematics for so long. The overall goal was for the United States to train more mathematicians and scientists to help them gain the advantage over the Soviets.

Less than 10 years later (1966) mathematics educators were worried about students' basic mathematics abilities; hence the second shift began.

North American students were being taught to use algorithms, and rote memorization was being stressed in the classrooms. By the early 1980s it was becoming evident that the “Back to Basics” movement was not working. American students were not performing at the same levels as their Asian and European counterparts. In 1989 the NCTM published the *Principles and Standards for School Mathematics*, which outlined a common curriculum for students from kindergarten to Grade 12. In 1993 the NCTM published a small book entitled *State of the Art, Transforming Ideas for Teaching and Learning Mathematics*; in this book the authors suggest a new (the third) shift in mathematics education. This new shift has five components: 1) view mathematics classrooms as learning communities, 2) remove the teacher as the sole authority for what counts as right and wrong, 3) emphasize mathematical reasoning to prove and/or verify moving away from rote memorization, 4) encourage students to make conjectures and be inventive in their problem solving, and 5) connect mathematics to other aspects of life, rescuing it from its isolation.

With each of the above three shifts in mathematics education, the study of teaching mathematics gained new and useful insights into how to best help others in their learning of mathematics. At the same time, however, we lose something. The shifts in mathematics education acts something like a pendulum: the pendulum swings too far in one direction, then the correction takes us too far in the other direction and eventually, the cycle repeats itself.

The swings in the pendulum do not occur overnight and even when the community of mathematics educators agrees that a change must be made, we may not all understand how this new change will affect our universities’ teacher training programs

and our schoolroom mathematics lessons. In the midst of any major change confusion and trial and error will exist and may result in students inadvertently being lost in the process. This may be an unavoidable consequence of process and progress. If we as a mathematics community do not have a good sense of what it means to teach mathematics properly, our students may experience [encounter? what do you mean?] 12 different theories on what teaching mathematics looks like by the time they reach university. This type of diversity makes the NCTM's goal very hard to accomplish.

To further complicate the issue, there appears to be a more lethal and silent opponent to the mathematics-for-all quests. In North America, school students are taught the core subjects by the same teacher in each grade, until they reach Grade 7; in some cases it may be until they reach Grade 10. Other subjects like second languages, music and physical education are often taught by specialists in these fields. I would argue that in the majority of cases elementary school teachers are required to teach mathematics that they are not sufficiently prepared to teach.

Dobson (2001) discusses the state of education in the United States. He cites a National Assessment of Education Progress study that concluded that 80% of fourth-grade children are not proficient in mathematics. Further on, Dobson includes a transcript of a radio conversation he had with Bill Bennett, Secretary of Education under Ronald Reagan.

Bennett pointed out that half of all the elementary school teachers they studied could not "divide one-and-three-quarters by one-half" (Dobson, 2001, p. 190). If this is true, and if we agree that Canadian education and American education are in many aspects similar, then why are we as citizens and parents not insisting that our

kindergarten to Grade 6 children be taught by mathematics specialists? “The United States is one of the few countries in the world that continues to pretend—despite substantial evidence to the contrary—that elementary school teachers are able to teach all subjects equally well” (Everybody Counts, 1989, p. 64). In his book *Innumeracy: Mathematical Illiteracy and its Consequences*, Paulos (1988) suggests that, “The background in math of prospective elementary school teachers is . . . nonexistent” (p. 102). Paulos suggests hiring mathematics specialists to teach in the elementary school.

I believe that elementary school teachers rarely teach incorrect mathematics. What I believe happens is either one of the following situations or a combination of the two. A teacher who is charged with teaching mathematics and is not sufficiently knowledgeable about the subject will only ever be able to teach the topics at a superficial level. For example, I can explain to you how an internal combustion engine works but I do not possess enough knowledge to diagnose and fix your car when something is wrong. In the elementary years students are building a foundation that they will be forced to rely on for the rest of their lives. If there is a slight misunderstanding or conceptual problem that is formed in the early years of mathematics education, that may stay with the student for the rest of their life. A teacher who is not intimately familiar with the subject that they are teaching may not notice these conceptual problems and/or not be able to help resolve them if they are apparent. “Despite massive effort, relatively little is accomplished by remediation programs. No one—not educators, mathematicians, or researchers—knows how to reverse a consistent early pattern of low achievement and failure” (Everybody Counts, 1989, p. 13).

In other cases, a teacher's own negative or ambivalent feelings towards a subject like mathematics may be tacitly communicated to their students. Mathematics may then become the subject where nothing fun ever happens, children who are naturally interested in mathematics can easily become turned off by bad classroom experiences. In either case, damage is done to the student and their future in mathematics. By the time they reach high school they may not have the choice to take the mathematics that will lead them to a "productive future." Therefore, teachers are concerned with "mathematics for all."

Finally, there exists a "pervasive societal belief in North America that only some students are capable of learning mathematics" (NCTM, 2000, p. 12); in North America we have made it acceptable, even permissible, to be "bad at math." This misconception has made it okay to fail in mathematics. Every time I have parent-teacher interviews I have well-meaning parents sit across a table from me and shrug their shoulders and proclaim that they could never do mathematics in school either, so why should their child be any different? It is as if there existed a mathematics gene that some people possess and others do not. "The myths surrounding the subject [mathematics] encourages children to give up the moment they encounter any difficulty" (Mighton, 2003, p. 20).

I was alarmed when I was watching a commercial for the 2004 summer Olympics in Athens. The commercial showed athletes competing and winning medals and the voice-over said:

“It does not matter where you come from,
Who your family is,
What you wear,
Or how good you are at math
All that matters is
That you give it everything you got . . .
To me that’s why the Olympic Games rock!”

(Lavigne, 2004)

The voice is that of Canadian teen rocker Avril Lavigne. What disturbed me when I first heard this commercial is that it would not be socially acceptable to replace “math” with reading. “Children can succeed in mathematics The evidence from other nations shows overwhelmingly that if more is expected in mathematics education, more will be achieved” (National Academy Press, 1989, p. 2). As a society we have to start realizing that it is not okay if you are not proficient in mathematics. As parents we need to make sure that our children are learning the mathematics that they will need for life, starting at an early age. As educators we need to be more vocal about this issue and become agents of change.

I believe that “math for all” is a worthy vision to work towards. I do, however, see a number of obstacles standing in the way of that vision becoming a reality. As a mathematics teacher who believes in “math for all” but sees the limitations, how do I enter a mathematics classroom full of students who have been left behind and teach them

effectively? This is not a question of effective remediation techniques. No, the question is what I have to change to be able to meet these students where they are.

Curriculum Concerns

It is possible that the students that I teach this year will have up to five different careers in their lifetime. In today's society, more than ever before, an individual must be prepared for change.

Part of that preparedness involves being numerate. Paulos (1988) defines innumeracy as "an inability to deal comfortably with the fundamental notions of number and chance" (p. 3). In his book *The World is Flat: A brief history of the twenty-first century*, Thomas Friedman quotes Tracey Koon, Intel's director of corporate affairs, who said, "Science and math are the universal language of technology . . . they drive technology and our standards of living. Unless our [North American] kids grow up knowing that universal language, they will not be able to compete" (p 272). Innumeracy and career choices are distant concerns of the average 14-year-old; be that as it may, it is at this age that students in Manitoba must choose which stream of mathematics they want to study during their high school years. This choice will have lasting repercussions at graduation and beyond.

One of my goals in this thesis is to improve my own teaching and help others in their journey to better pedagogy. I have chosen to focus my attention on the Pre-Calculus and Consumer Mathematics courses. As I have already stated in chapter 1, I see myself as a Pre-Calculus teacher.

As such I find that I have a hard time teaching the Consumer Mathematics course authentically and with integrity. For the purposes of this thesis I have chosen to focus on the Grade 12 Pre-Calculus and Consumer Mathematics course.

I would like to speak briefly on the nature of the students that I have taught in Consumer Mathematics. At the Grade 12 level the students sitting in many of the desks show a combination of frustration, fear and disappointment.

Many students in Consumer Mathematics are there because they have been unsuccessful in past mathematics classes.

Most of the students found the Grade 9 mathematics course difficult, and managed to just pass. It is not uncommon to find students in Consumer Mathematics who have taken the Grade 9 course two or more times before passing. Other students arrive in a Consumer Mathematics course after a very rough ride in the Applied or Pre-Calculus stream. Regardless of their path, many of the students arrive at mathematics discouraged, disheartened or reluctant. For many of the students, mathematics anxiety is high and mathematics teachers are not to be trusted. These students have been wounded by mathematics and are weary of getting too involved in any activity for fear of further failure. This is the challenge facing many Consumer Mathematics teachers.

More than once in these pages I have claimed that I see myself as a Pre-Calculus teacher. I struggle with this because I would rather see myself as a teacher of mathematics students. I believe that I have linked my identity as a teacher to the Pre-Calculus course so strongly based on the content and delivery of the course. I enjoy and am comfortable teaching academic mathematics, full of proofs, theorems, and algorithms.

I am also very comfortable but not always satisfied with being up in front of a class teaching for 50 to 60 minutes a day. Both of these are realities in the Pre-Calculus Mathematics courses.

Students in Pre-Calculus are in this stream of mathematics because they want to be able to enter any field of postsecondary study. Pre-Calculus is the only mathematics stream that will truly make this a possibility for students. I do not believe that a student who graduates from Grade 12 with Consumer Mathematics is prepared for any type of postsecondary education that involves mathematics.

In the introduction of the Grade 12 Consumer Mathematics curriculum the writers explain that Consumer Mathematics courses are “for those who may not use advanced mathematics in their careers, but who, nevertheless, will be consumers and active citizens” (Senior 4 Consumer Mathematics: A Foundation for Implementation, 2000, p. 3). The focus of this curriculum is not to prepare student for the study of mathematics at the postsecondary level; rather, it is to teach students to be intelligent consumers and active citizens. To this end it is very important that these students become numerate. I believe that if taught correctly, graduates of Consumer Mathematics can be fully numerate. The above statement would appear to be a clear signal that the Consumer Mathematics course is significantly different from the Pre-Calculus course. It stands to reason that two courses with different focuses should have different sets of goals for teachers and students. Yet the goals set out by both the Grade 12 Pre-Calculus and Consumer Mathematics curriculums are surprisingly similar (Table 1).

Table 1

Pre-Calculus Versus Consumer Mathematics Curriculum Goals

Curriculum Goals	
Grade 12 Pre-Calculus	Grade 12 Consumer Mathematics
Students should learn to value mathematics	Students should learn to make mathematically reasonable decisions
Students should become confident in their mathematical ability	Students should become confident in their mathematical ability
Students should become mathematical problem solvers	Students should become mathematical problem solvers
Students should learn to communicate mathematically	Students should learn to communicate mathematically
Students should learn to reason mathematically and think critically	Students should develop proficiencies in basic skills and understanding of fundamental concepts
Students should develop proficiencies in basic skills and concepts	Students should become proficient users of technology

Reading these two sets of goals I see only two practical differences: In Pre-Calculus the students are expected to learn to “value mathematics” and in the Consumer Mathematics students are expected to use technology. Otherwise, the goals are extremely similar.

I would argue that only the most seasoned teacher would be able to tell the difference between the Pre-Calculus and Consumer goals if they were given only the written descriptions in the curriculum documents. The two documents use slightly different language but essentially they are describing identical concepts. So where is the difference? What makes the Consumer Mathematics course different from the Pre-Calculus course other than the content covered?

The answers to the above questions are important to my exploration. If the only difference between the two courses is content, then I should not experience any tensions and be able to shift my identity as a Pre-Calculus teacher in order to properly teach the Consumer course. I have taught in both streams and I know from experience there are many differences other than just content. I do not understand why the introductions of these two curriculum documents do not reflect those differences. This is not say that the two introductions are identical. The Consumer document does explicitly address the need for a less teacher-centered learning environment. However, if you read the Grade 12 Pre-Calculus curriculum document carefully, you will find that this document also calls for a more activity-based, student-centered learning environment.

Perhaps the most dramatic difference between the two introductions is what they have to say about assessment. Both documents call for flexibility in assessment. In the Pre-Calculus course, testing is to be done on regular intervals and should be cumulative.

Alongside tests, students should be given many opportunities to demonstrate their learning and thinking through open-ended questions, journals, projects, and portfolios.

The Consumer curriculum makes it clear that testing is not the principal means of assessment in this course; rather, teachers should assess students through projects, portfolios, homework, interviews, and a variety of other strategies. With the exception of testing even the assessment practices in the two courses appear similar.

Taking a closer look at the topic of assessment, let us look down the road to the end of the two different courses: the final provincial assessment in Grade 12. The Pre-Calculus final examination is a three-hour pencil and paper test broken up into two parts: one hour with a calculator and two hours without. The examination is written on one day at the end of term, in January or in June. The test is worth 30% of the student's final mark.

The Grade 12 Consumer Mathematics final assessment is broken into three parts: a project, a portfolio, and a written test. Each of these portions is worth 10% of the student's final mark. The project is written in class over a three-day period. The portfolio is done on the student's own time and the final one-and-a-half-hour test is written in late January or June.

By designing and implementing the final assessment in such a way I believe that Province of Manitoba is sending a clear message to teachers that these course are different, with different purposes, and should be instructed in different ways.

Yet in my mind there is no significant tangible difference in the two courses' goals.

As a teacher who has been in both the Consumer and Pre-Calculus classrooms, I have a hard time with the two documents' introductions. The Province's final assessment for each of the two courses is very different. The students in the courses are very different. The goals for each course are not very different. I believe this is misleading and if in fact these introductions are to be useful for teachers these issues need to be addressed. I am prepared to acknowledge, however, that I may be reading these two documents from my "pre-calc" [why not say "Pre-Calculus"?] standpoint and in doing so I am finding it difficult to see the differences that do exist.

Writing In the Mathematics Classroom

In the mid-1970s universities and colleges in the United States were being pressured by corporate America to start producing students with better literacy skills. Elaine Maimon, a faculty member at Beaver College, Philadelphia, was asked by the dean to develop a program to improve the college's students' writing skills. The results of Maimon's efforts have become known as the "Writing across the Curriculum" (WAC) movement. This movement has its roots in England, originally known as "Language across the Curriculum" and is based on the work of theorists such as Bruner, Shaughnessy and Bruffee.

The basic premise behind the Writing across the Curriculum movement is that "Writing should not be confined to first-year writing classes; we live in the world of language, and students should be encouraged to engage in expressive, academic, and professional writing and speaking in all of their classes" (Tillotson, 1996).

With this drastic shift, writing was now being viewed as a tool for learning and not just as the end result of learning. By writing about what they were studying, students not only developed better writing skills but they deepened their understanding of the material. Writing across the Curriculum was not immediately accepted and was implemented differently on different campuses. Some universities increased and varied the number of writing assignments required in first-year writing courses. Other universities began widespread curriculum reforms.

“In 1989 the NCTM published *Curriculum and Evaluation Standards for School Mathematics*, in which the authors stated that writing is a communication skill that has been used to infrequently in mathematics” (McGehe, 1991, p. 36). In 1991 the NCTM published *Professional Standards for Teaching Mathematics*. The mathematics classroom was changing, teacher roles were being shifted and assessment and evaluation practices were being challenged. There were new standards to be implemented and according to Stewart and Chance (1995), “journal writing, in essence, became a tool for implementing many of these standards” (p. 92). By this time the benefits of writing for learning were well-known and writing could be used as a vehicle for professional change.

It did not take long for the Writing across the Curriculum movement to find its way into high schools across the United States and Canada.

Writing increased in other subject areas but mathematics teachers resisted this new change. “The teachers who are the most difficult to convince of the worth of writing as a normal part of their curriculum are mathematics teachers” (McIntosh, 1991, p. 423). McIntosh goes on to explain that the resistance comes mainly from misunderstanding.

Mathematics teachers want to be responsible for teaching writing about as much as English teachers want to have to explain fractions. It is my opinion that once mathematics teachers realize the benefits to the students and themselves and the true nature of writing in the mathematics classroom, more will be willing to try to use writing in their classes. There are many benefits to writing in any class and some that are especially important in a mathematics classroom. Following is my summary of its benefits and importance for mathematics teachers.

No other subject matter taught in high school or university has the power to silence the student's voice like that of mathematics. In the humanities the student's interpretations of the readings and writings that are being studied are sought and welcomed. In the sciences students are asked to use their senses to interpret the world around them, perform experiments and draw conclusions. In mathematics students are asked to use theorems and proofs, much of which is knowledge that the students have not taken ownership of and do not understand. Students are then asked to try to apply these notions to obtain correct answers that hold no value to the students other than knowing that they did it right or wrong. Borasi (1990) describes a number of misconceptions that students and some teachers hold about mathematics:

- Mathematics is about producing the correct answer to the given question.
- There is always a correct answer that is void of any personal judgment or decision-making.
- Mathematics has always existed in its entirety, and the best mathematicians can do is uncover a new piece of mathematics.

- A mathematics student's job is to learn the material that is being taught and be ready to demonstrate this new acquisition of facts and procedures on the next test or problem at the board.

Inherent in all of these misconceptions is the idea that there is no room for the student's beliefs or interpretations, no room for the student.

A strong mathematics student may be able to solve the problem on the test or in their homework but have little understanding of the whys and the hows of the solution, making their answers tentative and unsure. A weak student who is unable to replicate the teacher's solutions will experience varying levels of anxiety or disillusionment surrounding their mathematics studies. By introducing writing into the mathematics classroom, both situations can be alleviated.

Writing in the mathematics classroom can take many forms but all revolve around the idea of getting students to expose their inner thinking about mathematics. By having students write out their thought processes and strategies for solving problems you are inviting them to participate in meta-cognition—thinking about their thinking. Often a student will be asked to explain his or her solution and they are unable to. I do not believe that in the majority of these situations the student is being difficult or defiant. I believe that they really do not know why they did what they did.

“Students often find out what they think when they write” (Miller, 1992, p. 354). Vygotsky, the constructionist theorist, “believ[ed] that writing requires the writer to compact inner speech maximally so that it is fully understandable, thus necessitating the deliberate structuring of a web of meaning” (Pugalee, 1997, p. 308). In other words, by asking students to write out what they are doing you are in effect forcing them to come

up with a reason for their actions as well as helping them structure their understanding for better use in the future. According to Pimm (1987), the very act of writing one's thoughts down brings them from the inside of an individual to something permanent and examinable outside oneself. Pimm (1987) goes on to say that "writing externalizes thinking even more than speech by demanding a more accurate expression of ideas" (p. 203). Writing requires an active participation that is often missing in mathematics classrooms.

When we write we personalize the information that we are putting on the paper. By having students write about the mathematics that they are doing, the teacher makes the mathematics more their own. They take ownership of the ideas. After a semester of writing, students can look back on their records of learning and see just how far they have come. Taking ownership and seeing progress helps to increase student confidence and feelings of worth in the mathematics classroom. These are such important and powerful ideas for teaching and learning. Student writing, however, does not take place in a vacuum. Teachers must be reading and responding to the students to complete the cycle and ensure that maximum benefits are being gained from the writing.

Much of the resistance to writing in the mathematics classroom is based on the teacher's own feelings about writing. Many mathematics teachers do not relish the thought of sitting down and reading 25 journals and responding to them. Mathematics teachers worry that they will not be capable of responding properly in writing.

Many mathematics teachers are intimidated by the idea of writing to their students. Once again I believe that the benefits for both the teacher and students will overpower these negative feelings towards writing.

Mason and McFeetors (2002) give teachers the following suggestions when first starting to write in a mathematics class:

- Do not spend more time writing than you would normally spend marking a set of class assignments.
- Respond to each individual's writing; do not use a template for your responses.
- Like the student writing you should not expect your writing to be perfect, but it should be sincere and from a professional perspective.

By reading the students' written responses the teacher is granted a special look inside the thoughts of the students. This is something that is not available upon examination of a student's mathematical work. The best we can do from looking at mathematics work is conjecture about the student's thinking. By reading the "why" behind the work, teachers are then able to assess the student's understanding at a deeper and more productive level.

Armed with this new knowledge teachers will be able to tailor their teaching for certain classes and students. When teachers respond to their students they can encourage them to continue or they can help clarify misunderstandings. Chapman (1996) found that "journal writing really revealed an inability [on her students' part] to express mathematical ideas correctly, not incorrect ideas" (p. 589). I would argue that if a student holds an idea correctly in their head they should be able to express that idea in writing. If the student cannot do this I suggest that the concept in question is not comprehended at a deep enough level and more work must be done to solidify that learning in the student's mind.

This misconception or shallow understanding on the student's part may never have been detected without the help of writing. Miller (1992) explains that writing in the mathematics classroom "establishes an open channel of communication between teacher and students that promotes good rapport and a positive classroom environment" (p. 355).

Earlier I wrote about how mathematics has the ability to steal a student's voice. By asking students to write to you and reflecting and responding on that writing, you are giving them a voice in your class. If a student can see a change in your teaching based on a suggestion they made in their writing, I believe that you will find that a much stronger teacher-student relationship will begin to develop. By allowing students to express their thinking and feelings about mathematics to you in writing you will also be alleviating for many students the anxiety that surrounds mathematics. In a study done in the United States, two groups of students were taught the same material; one group used journal writing in their learning and the other group did not. After analyzing a number of pre- and post-tests from both groups, researchers discovered that not only had the journal writing group performed better on the post-test, they also found that students' anxiety surrounding mathematics had decreased (Stewart & Chance, 1995, p. 93)

When I was in high school the extent of my mathematical writing was the mandatory sentence at the end of a word problem. Writing in the mathematics classroom is light years beyond this pragmatic summary of a solution approach to writing. As I read different teachers' and authors' perspectives on writing, I realized that each had his or her own names and methods for the writing that they were promoting. The one thing that they all had in common was this; initially all writing that took place in the mathematics classroom has to start with the teacher.

Teachers must use appropriate prompts to obtain the desired writing. "Prompts need to point to a place where all students can begin" (Mason & McFeetors, 2002, p. 533). When developing a prompt, teachers need to be aware of their students' level of literacy, what type of response they are looking for and the purpose behind the writing. As mathematics teachers we are not trained nor do we have sufficient time to properly assess our students' literacy levels. This provides an excellent opportunity for both English and Mathematics teachers to work together to develop age-appropriate prompts. The prompts that we use will determine the type of writing we receive.

I believe there are four types of writing that are appropriate and useful in the mathematics classroom. Mathematical logs provide students with an opportunity to practice their technical writing skills. McIntosh (1991) suggests that there are three types of prompts that you should use when having students write mathematics logs. "How-tos" and "definitions" are prompts that ask students to explain certain mathematical principles that have been discussed in class. Students should be writing these in their own words as this is not an exercise in transcription. These prompts encourage the students to re-explain what they have learned, allowing for better learning on their part and better diagnostics on the teacher's part. "Troubleshooting" prompts are used when the teacher wants their students to explain their errors. For example, after a test a teacher may ask students to focus on one mistake that they made more than once and explain what the mistake was. Included in this explanation the teacher may also ask the students to explain why they made the mistake.

Not included in McIntosh's (1991) three types of writing logs are performance logs. These logs require a student to complete a mathematics questions and then explain their solution. For example, solve the following system of equations and explain why you used the chosen method of solution. With these logs teachers can check not only for mathematical proficiency but also for conceptual understanding. Performance logs do not have to be used solely to check a student's understanding of a specific topic. Teachers can use these logs to ask non-routine questions or address authentic problems that have more than one correct solution or conclusion. These questions allow students to "create" their own solutions and explain them.

Mathematical journals have often been used instead of mathematics logs. I see the two as very different types of writing with different intended outcomes. Journals should be used for affective and meta-cognitive writing. Journals are more relaxed and less technical than logs. Journals are great tools for expressing ideas and building relationships. Teachers may ask students to write about their favorite mathematics class, explain what a mathematician does, or imagine if mathematics were an animal, what kind of animal it would be. These prompts are not used to examine specific mathematical knowledge; they are used to elicit a student's beliefs and feelings about mathematics.

The last two types of writing, expository and creative writing, are not used widely or often in mathematics classes and in my opinion have limited uses. I believe that if a teacher is going to use either expository or creative writing in their mathematics classrooms then they should also have their students read both types of writing.

Expository writing is used to explain, but it is not intended to be as technical as logs. Have students read a mathematics-related article and write a report on the article after further researching a topic found in the article. Creative writing is the most difficult type of writing to justify as a mathematics teacher; however, if done correctly I do believe that it can be useful. Books have been published that have combined fictional situations and good mathematics. *The Number Devil* by Hans Magnus Enzensberger and *The Man Who Counted* by Malba Tahan are two such examples.

Up to this point I have purposely stayed away from the topic of writing mechanics. I do not believe that it is necessarily a mathematics teacher's primary goal to teach proper writing mechanics when using writing in their mathematics class.

I do believe that if we are going to ask our students to write in mathematics class then we should expect some level of basic proficiency. After all, writing in the mathematics classroom was initiated by a movement whose purpose was to increase students' literacy skills. McIntosh (1991) suggests that for larger pieces of writing, Mathematics and English teachers could collaborate and have the English teacher mark the piece of work for form and the Mathematics teacher mark it for content. If you choose to use writing in your mathematics classroom, make sure you know why and for what purpose you are using the writing. Without an acceptable rationale I recommend that no action is better than action. In mathematics class, then, the emphasis is writing to learn

Palmer: Identity and Integrity

I am a teacher at heart, and there are moments in the classroom when I can hardly hold the joy. When my students and I discover uncharted territory to explore, when the pathway out of the thicket opens up before us, when our experience is illuminated by the lighting life of the mind [meaning??], then teaching is the finest work I know. But at other moments, the classroom is so lifeless or painful or confused, and I am so powerless to do anything about it, that my claim to be a teacher seems a transparent sham: “What a fool I was to imagine that I had mastered this occult art” (Palmer, 1998, p. 1).

I believe this passage accurately describes what all teachers feel many times in the course of their teaching profession to varying degrees. I have spoken to many people outside of the teaching profession and I know that all jobs come with their good days and bad days. That being said, teaching is different; many great teachers I know have admitted to me that they lie awake at night and worry about their students, their lesson plans and their competency as teachers. Why is this? What is it about teaching that causes this to happen?

I believe that there are few careers that require you to give a part of yourself to the job, that tie you to the successes and failures of your endeavors.

“What makes me the best teacher is when I am being most who I am” (Helms, 1998, p. 825). Teaching is not just what we do but it becomes who we are, our identity. In this section I wish to explore this concept of identity and how it can be related to my initial question. What tensions and processes must a teacher go through to change his or her identity as he/she enters and engages in different courses with different students?

Why do we choose to teach in the style that we do? Why do we allow some behaviours to go unnoticed and watch others with eagle eyes? How is it that we can become elated when we see 24 students succeeding and in the next moment become saddened and anxious when we see two students not being successful?

We teach who we are, whether we want to or not. When a teacher walks into a classroom and begins to teach, a part of him or her becomes exposed for all to see. Teaching is a mixture of content knowledge, management strategies and most of all, teaching is about relationships between colleagues, students and subject matter. To be able to relate well to others we must first be able to relate well to ourselves.

I believe that this is what Shakespeare was referring to in *Hamlet* when Polonius bade his son farewell with a list of fatherly advice including the line, "This above all, to thine own self be true; And it must follow, as the night the day, Thou canst not then be false to any man" (*Hamlet*, act I, scene III in Shakespeare, 1993). I find special significance in the last line of this quote, "Thou canst not then be false to any man." I believe that refers to what Palmer (1998) means when he talks about integrity.

"Knowing myself is as crucial to good teaching as knowing my students and my subject" (Palmer, 1998, p. 12). When I step into a classroom I bring with me all that I believe and value, my past experiences, my future hopes and all of my current successes and failures. Palmer argues that if I insist on teaching as if none of that matters, then I will inevitably find myself frustrated and searching for a better way. Too often, Palmer (1998) explains, we look to answer "the what and how questions" (p. 18) of teaching and we neglect the who question. Who is the person that is responsible for teaching this class?

Without a good answer to this last question the first two will never fully find homes in our classroom. I may often search for ways to teach my students without looking in the one place where the answer is sure to lie, inside of myself.

“Face to face with my students, only one resource is at my immediate command: my identity, my selfhood, my sense of this I who teaches without which I have no sense of the [one] who learns” (Palmer, 1998, p. 10). At its most fundamental level teaching is about relationships between teachers, students and curriculum. As the driving force in the relationship it is imperative that I have a sense of my identity. Palmer (1998) describes identity as an “evolving nexus where all the forces (genetics, nature, culture, etc.) that constitute my life converge in the mystery of self” (p. 13). In conjunction with this definition Palmer identifies three components of identity: intellectual, emotional, and spiritual. *Intellectual* refers to our cognition, how we think, and the way we make sense of the world around us. *Emotion* is a filter that we pass all of our thoughts, actions, and interactions through. Emotion is often the driving force behind many of our reactions to the world around us. The *spiritual* component to identity is the part of our personhood that we connect with something outside of ourselves, something bigger than us. I believe Palmer regards this part of our identity as what gives us hope: hope that tomorrow will be a better day, hope that Monday’s class will be as good as Friday’s.

Being a whole teacher means living an undivided life, a life that is true to one’s identity. Palmer calls this “re-membering,” the act of putting ourselves back together by recovering our identity and integrity. This is a continual process of saying to oneself, “This is what fits me and this is what does not.”

If a teacher tries a new method of instruction, evaluation, or assessment and the activities are not in line with the teacher's identity, then the work being done will lack integrity.

For me, this is good news and bad news. I can stop looking at the horizon for the next great teaching method that promises to solve all of my problems. I do not, however, see this as an invitation to quit trying to better my practice but it is permission to let things go untried. The bad news is that I now have to look to my own sense of self to instruct me on how to proceed. This brings on both a sense of freedom and uncertainty; I am now responsible to tell myself what does and does not work best for me.

Palmer is not discounting good pedagogy; he is instead asking teachers to know themselves well enough to choose what works and what does not work for them. "As we learn more about who we are, we can learn techniques that reveal rather than conceal the personhood from which good teaching comes" (Palmer, 1998, p. 31). Part of this thesis process will be to examine how I can go about better understanding who I am. In their reflection guide to the book *The Courage to Teach*, Palmer and Livsey (1998) pose the following questions to help teachers focus on the key aspects of their identity:

Table 2

Palmer and Livsey Identity Questions

-
1. Why did I become a teacher?
 2. What do I stand for as an educator?
 3. What are the gifts that I bring to my work?
 4. What do I want my legacy as a teacher to be?
 5. What can I do to keep track of myself—to remember my own heart?
-

To accompany the questions asked by Palmer and Livsey I put forth the question asked by Blankstein in his book *Failure is not an option: Six principles that guide student achievement in high-performing schools*. Blankstein (2004) never mentions identity but he begins his book by asking the reader to identify their core.

“The core is defined here as the intersection of one’s purpose, values and intention” (p. 19). Blankstein’s core is analogous to Palmer’s identity; Blankstein goes on to explain that one method of determining one’s core is to answer the following questions:

Table 3

Blankstein’s Identity Questions

1. What do I value most? Another way to ask this might be, “What behaviors can I not tolerate and why?”
 2. What do my past life patterns, strong interests and passions tell me about my purpose in life?
 3. How do my values and purpose in life overlap with what I am doing here in my current role? What are my intentions relative to the work I am doing?
-

Palmer allows for a dynamic identity regulated by one’s sense of integrity. I do not believe that Palmer would agree that we can have multiple identities; this would in some way lack integrity.

I question whether Palmer's model of identity can stand up to a radical and rapid change. Can my identity change as I go from one class to another? Is it flexible enough to allow me to disregard values and beliefs that I hold dear [in one space ?] ? Will attempting to change like this ultimately violate my sense of identity?

Connelly and Clandinin: Narrative Stories

Connelly and Clandinin have been studying teachers and their knowledge since the early 1980s. For many years the acts and techniques of teaching have been studied, but only recently have teachers been studied. It is only in the last 15 years that teachers have been recognized as authors of valuable research on teaching. Connelly and Clandinin have worked for many years studying this notion, that the teacher can be both a source and author of knowledge with respect to their teaching in the classroom.

To help them in their studies they have developed a number of paradigms that they move in and out of when talking about teacher knowledge. They begin by defining "personal practical knowledge" (Connelly & Clandinin, 1999, p. 1); this knowledge is personal but can and does have meaning and applications outside of the author. "Personal practical knowledge is in the teacher's past experiences, in the teacher's present mind and body, and in the future plans and actions" (Connelly & Clandinin, 1999, p. 1). According to Connelly and Clandinin, knowledge is both "formed and expressed" contextually.

The context of a teacher's life is a web of different physical spaces and relationships that when woven together form a vast and complicated landscape that Clandinin and Connelly refer to as the "professional knowledge landscape."

Like other landscapes this one has hills and valleys and different people inhabit different places at different times. The metaphor of a landscape allows Connelly and Clandinin to deal with space, time and place in their thinking and writing about teachers. In terms of space they separate this concept into two broad categories: in classrooms and out of classrooms.

When we think of teaching I would argue that we envision a classroom of some size or shape full of students and a teacher, but there are many people involved in education who do not work inside the classroom: administrators, support staff, curriculum writers, researchers, policy writers and the list goes on. These are the people who dwell in the out-of-classroom spaces: the teachers, students, and teachers' aides dwell in the in-classroom spaces. The inhabitants of this landscape do not stay in their designated places all of the time. Teachers leave the classroom and administrators and board members enter the classroom either physically or through the decisions that they make.

Connelly and Clandinin explain that in education we all live storied lives. "Sacred stories" are the stories that are handed down from the curriculum and policy writers; they are the stories that are subscribed to by the research community, the "theory-driven views of practice" (Connelly & Clandinin, 1999, p. 3) written by educational leaders like Freire, Dewey, Pinar and Piaget. There is nothing inherently wrong or sinister about the sacred stories, but they do not necessarily have a place with the teacher. Inside the classroom, teachers are often the only adults responsible for directing the classroom story.

These in-class stories are called “stories of practice” (Connelly & Clandinin, 1999, p. 3). They tell of what the teacher does and what they believe and value. These stories are often referred to as “secret stories” (Connelly & Clandinin, 1999, p. 3), as they find their origins inside of the teachers. These are the stories that they are passionate about that give them life. The teacher must live inside and outside of the classroom; he or she is expected to adhere to the policies laid out by those in charge. What a teacher believes and does in their classroom will not always fit with the sacred stories that are passed down to them.

This reality often makes it necessary for teachers to tell “cover stories” (Connelly & Clandinin, 1999, p. 3), stories about in-class practices that adhere to the sacred stories; cover stories and secret stories are rarely the same. Teachers are the only members of the community who are forced to live out all three stories. As a result teachers develop “stories to live by” (Connelly & Clandinin, 1999, p. 3) that connect knowledge, context, and identity and are shaped by the above three different types of stories. These “stories to live by” become the teacher’s identity.

Connelly and Clandinin (1999) explain that when people are asked about identity they often think of “who am I, who are you” (p. 94) questions. There is nothing immediately wrong with these questions but they imply answers that are set in place, “root-like at the core of a person’s being” (Connelly & Clandinin, 1999, p. 94). If you instead consider identity to be the stories that we live by, you have to acknowledge the possibility that my story today will not be the same as my story next year. If our stories change, then so do our identities; Connelly and Clandinin view identities and stories to live by as narrative processes that are built and lived out in context, this gives our

identities history. History is written by the conquerors and not the conquered; our own personal narrative histories are written by certain memories that overshadow or block out other memories. Is this acceptable, basing our identities in large part on memories that may or may not be completely accurate? Connelly and Clandinin say it is, because the accuracy of the memory is less important than the narrative that the memory creates. "They [identities] are narrative constructs that take shape as life unfolds and that may, as narrative constructions are wont to do, solidify into fixed entity, an unchanging narrative construction, or they may continue to grow and change" (Connelly & Clandinin, 1999, p. 95).

What are the forces or reasons why one would choose to change one's story to live by (identity)? Much of this answer lies outside of the teachers: "schools are landscapes of interacting stories" (Connelly & Clandinin, 1999, p. 100). These changes are often implemented by people or forces other than the teachers themselves; new curriculum, budget cuts and changes in leadership all will affect the landscape of a school.

When teachers resist these changes they are resisting changes to their stories to live by; they are trying to preserve their identities. These situations resolve themselves in one of two ways. Either the personal stories to live by change with the changing landscape or the teacher goes deeper underground, building and constructing more elaborate cover stories so that they can continue living their chosen stories to live by.

Connelly and Clandinin (1999) also assert that a teacher's identity and story to live by will have to change or be altered when the teacher crosses borders in the landscape.

Borders can be both physical and temporal; again, teachers who resist any change to their story to live by will experience a crisis in identity when they cross these borders. As an example, Connelly and Clandinin describe an experienced teacher who was self-confident and skilled at what she did. She moved to a school where the class times were significantly longer than she was accustomed to. This physical and temporal change caused a crisis in this teacher's identity; she soon felt incapable of planning an effective class and doubted her abilities. The cause of her problem was that she was still clinging to her old stories to live by, which no longer fit her life.

I found the authors' discussion of borders very interesting; while I definitely see the significance of physical and temporal borders I had to wonder about expectation borders. When a teacher moves between classes he or she may not change physical spaces and time may not be an issue, but with the new class there will be a new set of expectations and goals. I wonder if these can act as a border that would require a change in stories to live by. If this is true, then our stories to live by would have to be dependent on our relationships with others who share the landscape around us.

I believe that Connelly and Clandinin (1999) would support this characteristic of identity and in fact they do insomuch as they acknowledge that for a teacher to maintain their story of practice, they have to tell cover stories to those that they teach for and alongside. If teaching was not relational, then the cover stories would be unnecessary.

Helms: Identity and Subject Matter

In *Science—and me: Subject matter and identity in secondary school science teachers*, Helms (1998) offers a “conceptual framework for thinking about identity and subject matter” (p. 811). Helms defines “self (identity) in terms of four major dimensions: (a) deliberate actions; (b) institutional, cultural and social expectations, or what people think others expect; (c) values and beliefs; and (d) where people see themselves going, or the kind of people that they want to become” (p. 829).

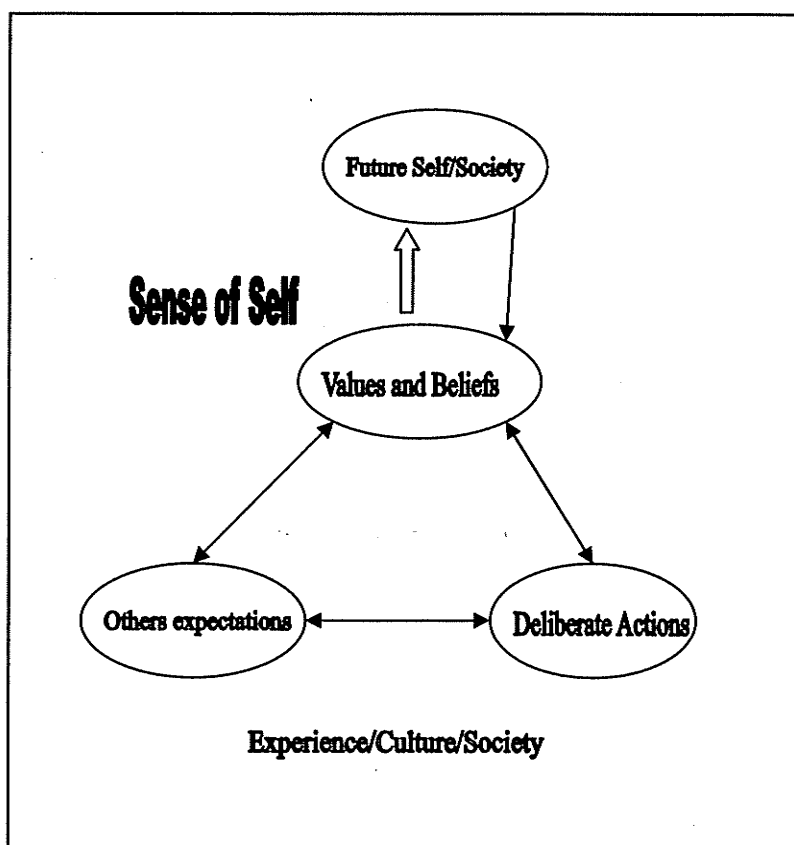


Figure 1. The four interrelated aspect of the Helms identity model and how each aspect is related to self, experience, culture, and society.

Helms (1998) signifies the direction and strength of the connection between the four dimensions in her model with arrows. The thicker the arrow, the stronger the link. At the heart of her model of identity Helms places personal values and beliefs. For many of us this is where we would begin to define who we are in and out of professional and personal situations.

Many other researchers and authors have used values and beliefs to help define the “personhood” of the teacher; I will now attempt to summarize a number of these ideas as they have been presented in Helms (1998). From the reading that I have done and my limited experience in the classroom I am convinced that to master the art of teaching you must first master the teacher. No document or strategy will ever be able to accomplish as much, or replace a deeply personal sense of who you (the teacher) are. By this I am referring to more than a keen self-awareness. Knowing how you feel or how you will react to certain students and certain situations is only the first step. As a teacher you must be willing to go beneath the emotions and the reactions to look at the cause. It is the “why,” not the “how do I react” that is important. Knowing the why is what I believe it means to master the teacher. This often requires that you confront beliefs or feelings that may not fit with who you believe you are. I am of the opinion that each individual operates from a core set of beliefs and values, which are often not fully understood by the individual. As professionals who are responsible for the intellectual, social, and emotional education of our students, it is important that we operate from as clear a set of values and beliefs as possible.

To obtain the clear sense of values and beliefs that I referred to one might want to examine their origins. Helms (1998) does not concern herself in this article with explaining where our values and beliefs are derived from. Others have written much on the topic. Taylor (1989) wrote in his book *Sources of the self* that “locating ourselves in a moral and ethical space enhances our sense of self; who we are is determined in large part by what matters to us and where our values are positioned in relation to others” (cited in Helms, p. 814).

This is important for two reasons. First, it links values with morals and ethics which we arrive at through personal interpretation of the world around us, often with filters put in place by those who raised us. In this sense, who we are, our identity, is connected to our past relationships, experiences, successes, and failures. Second, Taylor’s quote situates our values in relation to others, which corresponds well to “others’ expectations,” one of the four dimensions of the Helms model. If, as Helms claims, values and beliefs influence our actions, then it is through actions that we are able to determine where “our values are positioned in relation to others.” No two individuals will ever be positioned in the same place on a beliefs and values spectrum. This being true, it is fair to assume then that no two people will ever internalize and externalize the same way if placed in the same situation.

With all of this in mind, place 25 or more individuals in a room together for an hour a day for five months and ask them to work towards a common goal and you will begin to understand the complexities that a teacher faces every day. If the teacher is not as aware as possible of his/her own beliefs and values, then there is bound to be unnecessary conflict, either internal or external.

According to Helms (1998) the link between values and beliefs is most strongly connected to who we are becoming. Helms refers to a person's future sense of self/society as the horizon. The path that we take to reach this horizon is mainly dictated by our beliefs and values. The connection, although weaker in the other direction, is an acceptance of the fact that who I may want to be may not fit with what I believe and value today. In this sense then my concept of who I will or want to become can also affect what I choose to value and believe. Of the links between the four dimensions of identity in Helms' model, only these two dimensions, values and beliefs and future sense of self, are connected with two separate arrows. This is the only case in which the strength of the connection is not the same in both directions.

The link between values and beliefs and deliberate actions is for most a more obvious link but according to Helms (1998), it is weaker than the link to future sense of self. It is not difficult to assert that what I believe in or value will directly influence what I do. It is wrong, however, to assert that all of my actions can be in some way be connected to my beliefs and values. Many times we react to situations and these reactions may not be based on a previously exposed set of values or beliefs. I believe that this is why Helms has been careful to designate the actions as deliberate. Again Helms makes this link multidirectional, that is to say, my actions can and do in some way affect what I believe and value. I am somewhat surprised that Helms gives the same importance to both directions of this dimensional link. I am especially interested since I believe we often act outside of our values and beliefs system. Do these actions in some way erode or tarnish what we believe?

How would Palmer's sense of integrity fit in these situations? If we act long enough in opposition to our beliefs and values will they change, or will we be unhappy?

Others' expectations [relate ??] how those around us can influence what we believe and value and ultimately our own sense of self. The "others" in Helms' (1998) model can be individuals, organizations, or the societies that we live in. The notion of others' expectations in Helms model is in reality our perceptions of what or how others see us. It is impossible to know the thoughts or motives of others; at best we can interpret the information that we get from others. In a way when we enter into any type of relationship with another person, we step in front of a carnival mirror. The reflection that we see may be completely accurate in some ways and distorted in other ways. This perception allows us to internalize externals and make decisions based on our interpretation of those external reactions. We interpret how others perceive us or act towards us and that in turn gives us information with which we make decisions about how we will act and even what we will value and believe.

This can often cause a conflict between what we believe and the expectations of others. In her study many of the teachers Helms (1998) spoke with talked about the need to finish the curriculum. The curriculum was an external reality and not one that was self-imposed. Many of the teachers did not value or believe in completing the curriculum, but they did because others expected it from them. This is an example of an individual's actions being driven by something other than personal values or beliefs. This is the last of the links between the dimensions connecting others' expectations to our actions. Again the link is multidirectional. Do our actions in turn have some effect on others' expectations of us? Yes, they do!

Many times we are perceived by others based solely on what we do. In this way I see a whole new connectedness to Helms' model of identity. Who I will become is a by-product of what I believe and value which to a much lesser extent I choose based on who I want to be. I then act based on what I believe and value. These actions are seen by others and they interpret my actions and react to me. My interpretation of those reactions will further reinforce my values and beliefs and actions or cause me to change and alter them. This complicated web of interactions is strung together to form my identity.

Returning to My Question

Connelly and Clandinin (1999) openly support multiple stories. In fact, to maintain my identity as a teacher I may have to live a cover story. These cover stories should not be regarded as lies; they are who I am outside of the classroom. Connelly and Clandinin regard identity as relative. As I move from one landscape to another, who I am also changes. Thus according to Connelly and Clandinin, I am required to live multiple stories in and outside of the classroom, but Connelly and Clandinin never once discussed the need to live multiple secret stories inside of a classroom.

I do not see Palmer (1998) supporting multiple identities. In Palmer's model a person may change landscapes; however, I must continue to make choices about what does and what does not "fit" who I am regardless of where I am at any given time. I believe that Connelly and Clandinin's (1999) segregated identities lack integrity according to Palmer.

Helms (1998) believes that all of the dimensions of her identity model have to be viewed in relation to forces outside of the person and always as the “experienced self in context.” At first I understood this to mean that her model allowed for multiple identities each in different contexts, such as a different classroom. However, earlier in the text Helms refers to Blumer, who supports multiple selves based on different situations, and Helms (1998) in response “questions the extent to which the self can be so disconnected” (p. 814). At no point does she discount or support the possibility of a person forming two different selves or identities based on her model. That being said, I do not believe that she addressed this question in her research and it would be unfair to impose it on the model at this point.

I am not looking to divide myself; I am not pushing to form alternative identities for the different classes that I teach. I am trying to find a way to teach that is best for my students and myself; altering or switching identities as I switch classes may be what it takes to accomplish this. In order to determine how best to proceed I must examine the situation(s) where and when they occur, in the classroom with my students. Chapter 3 explains how I planned to go about this examination and what it ultimately looked like when I was finished.

CHAPTER 3

Methods and Methodology

I am hopeful that in writing this thesis I will be able to both answer my questions about tensions and identities in the classroom and demonstrate what it looks like for a teacher to intentionally explore issues surrounding his own teaching. To this end I begin the chapter with a look back at what I proposed to do during the data gathering phase of my research, folding in many of the foundational ideas presented in chapter 2. Later in this chapter I detail chronologically how my data gathering turned out, explaining and reflecting on the processes and decisions that were made. This chapter is intended to serve as both a possible road map for those interested in self-study and a travel log for those who are curious about my journey.

Proposed Research Methods and Methodology

What tensions are present when a Pre-Calculus teacher moves into a Consumer Mathematics class to teach? Can these tensions be identified and can the teacher's identity be reconciled to these tensions so that he and his students can participate in authentic learning? These were the questions at the heart of my exploration. This was never a question of what the students should do differently. It has always been a question of how if at all I should alter my identity. To frame my questioning in this search I have employed Helms' (1998) model of identity.

Helms believes that a person's identity is a composite of four interrelated concepts: future self and society, values and beliefs, deliberate actions, and others' expectations.

These four broad categories served as the scaffolding upon which I built my research. I attempt to touch upon all four categories of the model in my data collection and in my analysis.

It was clear to me that the word *identity* has different meanings depending on who is using it. Even among educators who speak about in-class identities there is some disagreement about the exact nature of one's identity. It was important that I make my understanding of identity clear to my readers before I do anything else. For the purposes of this thesis I have derived my definition of identity from those authors in chapter 2 and from my own sense of the meaning of the word. *Identity* is lived out across the contexts of a person's life; I do not support the idea that a person can maintain multiple identities for different contexts. Identity is an ever-evolving sense of where a person is headed, what they believe and value, how they enact those beliefs and values, and the expectations others have of them in specific contexts. I believe an individual must constantly make decisions with respect to each of the above components, choosing to maintain their identity or make changes and thus change their identity. I have intentionally set aside some of the more traditional psychosocial definitions of identity for ones that are better suited to this exploration.

At the centre of the Helms (1998) model is the individual's beliefs and values. These two words carry with them a multitude of implicitly understood meanings and connotations different for everyone who hears and uses them.

Therefore, before gathering any data, I set my operational definitions for both words.

Once the definitions were set I began my data collection (see Appendix A).

In this study I am the primary source of data, and the researcher and the author of the conclusions based on that data. Much of this research was highly personalized and localized in its initial stages. McMillan and Wergin (2002) in their text *Understanding and Evaluating Educational Research* explain that what sets action research apart from many other forms of research is the *why* not the *how* of the research. McMillan and Wergin (2002) write “[a] study is undertaken by educational professionals in their own practice setting for the purpose of better understanding their own work and how to improve it” (p. 173). Action research uses many of the same research techniques as quantitative research and to a greater extent qualitative research. Action research often focuses on an individual’s questions and situations that may or may not be representative or generalizable. There has to be a different standard to which this research is held up. McMillan and Wergin (2002) assert that the standard for action research is not how well the conclusions can be generalized to other situations but rather “does it [action research] provide information that helps inform decision making?” (p. 174). In my understanding this does not preclude the possibility for generalization but it does set the focus squarely on the teacher’s practice and his/her classroom.

I proposed that I would begin my self-exploration by addressing the questions posed by Palmer and Blankstein (pp. 43). My answers to these questions would be used to influence the writing of a personal Beliefs and Values Statement. Teaching is personal; who I am outside of the classroom always finds its way into the classroom.

Goodson (1991) claimed that we need to “re-personalize” the process of schooling and the lives of teachers. Goodson made these remarks in support of teachers writing their own personal histories.

In addition to my Beliefs and Values Statement I proposed that I would write an autobiographical history of my own educational experience. In a real way I am the sum of my past and present experiences; I will teach, believe, and value what I have experienced. Hunter Lewis (1990) asserts that “human beings cannot separate the way they arrived at values [experiences] from the values themselves.” [need page #?] This narrative history would serve as an excavation site that I could revisit repeatedly, digging further and further to uncover the key experiences that have influenced my beliefs and values that I carry with me into the classroom. In their writing Connelly and Clandinin (1999) often support the idea of personal teaching stories having historical aspects. These narrative histories contain valuable information regarding the *how* of *who* the teacher is today. This history was intended to be written from a personal non-objective point of view.

All of my personal writings were to be examined together in the hopes of identifying any internal inconsistencies. I believed that by identifying any of these inconsistencies early on in the research, I may have been able to narrow my focus for the remainder of the process. I recognized that some of the inconsistencies may have been a by-product of immature thinking on my part. It may also have been that these inconsistencies pointed to a deeper issue, one that had relevance for my discussion on identity.

What I believe and value will influence how I act, and according to Helms (1998), how I act will also flavor my beliefs and values. To that end my actions in each of the different classrooms becomes another window to look through to examine identity.

I realized early on that to attempt to explore my identity as a teacher and not include students, classrooms, and curriculum would be foolhardy.

This research was for the most part to be conducted over the course of a full semester of Grade 12 Pre-Calculus and Consumer Mathematics; the most intensive data collection period was to begin and end with the Variations and Formulas unit in the Consumer Mathematics classroom. I chose this unit because it is the one unit that I felt my teaching style in the Consumer classroom would most resemble my style in the Pre-Calculus classroom. For each of the units directly involved in the data gathering process I intended to provide a detailed sets of teaching plan and class notes, activities, tests, quizzes, methods, and explanations. Through these documents I hoped to see the differences in my methods and perhaps how they related to my identity in the classroom. I also decided that I would keep a daily journal for each class, writing as soon as possible after the class had finished. At the end of each week during the Variations and Formulas unit I would write a summary of the week's activities including personal reflections.

Students were to serve as secondary sources for my research. Student interactive writing and interviews from both a Pre-Calculus and Consumer Mathematics classroom would be used to examine the actions inside of the classroom and what they believe about mathematics and my purpose in the classroom. This is directly linked to the fourth component of the Helms (1998) model of identity, *others' expectations*.

As part of this study I decided that I would ask for volunteers from the two different types of mathematics classes; all students would be given the opportunity to participate. Ideally I was looking for three to four students, preferably evenly mixed according to gender.

If more than the predetermined number of students volunteer I would not turn any student away; however, I chose at the outset that I would focus the majority of my analysis on three to four students. All of my students in both classes would have already written journal entries for me as part of their regular classroom work. The journals entries of my three to four volunteer students would now be counted as data.

It was my intention that during the two-week intensive data gathering period my volunteer students and I would write an additional three to four journal entries. These additional entries were to focus on a number of predetermined themes and be directly related to the activities in class that day. "With interactive writing the teacher and the students get to know each other's views on matters relevant to learning mathematics" (Mason & McFeetors, 2002, p. 532). According to Mason and McFeetors (2002) there is one of four intentions behind most students' writing. I believe that each intention signifies a new and deeper level of relating by the students and a richer source of data for the teacher. First, many students write because they are told to, or it is the only appropriate way to respond to a question. This is the main intention in students writing at the beginning. Second, once the students get used to writing in a mathematics class they often move to writing in order to tell you (the teacher) something. This type of writing is still prompted by the teacher but the subject and the length are often dictated by the student.

Third, an extension of the last purpose is writing to reflect; in this writing the teacher is given a glimpse into the student's thinking. Again, the writing is often prompted but the outcomes are student-driven. This writing is very fertile ground for teachers who are searching for a glimpse into students' thinking.

Finally, there is writing to relate; here the student reaches out to the teacher on a more personal level in an attempt to strengthen the student-teacher relationship. With each of the different intentions comes a deeper level of commitment on the students' part. My hope was that after some practice those students who choose to volunteer would feel comfortable writing to reflect and relate. It was these types of responses that I believed will hold the most valuable information for my purposes.

Each of the two groups of students would write on the same themes so comparisons could be made across the two classes. I knew that it would have been shortsighted of me to list the different prompts that I planned to use, since many of the prompts would be drawn directly from previous student writing. I hope the students' writing would help me get a sense of their future expectations and their expectations of me. I also hoped to gain a student's-eye view of my actions in the classroom.

In addition to the student writing I decided that I would conduct taped interviews with the students to help me draw out information about their expectations of me, the school and the course that they are in. I believed that it was important to get the students to explain how they saw their future and especially how this course fit into them achieving their future goals. These interviews were to be conducted at noon hour and on a volunteer basis.

I spend my day in a building with over 1,000 people in almost constant motion. I am rarely in a room by myself, and yet I do not truly work with anyone. Palmer (1998), Connelly and Clandinin (1999) and other educational writers all acknowledged that teaching is essentially a lonely profession.

Yes, I work in buildings with other professionals who have the same goals and challenges that I do; however, when I step inside the classroom I am by myself. My study was to focus on my sense of identity and the tensions that I faced as I taught in two different environments. I saw the need for feedback on what I was doing from other teachers. Without this professional feedback I was operating in a vacuum and was susceptible to internal inconsistencies that I may not or may not have been able to see. This phenomenon was explained by Joseph Luft and Harry Ingham in the 1950s and visually demonstrated in the Johari Window (Table 4).

Table 4

Johari Window

	Known to self	Not known to self
Known to others	Open (arena)	Blind
Not known to others	Hidden (façade)	Unknown

It was the field that is known to others but not known to self that I was hoping would be brought to light by my critical friend(s).

The term “critical friend” appeared in the late 1970s and is credited to Desmond Nuttall (Heller, 1988, cited in Swaffield, p. 1). In my research I defined a critical friend as a peer who takes the time to actively and intentionally engage with you in your work. One of the roles of a critical friend is to ask thought-provoking questions aimed at providing you with new and different perspectives from your own. A critical friend’s overriding goal is to help you improve and clarify the work you are doing.

I was not looking for affirmation or advice. I was looking for another professional not in my building who would serve as sounding boards for my writing, absorbing what I wrote and reflecting it back to me in a critical manner. I can only relate this process to hearing your voice on tape for the first time; the question everyone asks is, “Is that what I really sound like?” I needed these professionals to help me hear what I really sounded like. My concern was that without this component I was likely to “hear” or attend to my own personal agenda, since I was so closely tied to the data. My interactions with my critical friend(s) were to be of two types. I provided my critical friend(s) with copies of my weekly journals, my Beliefs and Values Statement and my Personal Educational Autobiography. From their responses I was hoping to see my own actions, beliefs and values in a different light and perhaps be better equipped to identify any tensions.

As I began to think about how I would attempt to analyze the data that I was going to be collecting, I saw the analysis happening at two different stages for different purposes. The first analysis would take place during the data collection itself.

As I collected data (student journal entries, my own journal entries), I intended to read this data and use it to inform my next steps in the classroom and in my research. From this initial analysis I developed future prompts and interview questions for the students. The second analysis of the data would involve a much deeper, more analytical look at the writings that I had collected. This analysis was to take place after the final set of data had been collected. It would be in this second stage of data analysis that I would begin to employ many recognized analysis techniques with the express purpose of uncovering any patterns or themes in the data that may have pointed to the tensions I discussed earlier.

Coding

All of the reading that I have done has impressed upon me the importance of collecting “rich” data. Thus I knew it would be important that in my writing I added as many details as I could, especially about my own educational experiences and my experiences in the classroom. While I wrote about my experiences I attempted to be as intentional as possible about not editing details out; rather, I included as much as I could and allowed the coding to filter through what was relevant and what was not.

According to Miles and Huberman (1994), coding serves four functions. It 1) reduces material into smaller more specific units, 2) analyzes data during collection to help refine collection process, 3) encourages elaboration of cognitive maps, and finally, 4) helps in cross-case analysis when multiple cases are being considered. I believed that each of these functions would be served in my analysis. The data that I was collecting and analyzing would be anecdotal. It was with this in mind that I planned to use coding to help me extract the most critical pieces of data for my purposes.

On my first read of the data that I was collecting I planned to use what I was reading to help inform my next round of questioning and to begin to develop a coding system that I could use in my second round of analysis. I expected that each new pieces of writing would have the potential to bring with it new codes and cause old ones to be abandoned. I planned to continue to refine my coding techniques throughout the first reading of my data. Once I was satisfied with my codes and my data collection was completed, I planned to begin a new reading cycle implementing the final set of codes. These new codes were to be recorded directly on the data. Once all of the data was coded I planned on using a matrix-type recording system to further my identification of any patterns or themes that may be emerging from the data. I assumed that the codes that emerge would be based in part on the Helms (1998) model that I discussed earlier.

Coding was to help me identify and draw out themes and patterns in the data. However, I was then left to determine what the patterns and themes meant. Would the coding point to a larger picture or were the codes revealing patterns that were unconnected and scattered? Answering these questions would require more than codes in a matrix. It was at this point that I decided that I would use a technique called "memoing" to help me in my analysis of my data. Glaser (1978) recommends memoing as a way to go from coding to theorizing: "[a memo is] the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding" (Glaser, 1978, p. 83-84 cited in Miles & Huberman, p. 72). Memoing is done while the coding process is taking place, as the researcher moves through his/her data he/she writes memos about the codes. Memos are written primarily to the researcher by the researcher. A memo can be a short sentence or many paragraphs long.

The purpose of the memos is threefold: first, to help clarify the idea(s) behind the codes; second, to tie together a number of codes into more generalized concepts; and finally, to help distinguish between different ideas represented by already existing codes. One of the benefits of memoing is its ability to help the researcher cluster ideas together. During coding, two incidents or concepts may seem unrelated, but during the analysis the researcher may memo about the two and discover that they do indeed have common characteristics leading the researcher to a fuller understanding of the data.

Metaphors

Many times after going through the collected data, a researcher will create a metaphor for something that he/she has seen in the coding or clustering of concepts. A metaphor is a comparison of two concepts focusing on what they have in common, ignoring any differences. Lakoff (1987) has argued that in order for people to grasp abstract ideas they will need to project or “map” them onto something concrete first. This is the service that a metaphor provides for the researcher. By creating the metaphor a researcher can explore the concepts he/she is looking at through a different set of lenses and come to better understand them. Like coding and clustering, creating metaphors from the data serves as a data-reducing technique. Metaphors allow several individual concepts to be tied together based on commonalities. Miles and Huberman (1994) make several suggestions for the creation of productive metaphors:

- Stay aware of the metaphors you and people in your study are using, make explicit the metaphors that are being used.

- Beware of “overarching” metaphors too early in your research. The danger is you will too quickly settle on a metaphor that may not be all that it seems at the beginning causing you may miss critical information or force a fit were one does not exist. Wait until two-thirds of the research is complete until you try to create such a broad metaphor.
- Be playful with the words when creating your metaphors, switching domains, limiting your number of words.
- Share in the creation of metaphors with others.
- Know when to stop pushing the metaphor, the rule of thumb is as long as it is useful and not too complex. “Remember that the two things compared in a metaphor always have differences.”

(Miles & Huberman, 1994, p. 252)

Up to this point all of the analysis techniques that I had planned were being used with the intent of filtering the data and emerging with the important themes and patterns. Once I extracted the themes or patterns from the different sets of data I believed it would be necessary to compare and contrast each to help identify the tensions that I sought. Comparing and contrasting is in its most base form the act of asking “What is the difference?” According to Miles and Huberman (1994), when comparing and contrasting different sets of data it is important to be mindful of your final outcome. If no practical significance exists when comparing or contrasting two concepts then it would appear to be a pointless exercise.

I believed that I would find different themes and patterns in the writings pertaining to my educational background and my Pre-Calculus class compared to the writings pertaining to my Consumer class. By intentionally looking for the differences in the two classrooms in relation to my own personal experiences I was hoping to be able to name the tensions that existed and relate those to my initial question of identity.

Once I have arrived at my conclusions based on the analysis of the data I have to ask one very important question: Are my conclusions *valid*? Research that arrives at invalid conclusions is of little use to the researcher or anyone else. In scientific fields validity often hinges upon reproducibility: can the same result be arrived at through the same processes? If the answer to the last question is yes, then the original findings are deemed to be valid. This is not the case in action research. No one else will think or act they way that I do in a similar situation, so to replicate my findings would be an impossibility. Where does that leave us in terms of validity? What we are left with is the question of *plausibility*: Is what is being reported to us plausible?

“We are not looking for the ‘best’ or most ‘correct’ explanation, but one that makes sense or can be accommodated by all stakeholders” (Stringer, 1996, p. 93, cited in Holly, Arhar, & Katsen, p. 213).

During the planning of my research I was plagued by a nagging structural question. I am the primary source, the analyst, and the main consumer of the data. This would be an incestuous process and if I was not vigilant and constantly self-monitoring I ran the risk of my preconceptions driving the research towards an outcome that I desired. Goleman (1992) asserts that the “human mind finds patterns so quickly and easily that it needs no how-to advice.”

Without the proper checks in place, it would be easy to code and find patterns that I see as important and suited to my liking? Although I planned to be the primary source of the research I included data from my students and from my colleague(s) outside of my school. These additional sources of data were put in place to help ensure that I was not able to easily force the findings in one way or another. I also included multiple sources so I could try to triangulate my findings. Triangulation is one of the best methods for ensuring validity in results.

Often disconfirming data is just as important as finding confirmation for the conclusions that you are trying to make. Intentionally seeking data that does not fit with the themes and patterns that emerged from my sources would allow me to probe deeper into what I was discovering. I planned on spending some time looking at the outlying data to inform me about the different clusters and metaphors that I would be creating. This outlying data may provide me with a counterexample to help in my analysis. Often a counterexample will shed more light on the true nature of what you are looking at than a second or third confirming example could do.

Bias

As I planned my research and analysis I was keenly aware of the possibility that I had the potential to bias the data. By looking to multiple sources for my data I was hopeful that I could remove or negate my opportunity to bias the results as much as possible. However, this can be difficult in action research designs. Miles and Huberman (1994) set out three bias archetypes: holistic fallacy, elite bias, and going native.

The *holistic fallacy* involves seeing patterns and grouping events when they do not belong together. A researcher guilty of this will leave or ignore many unanswered questions in the pursuit of a more appealing answer. The *elite bias* occurs when the research only focuses on the elite in a group; in my case the elite would be the students who articulate themselves well, show up for class on time and do their work. By focusing on these students I will have left off or ignored a whole other population of the classroom. *Going native* is all about loss of perspective, when you lose the ability to see outside of the situation. All of these are potential pitfalls in this research process. [NOTE: some people may be offended by the expression “going native” because of its imperial derivation.]

Holly, Arhar, and Kasten (2005) urge the teacher researcher to do the following when conducting their own research to increase the validity. If you cannot eliminate the biases, be upfront about them.

As I conduct my research I may have to admit to going native in the Pre-Calculus classroom; this is a bias that I may possess and will become clearer once I begin my self-reflective writing.

From the reading that I have done and the discussions that I have had with other researchers I have come to the following conclusions regarding ways of trying to produce valid research.

- Triangulate whenever and wherever possible.
- Revisit the data often; put aside data for a specific time and reread it later with fresh eyes.
- Check to ensure that the original conclusions/coding are accurate.

- Be systematic and transparent in analysis; be very explicit when explaining what has been done.
- Finally, provide the readers of the research with as much of the raw data as possible so that they can go through it themselves if they desire.

Research Methods and Methodology

Once I had finished my data collection and had time to reflect on the process of planning and carrying it out, I was reminded of all the hiking trips I had planned and taken. The key to hiking is being prepared for everything. Nothing is more dangerous than being miles from help and finding yourself in need of something. At the same time you have to acknowledge that everything you bring must be transportable on either your back or the back of a fellow hiker. I found planning my research much like planning for one of my hiking trips. I did not know what I would need and did not want to be left without or wanting, so I planned to the best of my ability for every eventuality. Now that I am finished I find myself in a situation resembling the end of one of my hiking trips, looking into my pack and wondering, did I really need that?

This question can only be [afforded ?] those who have completed the journey, knowing where they have been, how they got there and what they did next. What follows is a description of where I have been, how I got there and what I did next.

At my request I was granted the opportunity to teach a Grade 12 Pre-Calculus in the first semester and a Grade 12 Consumer Mathematics in the second semester of the 2005-2006 school year. The description of my methodology below is written in chronological order.

I begin by describing two documents that I created about my own educational background and my beliefs and values. Next I describe the data collection in the Pre-Calculus class and follow that with a description of the data collection in the Consumer class.

Retrospective Data Gathering

During the first semester, before beginning my data collection with the Pre-Calculus class, I sat down and wrote out my Educational Autobiography (see Appendix A). I chose to write about those incidents I believed had a profound influence on me as a learner and an educator. At about the same time I began to write my educational Beliefs and Values Statement (Appendix B). I found this to be a challenging document to write because there are so many things that a teacher can claim to believe or value. What I wanted to identify were my core non-negotiable beliefs and values. To this end I chose to focus on three categories: teaching, learning, and the nature of mathematics.

While I wrote about the nature of mathematics I found that I kept running into contradictions with my other beliefs and values. I believe that all students can learn mathematics and I value the fact that the Province of Manitoba currently offers students three different levels of mathematics to accommodate their varying learning strengths. The contradiction was, I did not believe that much of what my Consumer Mathematics students did counted as mathematics. I bristled at even writing this statement but it was true. If I did not consider what these students learned in class as “mathematics,” how could I turn around and say that I valued what they were learning as “mathematics,” when I really considered what they were learning “arithmetic”?

I needed to find a way to resolve this contradiction. What had to shift was my view of the nature of mathematics so that what I was teaching in the Consumer classes would fit. My repositioning of what comprised “mathematics” was not profound in and of itself; however, I believe that it caused a major paradigm shift in my approach to teaching all levels.

Pre-Calculus Data Gathering

My Grade 12 Pre-Calculus class was large; the first day of class I had over 30 students on my register. The challenge with this course is to be both welcoming and honest and upfront regarding the challenges this course has to offer. By November 2005, I felt I had established enough rapport with the Pre-Calculus class that it was time to introduce them to my research topic and ask for their assistance. Students who agreed to help would allow me to use their journal writing and if they wished they could participate in a final recorded interview.

Initially I planned on having a third party make this introduction for me. However, due to the nature of my study I chose to do the introduction myself. I was the person would be asking the questions, collecting the data and writing the thesis. I was the one they had been in class with from the start of the semester. This was a chance for me to model what it meant to be a lifelong learner for my students. Having a third party introduce the study would have been artificial.

I was also unsure about a third party’s ability to answer any of the questions the students may have asked.

A week later I had seven students willing to participate, six girls and one boy. Once a volunteer identified himself or herself I spoke to them in class and reinforced the idea that their course work came first; if an extra journal entry could not be completed right away or at all, that was okay. Along with the two journal entries already completed by the entire class, I gave my volunteers three new journal entries to complete over the next weeks. (A complete list of the questions is included in Appendix C.) Two of the students submitted all five entries, two submitted four and the other three submitted two of the questions.

I chose to collect my data during the unit dealing with permutations and combinations, a unit students either understand or struggle with. I like this unit because for a student to be successful they have to abandon their mechanical view of mathematics, even if for just a little while. I tell my students that it would be impossible to prepare them for every type of question. What I can do is teach them how to read these questions and what structures to look for. This unit ran from December 7 until December 19, 2005. While I was teaching the unit I kept a daily journal about the students and my teaching. This journal gave me a chance to sit and reflect on what happened that day in class, why it happened and what my next steps would be.

Once the course was completed and the new semester was under way I approached the seven volunteers from first semester about sitting down for a few minutes and talking about that semester and the journals they wrote. Of the seven participants, three agreed to meet me at lunch or during their spare to be interviewed.

The interviews took place in the first two weeks of April. Each interview lasted between 5 and 10 minutes. My purpose in interviewing the students was to try to extract more details from the students about what they wrote to me in their journal entries. I did not go into the interviews with a set of scripted questions but derived my questions from their writings. In hindsight, this may be the one thing that I would change about the way I did my research. I found the students needed more prompting to talk, especially when the topic was me and my teaching. The course was over and the grades were set but I was still “Mr. Hirst,” their math teacher, making it difficult for them to talk about what they thought and felt about the way I taught the class. I also got the sense this was the first time they were ever asked to talk with a teacher about how a class was taught or managed.

Consumer Data Gathering

In semester 2 I taught Grade 12 Consumer Mathematics. This class was smaller than the Pre-Calculus class, starting out with 24 students. This was an excellent group of individuals; they had lots of personality and energy and were never shy about being themselves. This group was a mixture of successful students and those who struggled educationally. For the first time I introduced a mathematics course as a course in communication, a direct result of writing my Beliefs and Values Statement. I told the student that one of our focuses this year would be to learn how to read, write, and communicate mathematically. My hope was that this idea of communication could create a foundation for all of us to talk about the “mathematics” that we would do in class.

I was hesitant to proceed in this manner because I was afraid that I would be skewing or biasing my data. This was not how I usually taught a Consumer Mathematics course. On the other hand, I was now convinced that by using communication as a common ground I could move closer to overcoming my own reservations about the content in the course. I chose to make this change in my teaching because I believed it would improve my teaching of the course and the students and this had to come before my research.

In April of the second semester I introduced my research to the students. This group of students was very receptive to the idea and 11 students responded that they would be willing to allow me to use their writing and participate in additional journaling for the purpose of my research. Although I stressed to the class during the introduction that their participation would have no effect on their academic status in the class, I do feel that some of the volunteers agreed to help hoping that by participating they would make points with me. Again I told each of my volunteers that their class work must come first and that the extra journals were to be done when they had the time. Only one of the students submitted all the journal entries, three submitted five entries, five submitted four entries and the other two students submitted three or fewer.

I chose the Consumer unit Variations and Formulas because it was the most like a Pre-Calculus unit. It was in this unit that I felt I was most at risk of acting like a Pre-Calculus teacher. As in my Pre-Calculus course I kept a working journal as I taught. Three of my students agreed to sit down and about their writing after the final exam in June. With this group of students I came into the interviews with a few more "scripted" questions.

I still tried to allow the majority of the questions to come from the students' own writing.

Data Not Gathered

As I proceeded in my research I came to the realization that there would come a moment when I would have to choose if I was the researcher or the teacher. I committed myself to choose to be the teacher; this was my purpose for being in the classroom.

Although at times I struggled with this choice I feel that it was the option that offered my identity the most integrity. This meant that there were some questions that I left unasked and avenues left un-pursued. This is a challenge for those who would choose to undertake a self-study.

There was at least one other instance where data was not gathered and the reason had nothing and everything to do with what role I was playing. I originally intended to look at my actions in the two different mathematics classrooms by examining the artifacts that I created as I taught: course outlines, test, assignments, and lesson plans. This data was not gathered, and with respect to the lesson plans was never created. As a teacher I have moved away from detailed lesson plans as I grow increasingly comfortable with my subject and my craft. As such, when I began to teach the selected units in each course I did not create lesson plans, I simply taught the way that I always do. I realize now that as much as anything this is a commentary on who I am as a teacher. To behave in any other manner would not have been authentic. As the teacher I am satisfied with the lessons that I delivered and the learning opportunities that I offered.

However, as a researcher I have left a stone unturned. Perhaps I should have been more intentional in my data gathering and produced these documents so that I could compare and contrast them. As a researcher I must now determine to what extent this lack of data will affect my ability to complete my research and answer the questions that I started with.

Helms' model of identity is comprised of four components, deliberate actions being one of them. The data that I did not collect was intended to speak to my actions in the classroom. This was not the only data that I intended to use to examine my actions. Student writing and my teaching journals were also intended to focus at least in part on my actions. I feel that I am still able to include this aspect of the Helms (1998) model in my analysis. This is important since I believe as Helms does that each component is influenced by and influences the other components in the model. If I had to exclude one of the aspects of the model, I believe my ability to identify and understand the tensions that I experience in a Consumer classroom would have been weakened. I believe that my understanding of my actions in each classroom would have been enhanced by the missing data but I do not feel that it was of a critical nature to my study.

Data Analysis

Once all of the data had been collected I began to transcribe the students' interviews and enter their journals into a Word document. Once the data was in digital form it was easier to navigate through it and create multiple forms of it with specific purposes in mind. The Helms (1998) model of identity provided me with the framework I needed as I read the students' writings and interviews.

I created codes that reflected the writer's voice (Pre-Calculus student) and the dimension of Helms' concept of identity (deliberate actions) that their words related to. I selected only the portions of the texts I felt had relevance with respect to the Helms model.

I went through the same process with my own journals. Once all of the documents were read and I had removed any unnecessary sentences I went back over each, classifying the remaining statements as belonging to one or more of the four elements of the Helms model: beliefs and values, actions, expectations or future sense of self, and society.

As I read each document I made comments in bold behind certain phrases or comments made by the students. These memos helped in my classifications of the data and in the sifting process later on. The memos were also helpful when reading the data in order to process my thinking about them. Each time I chose to omit a sentence because I did not see its relevance to my thesis I was altering the data. Although I am comfortable with the work done, each time I chose to remove a statement I was perhaps biasing the data.

The next step in this process was to combine all of the Consumer students' data and all of the Pre-Calculus students' data. When combining the data I chose to separate the statements that pertained to students from the statements that spoke about me as teacher. Thus for each of the two groups of students I had two new combined documents labelled "Students' Perspectives" and "Teacher's Perspectives." As I went through this process I was careful to keep each individual's data together. By this point in the analysis I had decided that I would need to focus as much of my attention on who the students were as I would on who I was.

Once I had all of the Consumer and Pre-Calculus students' data together I further refined my original labels for each of the remaining statements.

I now had four groups of like statements, two pertaining to who I was as the teacher and two pertaining to who the students were. Each group had four subcategories related to the four aspects of identity as set out by Helms (1998). When I was finished I had 32 documents. Each document was specific to the way in which the data was collected, journal or interview, and each document focused on one aspect of the Helms model of identity: values and beliefs, actions, expectations or future sense of self and society.

This was a massive amount of data that would have been physically difficult to maintain and sift through. I chose to combine the Consumer and Pre-Calculus data in such a way that I could keep them separate and still place them in one document. I did this by creating documents laid out in landscape format split down the middle with the Consumer data on the left and the Pre-Calculus data on the right. These new documents were given labels such as *Students' Journals: Teacher Perspective & Actions*, meaning that this data was from students' writings and it focused on my actions as the teacher in the classroom.

I reread each of the new documents and attempted to further code the statements. I found this difficult to do but valuable to my thinking and reflecting process. I found that each of my remaining statements was being coded multiple times. After further refining my codes I tried again, and again I found that I coded the same statement multiple times. In the end I did not use these additional codes or labels directly and did not recode every document.

I did determine that I would use this data and synthesize it into four documents, each one examining one of the four “players” in the research: Pre-Calculus students, Pre-Calculus teacher, Consumer students and Consumer teacher.

I wrote each of these new documents working hard to stay close to the data and not editorialize. Whenever possible I tried to use the student’s or my own words. During this process I intentionally did not refer to my Educational Autobiography or my Beliefs and Values statement. I was afraid that if I referred back to these documents, my analysis of the data would be affected and I would inadvertently steer my conclusions in a direction that might suit my purposes. This was an intentional choice on my part to try to limit the biasing effects that my multiple roles in the process have on the data.

While I was finishing the analysis and synthesis described above, I contacted a friend, colleague, and fellow graduate student I have known for a number of years. She knew about my research and agreed to act as my critical friend.

I sent her copies of my Educational Autobiography, Beliefs and Values Statement and my personal journals written during the data collection. In December 2006 my critical friend and I met to discuss her views and thoughts on the information she was given. This proved to be an invaluable conversation; she was able to highlight aspects of the data to which I had not previously attended and in some cases had neglected due to my proximity to it. After our conversation I wrote a summary about the issues that we discussed and worked to further develop some of the ideas arising from that meeting.

I have discovered that a self-study has the potential of becoming a black box. A black box is any device or set of activities where there is input and output but the whys and hows of the processes involved in creating the output are obscured from view.

At every stage in this research I have tried to be open and transparent about the decisions that I made and why I made them. Chapters 1 and 2 served as input chapters; they explored my question and the ideas surrounding those questions.

In chapter 3 I have discussed how I planned to conduct the data gathering stages of my research. I then explain how the actual data collection occurred. In some instances what I planned to do and what I actually did were not the same. In chapter 4 you will see many different pieces of the data from my students, me, and my critical friend. I have attempted to fit all of these different voices together to create composites of the people involved in this process, namely my students and me. Looking ahead, chapter 5 is the output chapter; there I will reveal what conclusions I have arrived at about my identity, the tensions that existed, as well as my conclusions about this process.

CHAPTER 4

Data Interpretations

In this chapter I will present my analysis of the collected data (teacher and student journals and interviews) alongside the retrospective data (my Educational Autobiography and Beliefs and Values Statement). It was this data that I used to answer the central questions of this thesis: What are the tensions and the processes that a teacher must go through to change his or her identity as he/she enters and engages in different courses with different students? In this study who I am (identity) is connected to who I am with, my students. This chapter is written chronologically. I begin discussing the process of writing my Educational Autobiography (Appendix A) and Beliefs and Values Statement (Appendix B). I then share with the readers descriptions of who my students and I were in each of the two different mathematics classrooms. Finally, I have included the summary that I wrote after the conversation with my critical friend.

Retrospective Data Generation

The first two sets of data—my Educational Autobiography and my Beliefs and Values Statement—were completely self-created. They relied on no outside objective source. I was the only author of this data. I created these documents based on the reading and research that I had done. Palmer (1998), Connelly and Clandinin (1999), and Goleman (1992) support the use of personal histories (such as my Educational Autobiography) as valid sources of data for teachers and others to be used in research.

Helms' (1998) model of identity was my scaffolding for the entire process of writing my Beliefs and Values Statement, and she places beliefs and values at the centre of her identity paradigm.

These first two documents were highly personalized and very subjective. However, since I am the subject of this research, I believed that these were completely appropriate places to start. The process of writing my Educational Autobiography (Appendix A) and my Beliefs and Values Statement (Appendix B) turned out to be more than data generation. As I wrote these two documents I was constantly reflecting and analyzing their ideas and concepts. In terms of the processes involved I compare the writing of these two documents to tilling the ground in the spring. Before a crop can be planted, nurtured, and harvested, the ground must be prepared. I view the creation of these two documents as preparing my mind for the future data gathering, analysis and the conversations that I would have with my critical friend. While writing my Beliefs and Values Statement I was confronted with an inconsistency that I could not ignore, and the resolution of that inconsistency has had a lasting effect on this research and my teaching. I have included both of these documents in the appendices of this thesis and I encourage the reader to visit them.

Analysis of Data

The next five sections of this chapter analyze data collected from personal and student writing during the course of my research. This chapter is written in chronological order starting with the Pre-Calculus data, then the Consumer data, and ending with my

critical friend summary. I have continued to use the identity paradigm laid out by Helms (1998) while describing these students.

Helms identifies four components of identity: values and beliefs, deliberate actions, others' expectations, and future sense of self and society.

When I first began to question the reality of my teaching different courses and the difficulties that I experienced moving from a Pre-Calculus classroom to a Consumer classroom, I purposely chose to focus on myself. I did this for the simple reason that I have no control over who walks through my door at the beginning of each semester. In the back of my mind I always knew that those who joined me in the classroom had a profound effect on how my identity was expressed while I was with them. It is for this reason that I have created what I regard as composite sketches of my students and myself in the different course settings. As much as possible I have tried to use the students' words to describe themselves and me. Like all composites these are incomplete and imperfect, but it is my hope that by examining these sketches I will be able to better understand who I am with them and why I find the Consumer Mathematics class so frustrating.

Pre-calculus: Student Sketch

In the classic children's book about the little train that could, the little train makes it up the hill, all the while saying to himself "I think I can, I think I can." How important to the train was it that he thought he could? I believe that for many students this is more than half the battle. Pre-Calculus students appear to have won this battle.

Many of the students that I interview and corresponded with reported positive feelings towards mathematics as a subject and towards their ability to handle the course material. Amy writes early on in her journaling “I know how important this course is. This is why I have to give that extra 10% that doesn’t come from natural ability.” What confidence she displays in this statement, that 90% of her success in this course will come from natural ability. Pam echoes these sentiments when talking about her choice of mathematics courses: “To be honest I knew that I was capable of this course.” Again, a confident statement made by a student who has never failed to reach the top of the hill. This confidence, however, has its limits and even these students have their doubts.

Knowing or believing that you are capable of accomplishing a task does not make it happen. Many of the students who responded in my study acknowledged the importance of hard work in order to be successful. These students seem to possess not only the belief that they are capable but also the understanding that to fulfill that potential they must work for it. Michelle may have put it best when she said, “I probably (definitely) haven’t put in the required amount of effort to achieve my full potential.” What I love about this statement is not the admission of not working hard enough but rather the acknowledgement that she could do better by working more. Other students spoke about the amount of work they did outside of class in order to do well. “You need to take it [class work] out of class and do it at least an hour a day and that was hard for most of us but if you did you would do excellent in this course” (Tanya). In one interview Pam put it plainly: “If you want to be here then you’re going to work hard.” Another student put it this way: “In order to survive in this course, you have to be motivated to do well; you cannot be lazy and skip classes” (Treva).

Treva definitely saw the need to work hard but she brings in two other characteristics that are central to the Pre-Calculus student: attendance and motivation.

Most would agree that it is very difficult to learn the material presented in class if you are not in class. A number of times in my conversations and writings with the students this idea of being in class and being focused came up. When asked what was the most important thing for a Pre-Calculus student to do, Pam wrote, "The first most important thing is to show up to class, each day on time." Other students spoke about the importance of just "being there and being up to date" (Todd). Every year in my Pre-Calculus classes, however, there are a few students who seem to feel that they are entitled to a number of days out of class while the rest of their peers attend regularly. Each year there are also a few parents who seem to feel that it's okay for their son or daughter to miss class for a hunting trip or family vacation. Many of the individuals I have spoken to have the notion that work can be handed out to the students ahead of time (or when they return) and can be handed in later to be marked. Unfortunately, this line of thinking eliminates the students' interactions with their teacher and classmates and the effect that these interactions have on learning. It has been my experience that it is the rare student who is able to catch up and not have their absence affect their learning, let alone their marks.

Equally as unfortunate is the belief held by some that students in a classroom will learn just by proximity. As long as the students are going to class they will learn, regardless of what they do in the class. A few of my students mentioned this during our correspondence. "There were a lot of students who liked to talk a lot about things that weren't relevant to the course" (Nicole).

Another student put it much more succinctly: “You definitely know who are the people who really want to be here and the people that didn’t” (Pam). In my own writing I often noted my difficulties with students in class not working or not trying to learn the material.

“I find that 2/3 of the class is really trying while I go over these problems and talk about the ways to approach a problem and ways to ensure you are on the right track. The others seem to be biding their time until the class is over. I wish I knew what that 1/3 of the class want or if they want anything at all. I certainly don’t think they are in the right mathematics course if all they want is to sit and watch a clock” (December 12, 2005).

Motivation at its most base level is what drives us to act or not act in a certain way in certain situations. Without exception every Pre-Calculus student that I interviewed or corresponded with for this study spoke often about the tests and the exam. The motivation for the vast majority of these students appeared to be only their marks. Very few students made any direct or indirect reference to learning for the sake of learning. Only two times in all of the interviews or journals did a student comment on learning that was not connected to or immediately followed up by a comment on getting good marks or graduation. Amy made the comment “I felt as though I learned a minimum amount of material . . . [that] puts me in a bad mood for the rest of the day” (Amy does not reveal why this puts her in a bad mood). Todd observed that “by the end of this course I will have learnt a lot of math skills that I hadn’t had in S1.” The rest of the comments surrounding learning were made with reference to the marks that the student received or were hoping to receive on the tests, assignments, quizzes, and the exam. Michelle went as far saying “without tests I don’t think anyone would do the work.”

This extreme focus on the end result, the mark, seems to have two by-products. First, students in this course display high levels of anxiety surrounding any type of assessment where they lack the opportunity to control certain elements like time and resources (test, quizzes, and the exam). Pam put this into words when she wrote "I often freeze on tests because I get so nervous, an assignment would be less pressure and I can do it to the best of my ability." Twice during the year I had good hard-working students leave tests blank or almost blank and I know that on at least one of those occasions that student knew her material; the anxiety over the test was so great that she could not perform. It is interesting to juxtapose this with the confidence that they expressed in their own ability. Students often spoke or wrote about this. Michelle wrote, "I was extremely paranoid after the last test that we had on Circular Functions." Nicole said, "I would increase the number of take-home assignments, while decreasing the worth of tests." Pam said, "I was so concerned about doing good I ended up just freaking out and not finishing it all." When given the option to do away with tests all of the student who responded refused to do so, claiming they needed to practise for the exam. "Tests are still important to have, as they both test our skill and prepare us for the final exam" (Nicole). It seems the fear surrounding test writing is eclipsed only by the fear of writing a final exam.

Second, and perhaps more insidious in terms of its far-reaching implications, is that the students who focus so much attention on marks seem to lose sight of the bigger picture, learning. In my December 14, 2005 journal entry I commented, "The 'hunger' to learn seems to be nonexistent with these students, yet their desire to do well is in your face."

I believe that many of these students see mathematics and perhaps school in general as a system of gaining enough points to be permitted into the next level. This desire to do well, not learn well, often seemed to drive these students to expect extra help outside of class. "We should have math help at lunch" (Michelle). Treva writes, "We [students] need the opportunity to get extra help from teachers and guidance on questions." These tutoring sessions were less about clearing up uncertainties and more about helping the students with their daily homework. This seemed to create a dependency on me, where little to no work could get done unless I was there to answer questions. I believe this is what Tanya meant when she wrote about her desire for more in-class assignments: "[We should] do more class assignments, for both a chance at more marks and more help because the teacher is there." Pam alluded to this in her interview when she spoke about the importance of the teacher "giving us the answers to questions and seeing all the work so that we can see if we worked through it properly."

I found that during these help sessions students were constantly probing for exactly what kind of questions were going to be on the test. Many times they would come right out and ask, "Is this question going to be on the test?" Many students wrote to me expressing their desire to have review classes prior to every test. "I feel that a review in class before every test would help out a lot" (Amy). All of this extra work outside of class did not mean that the students were learning more; rather, I would argue they were practicing how to do well on my tests. For these students, learning and understanding the material is equated with getting good marks.

There are many successful Pre-Calculus students who do not understand the material being presented to them. These students learn to rely on their ability to memorize routines and to recognize cues in questions and visual patterns to prompt them to start these routines. For example, on one test this last semester I used both (x) and θ to represent an unknown angle. After the test one of my students wrote, "On tests keep the same terms $\cos \theta$ or $\cos(x)$." The student was unable to answer a question because she could not recognize the θ as serving the same purpose as the (x) . This student who could not see that (x) and θ were the same thing had very little conceptual understanding of what she was doing. This was not an isolated problem. Another student wrote, "The out of school class/work assignments are more difficult because many of the questions aren't anything like the ones in class" (Amy). Students are looking for a finite number of question types that they can memorize and "spit" back on their tests. Michelle made this point clear when she wrote, "I think that we should get a review booklet for the types of questions that you will give us on a test." On one occasion I was trying to explain why we take a certain step in a problem and the student exclaimed, "I don't want to understand, Mr. Hirst, I just want to do it."

Why would students put themselves through this kind of rigorous mathematics course if they did not intend to learn the material? A few students spoke about their desire to be "challenged" by taking a course like this. For the majority, however, Grade 12 Pre-Calculus was a means to an end. "I will know [that Pre-Calculus was the right choice for me] when I receive my letter of acceptance into the university field of study that I want" (Nicole). "I chose precalc in S2 because I believe I will need it if I decide to take engineering" (Todd).

“[I took Pre-Calc because] I have always known that medicine was the career that I wanted to pursue” (Pam). Some students, like Tanya and Nicole, did not have a final academic goal in mind when they signed up for 20S Pre-Calculus. All they knew was that “Pre-Calculus is a course that opens many doors for future opportunities (Tanya), and “I heard that a lot of universities didn’t accept, . . . didn’t let you in to certain courses if they didn’t have pre-calc and that is not something that I wanted to run into” (Nicole).

To bring this discussion back to the framework that Helms has provided for us, who are the students who take Pre-Calculus at Murdoch Mackay? Murdoch’s Pre-Calculus students have experienced success in past mathematics courses and they believe that they are capable of learning and succeeding in Grade 12 Pre-Calculus. For the most part these students believe and understand that in order to do well you must show up to class and participate in the learning. You must also take work outside of class and study hard. These students value the affirmation that their marks in mathematics bring them. I believe that they see their marks as the end prize and not as a tool or an indicator of a much more important goal, learning.

Since marks are given such importance, many of these students experience high levels of anxiety associated with their success in the classroom. This anxiety is most often expressed in relation to tests and exams in the class. However, the anxiety over performance and getting it right also manifests itself in student behaviors in the class on a daily level. Many students will not participate in discussions unless they are certain that they know the right answers; they see no value in getting it wrong.

This overemphasis on marks creates the expectation that their teacher will be there for them whenever they need extra help. More than this, I believe many of the students see it as part of the teacher's job to make sure that they do well in the course.

These are students who are looking ahead, looking towards careers and future learning. For the majority of these students Grade 12 Pre-Calculus is a necessary step towards getting to their final vocational destination.

Pre-Calculus: Teacher Sketch

It is my experience that the days are gone when homework could be assigned and the majority of the students would have it completed for the next class. This does not mean that work outside of class is not expected. From the data that I collected I think it was quite clear that as a Pre-Calculus teacher I expected quite a lot of work to be done outside of class. "At the beginning of the year I told this class that to be successful in this course would require a commitment of 30-45 minutes a night on homework" (teacher journal, December 14, 2005). This expectation was echoed back to me time and time again when students wrote about their ability to meet my expectation. "I didn't do enough honestly, but I just think that with my schedule it was kind of difficult spending that much time each day" (Nicole). "You need to take it out of class and do it at least an hour a day and that was hard for most of us to do but if you did you would do excellent in this course" (Pam).

Students are given a collection of question sets at the beginning of the year. After each lesson I highlight which of these question sets relate to the topics that we just discussed.

I do not assign these questions for homework. Answers and solutions to these questions were provided, but these questions were not checked for completion the next day in class.

I realize that many of my students work part time at night and I expect them to find time to finish the course work before the test. "I always stress the need to do lots and lots of questions and in the past even my busiest students have found the time in their own lives to get the questions done" (teacher journal, December 14, 2005). I do not want to insist that work be done every night. This expectation is one of the reasons I do not work through the assigned question in class. In her journal on what she would change about the class if she could Pam wrote, "[It would be nice if] each day we could go over examples from our work books so we could see if the questions are being done right." I do, however, expect that students will come to me with their questions. I try to make myself available to my Pre-Calculus students as often as possible. This time, however, is only accessed by a minority of my students: "Sadly the only students who came to see me about this test were the five girls in the front of the room who are all doing very well." (teacher journal, December 14, 2005)

From reading my journals it is clear to me that I do expect these students to not only spend time outside of regular class hours working on questions but I also expect them to spend out-of-class time with me getting help. "I offer help but they always find reasons why they can't come" (teacher journal, December 13, 2005) or "We are 4 days into the unit and there are 5 exercises that have been assigned and not one student has come to me with a question about any of them" (teacher journal, December 13, 2005).

One of my expectations for these students is that they will learn not only the how but also the why of the mathematics being taught. It is this expectation that prompts me to try to get my students to explain the mathematics they are doing. "I asked all of the students to explain to me what the fundamental counting principle was in their own words" (teacher journal, December 7, 2005).

It is important that these students understand the mathematics they are doing. "I tried to make the connection between the theorem and the examples that we were doing" (teacher journal, December 8, 2005). This is one of the reasons why I place a theory question on each of my tests. I want them to be able to understand the mathematics, not just be able to do the mathematics. "I want to try and train them to think through a problem rather than just recite and rehearse methods taught to them by their teacher" (teacher journal, December 12, 2005). This expectation was challenged this year more than any other. Never has it been expressed so clearly as when one of my students exclaimed, "I don't want to understand, Mr. Hirst, I just want to do it." I wrote in my journal that night, "This is not just one student's opinion; I believe that this is how most of my students feel. If this is in fact true should I change my teaching focus, should we drill and practice over and over and never strive for understanding, is this what they really want, can I in good conscience do this? I am not sure that I have an answer for the first one but to the second question the answer is no, I could not do that" (teacher journal, December 15, 2005).

I believe that students need to be connected to the material that they are expected to learn. This is one of my biggest challenges in the Pre-Calculus classes for two reasons.

The first is curricular; much of the material in the Grade 12 Pre-Calculus course is far removed from anything that these student have encountered or ever will encounter outside of the mathematics classroom. This challenge can be overcome by giving the students opportunities to encounter the mathematics through problem solving. They need a chance to be challenged and have to think critically about the mathematics.

“Today was the beginning of the permutations and combinations unit. I wanted to give the students a small experience to get them started, I feel like without something like this the units seem to come out of nowhere and the kids have a hard time relating to what’s going on. I handed four playing cards to each student . . . and asked the class to choose three of their four cards, setting aside the fourth card. I wanted them to arrange the three cards they chose in a row on their desk. I then asked them how many different rows they could make with the same three cards” (teacher journal, December 7, 2005).

Many of these activities are teacher-led and require a great deal of class participation if they are going to bear any fruit and lead to a deeper understanding of the concepts that we are studying. I do not expect that these students will always come to the correct conclusions on their own. If they did, why would need me? But I do expect that they will try; above all else in my classroom I value students who are willing to try. Tanya echoed this sentiment as simply as possible when she wrote that “the most important thing for a student to do is keep trying.”

In every Pre-Calculus class, however, there are a minority of students (this group of students seems to be getting larger every year) who are resistant to trying anything that they do not think they will be successful at.

So often I will give out a challenging problem for the student to “play” around with and they sit and wait for me to do the question on the board. “I find that $\frac{2}{3}$ of the class is really trying while I go over these problems and talk about the ways to approach a problem and ways to ensure you are on the right track. The others seem to be biding their time until the class is over. I wish I knew what that $\frac{1}{3}$ of the class wanted, or if they want anything at all. I certainly don’t think they are in the right math course if all they want is to sit and watch a clock” (teacher journal, December 12, 2005).

If I assign the question for homework, they simply won’t do it—they won’t do anything. It is as if they have decided that if they do not believe that they can be successful at a task then they resist even trying. “So few students are willing to offer answers in class, I hate to see them shut down just because they don’t get the exact right answer the first time. I often tell them that they will learn more from their mistakes so don’t be afraid to make them” (teacher journal, December 19, 2005).

I have recently become aware through my student interviews and journals that I place a huge emphasis on the final provincial exam in this course. In my own journaling, the exam never comes up, but in my students’ writings and interviews it is often referenced. I believe that this repetition may be due in some part to my constant references to the exam in class. As I have thought about this I have become very aware of how I use the exam and its effects to motivate my students. By the time the course is over, my students are either already defeated or terrified of the exam. When asked about the exam one student replied, “It scared me more than anything.”

Another student commented about knowing that there was a provincial exam in the course, “It definitely killed me . . . I just froze cause I was so concerned about doing good I ended up just freaking out and not finishing it all.”

I am realizing that my main motivational strategy was fear, fear of poor grades, fear of poor preparation for university, fear of failing the exam. The assumption here is that these students are mark-motivated and the fear of failure or potential failure will be enough to get them to work and study. For a person who believes that he loves learning for the sake of learning it is interesting that this has become such an important strategy.

As I read what I have already written I am struck by the simplicity of what I see. I believe that students should work on mathematics outside of class. I expect them to come for extra help when they have questions.

I provide them with time outside of class to see me about the course. I value giving students experiences to help enrich their learning and I expect them to try to learn the material. I believe that students need to know more than what they are doing. I want them to know why they are doing what they are doing. Sadly, I expect them to be self-motivating and self-monitoring and I see fear as one of my best motivators to accomplish all of this.

Grade 12 Consumer: Student Sketch

If the Pre-Calculus students are the little trains that could, then the Consumer students by their own admission are the little trains that didn't think so, didn't want to try or were told not to. Every year during registration I have Grade 9 students come to me and ask me which of the three mathematics courses is the easiest.

As a teacher I have developed an involuntary response to the question that goes something like this: “Well, all of the math courses are difficult, in their own way, it just depends on what kind of learner you are and what you are interested in.” I also usually throw in something about university and not closing any doors (Pre-Calculus bias). The truth is that Consumer Mathematics is much easier than either of the other two options. There is less content, less work for the students and the material is far less complex. “The difficulty level in this course [Consumer Mathematics] is nothing compared to the Pre-Cal. Math” (Stacey).

It is designed to teach students the type of mathematical thinking that they will need to be competent in the “real world.” This is the reason Steve gave for taking Consumer Mathematics: “I knew I wasn’t going to pre-cal or applied math and with consumer you need it in everyday life and you don’t need pre-cal or applied.”

Another way of describing Consumer Mathematics would be that it is the mathematics course where those students who have been battered and bruised by mathematics their whole lives can find some respite. Melanie, who would be considered a strong Consumer student, said that she took Consumer because “I initially took Pre-Calculus but failed with a 10%.” Miranda, also a strong Consumer student, said, “I chose to take consumer mathematics in senior 2 because I knew that I wouldn’t be able to complete pre-calc or advanced.” Justin wrote, “I know I made the right choice because if I didn’t stick with consumer I would have failed any other math.” Aaron, an older student who struggled with mathematics, told me that in Grade 9 he was told “[that] he was not too good in math so they just said you should take consumer math.” Aaron adds, “I chose to take consumer math in S2 because I didn’t know how to do Applied math and

Pre-Calc, I just heard that the other stuff was a lot harder and it's really for the smarter people so I figured that" If I had to sum up what these students have told me and written to me over the year, I would say that the vast majority of my Consumer Mathematics students did not choose to take Consumer Mathematics or made their choice by default because they believed that they could not choose the other two options available to them.

When presented with this type of information as a teacher I have to ask, what is the motivation to work in class and to attempt to learn the material? I was presented with two very honest and striking answers repeatedly. One group of students saw June as their motivation: "I want to graduate and move on to bigger and better things" (Steve). Darlene told me repeatedly throughout the course that "this is a very important course for me to graduate." "The most important thing for a student is to graduate from high school" (Aaron). These students made no mention of goals after graduation, they did not talk about preparing for university or college or even the work force. For these students finishing high school was the goal and this course was an obstacle that stood between them and their goal.

This group of students often spoke about or wrote about doing their work, handing things in on time, because it would lead them toward getting good grades and graduating. When asked what the value was in doing the work that was assigned, these students reported that "the value I see by doing the work is better marks and a higher grade." Justin told me that for him the value in doing the assignment was to help him "practice for the test, quiz and exam." Both Darlene and Miranda spoke about doing the work because it "helps us understand more."

These students are reporting that they saw the value in doing the work that was assigned. The truth was that in one unit, I counted all of the work that had been assigned compared to the work actually done, and the average number of questions completed by the students was 7.5 out of 65. The only conclusion that I can draw from this is that while the students acknowledge the value of doing the work in theory, they do not follow through in practice. This may have been a case of telling the teacher what they thought he wanted to hear.

The second group of students did not report that they saw any value in doing the work assigned. "I chose not to do them [the assignment] because they don't interest me enough" (Roby). Drew was even more forthcoming in her statements: "I see very little value in working on my assignments, over the years I have found that I really don't learn anything from doing the assignments. The only reason I do some assignments is for the mark value." Mark told me, "I don't see any value because I'm honestly too lazy in class and I do not take it home to work on. I'm sure it's extremely valuable if you do the work, I'm just not motivated." In both cases it was apparent that work was not being done outside of class. In one of my journal entries I wrote, "It quickly became apparent that many of my students did not study. In fact many of them were surprised when I handed out the tests. It was as if the weekend had erased their memory of what was to come (teacher journal, May 23, 2006).

There was one exception to both of the groups. Justin reported that "I do find value in my work. I like to see myself getting good marks on assignments. It makes me feel good when I get tests back that have high marks." Justin did not always complete all of his work but he always did enough to make sure he understood the concepts and did do

well on the tests. One attitude or worry that was completely absent from this group of students was any notion of anxiety over tests or the final exam. Students did not talk or write about being nervous for tests or exams. There was no evidence that the exam created any nervous energy that was adaptively used to help prepare for the exam.

Few students made any direct reference to the in-class environment. Stacey, who was in my Pre-Calculus class first semester and my Consumer class second semester, had this observation: "I liked the atmosphere better in Pre-Calculus because everyone was there to learn and not just because they had to be there. In consumer lots of people were talking and it did not really seem like they wanted to be there and they weren't paying attention that much." In my own writing I often complained about the lack of work and effort on the part of the students in class. "The class was less focused than I had hoped, one girl in the back was on a cell phone and two other students were sleeping in the back corner" (teacher journal, May 8, 2006).

In another journal entry I wrote, "It's interesting that my consumer mathematics students complain and complain about taking notes in class and then never reference their notes when working on assignments or studying for tests" (teacher journal, May 15, 2006). Once the notes were finished in class many of my students would close their books and wait for class to be over. They did not make efficient or effective use of the time they were given to practice the materials that we were studying. When given time to work in class, "the majority of them [students] will choose to do other things, talk, sleep, text message."

One of the most interesting observations that I have made about my consumer students is that when they do choose to engage, they ask good questions but they seem to be incapable of staying with the process to hear the answer. I believe the inability stems from one of two places. First, they lack the patience or desire to attend to the answer: "I have come to the realization that in this class (consumer course in general) the students often ask good questions about the nature of the topic that we are studying, however, they do not have the patience to listen to or explore the answer, they are looking for a yes/no/do-it-this-way solution" (teacher journal, May 16, 2006).

When asked, my students told me that they believed that it was the teacher's job to make them understand the material. "The most important thing for a consumer math teacher is to make sure that students understand the material and change different methods of teaching" (Roby). Another perspective offered was, "The most important thing for a teacher is to teach the curriculum and help the students pass the course" (Aaron). There were many more statements like these; on the surface they all seem to indicate that the students want the teacher to help them learn and understand. However, many of the statements imply that it is the teacher's job to "make them learn" or "help them pass." There are a lot of expectations placed on the teacher while little is expected of them.

The second reason that I believe these students have such difficulty in class attending to answers and lessons is that many of them lack even the most fundamental mathematics skills. Very few of the students can operate without a calculator, even for the most basic mathematic operations. Beyond simple computation there is a general lack of understanding, especially when it comes to the language and symbols used in

mathematics. “I expressed the volume in cm’s cubed (cm^3); more than one student thought that the 3 above the cm meant that the entire volume quantity must be cubed first” (teacher journal, May 18, 2006). “After a few minutes I realized that some of the students did not know how to use the equation (formula)” (teacher journal, May 9, 2006). In one case I was working with one of my more dedicated students at lunch and we were looking at the expression $1200 = P(1.02)^{12}$ and she said, “I know that I am supposed to do something with the floating 12 but I just don’t know what it is” (Treva).

By saying the “floating 12” this student reveals that she lacks the technical vocabulary to even talk about the problem with me; I can only imagine what it would be like to hear me explain something on the board when words like *exponent* and *coefficient* mean nothing to them. This does not mean that these students are not capable of “doing math,” they just do not use a proper vocabulary. On one test students were responsible for making a formula and then using the formula to find an answer. “Many of the students had difficulty putting the formula together; however, when it came to calculating the answer many got the answer correct despite an incorrect formula.”

These students lacked the ability to communicate mathematically but they were able to calculate the correct answer. In another session with a student I asked her how she came to an answer and she proclaimed in frustration, “I don’t know how I did this, I just used common sense” (Sarah).

What then do these students expect from me as their teacher? Many of the students wrote to me explaining that they believed it was my job to make the material understandable and to help them focus. “The most important thing for a teacher to do is to make sure that students understand the material” (Roby).

“The most important thing for a teacher to do is to get the kids to pay attention” (Melanie). “Explain the question good and if they ask questions about it just explain it differently, make sure the kids understand it” (Steve). There were a number of statements like these, all very passive from the students’ perspective. It was as if they believed that if the teacher was good enough then they would learn without any actions on their part. A few students wrote about the need for the teacher to know what he was doing: “If the teacher has good knowledge of what they are teaching it is easier to learn” (Melanie), again a passive stance from the student.

More than once in their writing the students told me that they needed a teacher who would hold them accountable, keep them on task. When asked about due dates, Aaron spoke in the interviews about his need for them so that he could organize his life to get the work done on time. Miranda wrote about the need for structure when she said, “The most important thing for a teacher is to teach and be strict with the students.” In the next sentence she contradicts herself by saying, “but let them [students] do what they do if they don’t want to work then it is useless to push too hard.”

I think this is an excellent example of what the students need versus what they want. They need a teacher who will hold them to their task but they do not want a teacher who will “force” them to work if they do not want to work.

As I have already touched on the topic of student expectations surrounding my role in their learning process, I would like to address a much more surprising theme that appeared from the students I corresponded with throughout the semester. In many of the students’ journals and interviews the importance of the student–teacher relationship came up.

“This math is a lot easier than I thought it would be . . . maybe I am just trying harder and I like the teacher better now” (Miranda). Another student commented, “My consumer math experience depends on the teacher” (Aaron). In another interview a student was talking about why he was doing well in the course and he ended with “I think because you’re a good teacher and I think because you’re my old basketball coach, that kind of helped too” (Aaron). In one interview I asked Steve how he would describe my teaching style and he instead talked about how much he “liked me better” than his past teachers. This was especially palpable when the students spoke about how they felt about the class.

It was as if their relationship with the teacher determined how well they did in the class. “Be there because you want to be there not because you have to” (Aaron). When I read this I hear a student saying we want a teacher who is engaged and gives us a reason to care. I would argue that it is not uncommon for students to like teachers who teach classes that they do well in. Aaron’s statement appeared to be somewhat of the reverse—if I like the teacher then I will do better in his class. This attitude did not present itself in my Pre-Calculus class.

I cannot finish this analysis without commenting on Mark. Mark may be every teacher’s poster child for Consumer Mathematics. He is a nice boy who is great to converse with but has no interest in working hard or trying in your class. He admits that he is lazy and unmotivated and that these are the reasons he fails classes. In class Mark has no problem speaking up and participating and has often brought good ideas to class for discussion. Mark showed that he had some aptitude for mathematical reasoning but no desire to be pushed. I am singling out Mark because he seems to have displayed the attitudes that I believe many of my students held but did not exhibit. In late May, just

before getting ready for the final exam procedures, I called Mark over to a computer to show him what work he had not handed in and what his mark would look like if he would just finish the work that he owed me. Mark laughed (nervous, deflective) and said he was not sure if he could get all the work done. I offered him help outside of class, still no commitment. Finally I asked Mark if he had any desire to pass the course, and he could or would not answer. I asked Mark, "Do you want to pass?" No response. Finally I asked Mark to repeat after me: "I want to pass math." Again nothing! Mark's refusal to answer my question was indicative of his approach to the class.

Mark quit coming to my class a few days later and did not complete the course or graduate. Mark often would tell me that he was just too lazy to complete an assignment or try the class activities. I believe that Mark was too afraid of what would come next; I believe that he opted to fail and stay in high school where he was secure. I certainly do not think all of my students are as extreme as Mark but he may not be as uncommon as one would think.

Consumer Mathematics: Teacher Sketch

"My question remains, do these kids need to change to be successful in math or is there a method of teaching the mathematics that will bring this math to the kids in a way that they can and will learn?" (teacher journal, May 25, 2006).

When you read through my journals from the Pre-Calculus and Consumer Mathematics classes there is something in the Consumer journals that is not in the Pre-Calculus journals . . . doubt. I find that as I read through the journals to write this piece I am confronted with many entries that express my uncertainty regarding my actions and

beliefs in the classroom. In some entries it is as if I am of two minds, at conflict with each other. Other times I seem certain that what I am doing is correct, only to contradict myself later. At times I can hear the traditionalist in me screaming “No! These kids are lazy and uninterested and they lack the one most important characteristic needed to learn, desire.” This statement more than any other in any of my other writings sums up what I believe about these students. The beliefs expressed in this statement echo through all of my actions and expectations for and of these students. I find that in many situations what I espouse as a belief is not reflected in what I do or expect.

I believe that students must be able to connect with the mathematics on some level before they can understand it. I try to provide these connections through questions and problems posed in class. What I found was that as long as I was engaging them in the problem they would “play along” but when I left them to work on the problem on their own they would become disconnected, stop trying or give up. “I am at a loss, what do I do? Do I teach the entire time and keep them engaged in teach-lead examples for the whole class or let them work and accept the fact that the majority of them will choose to do other things; talk, sleep, text message” (teacher journal, May 12, 2006)”. If I can engage them in teacher-led discussions and exercises for the entire class, then why do anything else? The reason that I want them working on their own is that too many students sit passively and wait for the next answer to show up on the board. They never “make” the mathematics their own, they never strive to understand.

I believe that students need to understand the mathematics that they are studying, not just at a working level but at a conceptual level. While I truly believe this I often treat the mathematics in the class as if it were a set of steps to follow to get a desired outcome,

like baking a cake. "I try and approach this type of exercise with as formulaic an approach as possible" (teacher journal, May 16, 2006). "I explained to the class that many times we are provided with the rules or steps to find the answer. We just need to know how to use them properly" (teacher journal, May 18, 2006). In another journal entry I complain that these students do not recognize that "math at this level is basically a skill-based course, you must practice to get better, to get understanding." I have not totally abandoned my belief in understanding but I have relegated it to the back of the bus. I am quite sure that from these students I would be very pleased with right answers without right understanding.

I am even more troubled by the fact that I often bypassed opportunities for learning by not exposing these students to the mathematics. In the vast majority of these situations I did so through rationalizing my actions by saying that I was helping them by not making the class too rigid and mathematical.

"I am very intentionally trying to stay away from any math vocabulary that I would typically use when teaching this topic in the Grade 10 Pre-Calculus course" (teacher journal, May 8, 2006). At times in my own writing I question these methods and their motivations. "I wonder if I am robbing them of an opportunity to do some real problem solving/thinking, and am I just adding to their belief that math is a set of unrelated, abstract steps to follow to generate an answer that has no anchor in real life." "I did not even use the "real" when I told them that they will be replacing [the variables] with numbers, I don't want them to get confused by the word "real" (is that fair to them???)" (teacher journal, May 16, 2006).

This belief that these students do not want to learn or are incapable of learning the mathematics at a deep level carries through to my assessment of them as well. For this class I modeled their tests on the work assigned in class. Never have I given tests that so closely resembled the work done in class. Typically “in other courses I like to split my questions 70/30, 70 percent familiar questions and 30 percent new questions” (teacher journal, May 24, 2006).

As I read through these journals and the writings from my students I keep wondering, who is in charge in this classroom? If I believe that students need to practice the mathematics that they are learning on their own as a way to facilitate their understanding, then why do I not insist that this is done? It is my classroom. I can enforce the rules, can I not? Not once in any of my journal entries do I write about removing students for not working. What I do read is comment after comment that sounds like I have surrendered to the fact that these students just will not or cannot do the work. “I had one girl on a cell phone and two sleeping in the back of the room, so much for engagement” (teacher journal, May 8, 2006). Two of my students—one from the Pre-Calculus class (Stacey), who I taught in the first semester, and an older student (Aaron) who needed the course to graduate—commented on my in-class demeanor. Aaron told me to “not be so lenient on you know the other kids when there is a due date.” Stacey said that I “was a little bit more lenient on things, I was more relaxed.”

There is another voice that I hear, quieter, less aggressive. It says these kids want to learn, they want to do well but we (the education system) have failed them, we have not given them the tools they need to be successful. I know that they want to do well and that they feel good when they do.

“I do find value in my work. I like to see myself getting good marks on assignments” (Justin, student journals). The sad truth is that many of these students have not mastered even the most basic mathematics skills with any level of proficiency. “If I were an outsider, a parent or a community member I would be questioning the math education these students have received over the last 12 years of their lives” (teacher journal, May 15, 2006).

Since I know and accept this as the reality, when I am teaching I try to give my students the most thorough explanation possible. I try never to assume that they understand even the most basic concepts. I often found, however, that I had assumed too much.

“I would say that a third of the class was unsure where to place the “x” value and another third did not know what to do once they put the “x” into the equation” (teacher journal, May 9, 2006). I quickly realized that if these students were going to have any chance of understanding the concepts then I would have to abandon my desire to use formal mathematical language. I found that these students were willing to talk about the mathematics. They just lacked the proper vocabulary and did not want to discuss anything abstract like x’s. They did not seem to be held back by the fear of being wrong. More than once I had students debating with me about the way to do a problem. Usually I was trying to move them toward more formal mathematics and they wanted to stay with their “common sense” approaches. This soon became my most effective teaching strategy, having the class discuss the mathematics in their own words. “I had the entire class graph the values that we were given and from the pictures determine what type of variation we had.

This exercise went well on the whole; that class did well producing the graphs and could easily pick out the inverse variation graph; Roby (often disengaged) was able to explain the difference between an indirect and a direct variation graph. We generate a list of characteristics for each type of graph” (teacher journal, May 15, 2006).

The challenge for me was to then take those discussions and translate them into notes for these students. The students, however, seemed to appreciate the work we did in class together. “I like it better because you’re more hands-on, like you teach it really good, you explain it better . . . and you’re just easier to understand” (Steve, student interview). Aaron also seemed to appreciate the in-class work: “You do the work and I can write notes and stuff and I can actually study that.”

In my Consumer Mathematics classroom I do not believe that students will work on mathematics outside of class. I do not expect them to see me outside or inside of class time for extra help. I want to give students experiences to help enrich their learning and I know that they will discuss the mathematics with me in class, but I am convinced that they lack the prior knowledge to translate those experiences into mathematical understanding. I am not sure that I believe what these students are studying is mathematics and not just glorified arithmetic. I believe that students should know more than just how to do the question but I will only give them the “how to version” because I do not think that they can handle the rest. I do not expect them to be self-motivating and self-monitoring.

Conversations With a Critical Friend

The purpose of a critical friend is to help see the data differently, and this is especially important since I am the main source of data. It is crucial that I make every attempt to look at who I am objectively; this is hard to do from inside my own head. My critical friend, Anne, is someone I have known for a number of years and who has agreed to help shine lights on the parts of my Beliefs and Values Statement that I perhaps have not acknowledged, either because I am unwilling or unable to. What follows is a summary of the key points from a conversation that I had with Anne.

When I stand in front of a class (Pre-Calculus and Consumer) I often wonder, What is wrong with these kids? Why do they not care about their grades? Why do they seem so uninterested in learning? Why do they run from a challenge rather than rise to the occasion? Where is their passion for learning? Why are they not more like . . . *me*?

When I think about my students in the classes that I teach, Anne suggested that I was knowingly or unknowingly comparing them to who I perceive I was as a student. I say *perceive* because, as Anne pointed out, my perception of who I was as a student is not necessarily the reality of who I was. I agree with her and after some thought and reflection on our discussion, I think I have been looking back at who I was as a learner and as a student through a number of different filters which have altered the reality and presented me with a different and altered perception.

- Filter 1: Achievement. I am and always have been motivated by performance and achievement. An endeavor was successful if the end result lived up to my or others' expectations. If an outcome was successful, then the process by which it came about must also have been successful. Hence, since I was successful in school, then as a student I must have acted in ways to make me successful.
- Filter 2: My high school peers. The students I attended classes with were successful, so they also possessed the qualities necessary to become successful, and were not like those I currently teach.
- Filter 3: My job. I am a teacher. I see a wide spectrum of students with a variety of personalities and abilities. As part of my job I am responsible for reporting on what they have and have not learned.
- Filter 4: My current love of learning. There are few things that I enjoy more than learning something new.

I do not believe that any of these filters are unhealthy or harmful in any way, but are they accurate? I was challenged by Anne to look at each more closely and objectively.

In our discussions we began to unpack many of the issues around these filters.

What follows is a compilation of the discussion that Anne and I had and my own analysis of the filters.

Filter 1: Achievement

As a student I was academically very successful. I graduated with an average just over 93%, I was voted the valedictorian of my class, I captained the varsity basketball team, I was accepted early to the faculty of my choosing at the school of my choosing . . . success, success, success. One of the fallacies that I have perhaps fallen into is that all of this success must have come about because I as a student or person possessed all of the qualities that a good student or person possesses and therefore I created my own success. If you ask me to make a list of all of the qualities of a good student it might look something like this: hard-working, determined, curious, prepared to learn, not afraid to be challenged, rises to the occasion when challenged. All qualities that I, as a 30-year-old teacher, believe good students possess, all qualities that I believe that I possessed as a student and wonder why my current students do not.

Was I hard-working? Yes. Was this a quality that I naturally possessed? No. I learned to work hard from my parents; I learned to work hard from Frank (see Appendix A). I worked hard because there was a payoff of good grades and approval. Hard work was not an innate quality; it was something that I was taught to do. Was I curious? No more than any other high school student. Was I determined? I was willing to rise to a challenge. This is the one quality that I find so lacking in my students—when they run into a difficult problem or find the course material difficult, they quit. I cannot understand this. I never quit, or did I?

In my autobiography I spoke about my Grade 5 science test and how poorly I did and the effect on my grade in that subject. The poor grade was certainly not acceptable in my family and at that age I do not believe that I would have considered quitting.

However, that was a watershed moment for me as a student. It was from that point on that I really began to study for my test. I do not recall giving school a whole lot of effort before then. Back up for a moment and think about what I just said: did I as 10-year-old have the skills necessary to change my behaviors and learn how to study? No. I had parents who were educated and cared about me and were able to teach me how to study and persisted in training me in study habits through junior high and into high school. Much of my preparation to learn has to be credited to my parents.

Fast-forward to Grade 11 advanced mathematics. I failed two quizzes. By that time I had been taught how to study and I was still not doing well. I thought I needed to get out of that course. Determination? When I ask my teacher about this, he encouraged me to stay the course and prescribed more home study and then followed through by checking with me that it was being done. Not included in the autobiography was my attempt to drop first year physics because I had failed the mid-term with 40% after studying. I only stayed in the course because the professor told me that the curve would bring my mark up to an acceptable level.

In the past I have used many of these examples to contrast who I was to who I see in front of me in the desks every day. Previously I would have ascribed my success to qualities that I already possessed but with each example there was an outside influence preparing me, supporting me, encouraging me. Also in each of the examples, the outcome that I sought was attainable.

Let me offer a counterexample to further illustrate the point. As I mentioned in my autobiography (Appendix A) I had a Grade 8 teacher who once confronted me about my poor spelling. I could pass all of the spelling tests.

What I seemed unable to do was retain any of the correct spelling in my day-to-day work. I knew that I was a poor speller and here was a teacher directly confronting me, with this fact saying that I should really do something about it. Did I change? Did I go out and seek help for my spelling? No, I was doing well in school. I was achieving. Spelling could not be that important. In this example, outside of the talk at his desk, there was no other help offered and I did nothing on my own to try to fix the situation. Why would I? I was a 13-year-old student left on my own to fix a problem that I did not know how to fix. So I did nothing, exactly what many of my students do every day in my classroom.

I have been blessed in my life to have others who have supported and encouraged my education. In the midst of this I have attributed much of my personal success to myself without the acknowledgement of the outside help. As a teacher I do not know what type of help and encouragement my students are getting when they leave my classroom. All I can do is try to be helpful and offer as much encouragement when they are with me as feasible. I can no longer look at my current students and wonder what is wrong with them, why they cannot be more like me. The truth is that perhaps they are. This, however, does not account for all of the rest of the students that I attended classes with in high school.

Filter 2: My high school peers

The students I attended classes with were very much like me, good students. I am lucky enough to still be close friends with my high school classmates and know their families well. More to the point, I am still friends with those people whom I was in advanced courses with.

We were an island in the school, remote, removed from what was perhaps a more realistic perspective.

As I look at my friends from those days, all have gone on to be successful in some way in their chosen fields. Not all have gone on to school but most have obtained multiple degrees from universities and colleges. They have also achieved at high levels, so like me they must also have been good students who shared my good qualities. These experiences only serve to reinforce my previous belief that I (we) were not like the kids today and something must be wrong with my current students. Perhaps, but were we the norm? No, in my high school there were close to 200 in my graduating class, but the group of students that I refer most to when I think back total about 28. As Anne suggested, this was my snapshot of high school but not the entire picture.

Filter 3: My job

In a given day I will interact with 75 to 120 students, just in the classroom. If I think back to whom I was surrounded by in high school and if I consider them to be the norm, then it is little wonder why I am so confounded by who I see in my classrooms year after year. As a teacher I move from class to class, from student to student. I do not have the luxury of teaching only highly motivated advanced students. The initial impetus for this whole project was the realization that I have trouble moving from a Pre-Calculus class to a Consumer class and maintaining who I believe I am as a teacher. A large part of that difficulty may lie in my mental image of who students were when I was a student and in my unfair comparison of my current students to that mental image.

Out of the 200 students that I graduated with, there were about 172 I do not think of when I think of students and what they should be like. As a teacher I spend the majority of my day with those 172 kids, and it is my job to help them learn.

Filter 4: My current love of learning

The final filter that I have identified is my current love of learning. I use the word *current* because it would be wrong to assume that I have always loved learning. In fact, for the majority of my academic career I did not love learning. I loved achievement and if I learned the material that was a bonus.

Here is one scenario that may help in this discussion. No question drives me crazier in class than “Is this going to be on the test?” I am upfront trying to teach these students the whys and hows of the mathematics that they are learning and all they want to know is “Will I be tested on this?” In F. J. Crosswhite’s presidential address to the National Council of Teachers of Mathematics he called these students “bottom line” learners: just tell me the bottom line, what do I have to know for the test and I will learn it. As a student in high school I did not love to learn for the sake of learning; I loved getting good grades and doing well on tests, as do many of my students. I was a bottom line learner. I became very good at determining what the bottom line would be so I would only focus attention on those things that I knew were going to be tested. I did not seek out new understanding for its own sake.

In many ways I believe that I was much like my current students, perhaps just a little more subtle. This attitude did change. I can clearly remember the day in university when I decided that I had to be in school not for the grades that I could obtain, but for the

learning that I could do. From that day on in my own education learning became paramount, followed closely by achievement. But the focus had shifted and I was more concerned that I understood the material and could make it fit with what I already knew than with the mark I got on the paper. It was this shift in thinking that ultimately drove me to choose to write this thesis. However, as I said, this was not always the case and I can no longer look at my students and wonder where their love of learning has gone.

Conclusion

The four filters that I have identified make it absolutely reasonable that I find some of my students so hard to teach. However, if I can acknowledge and remove the filters for a moment, how would my view change? I would have to admit that I was very much mark driven and not learning driven as a student. If I remove the filters then I have to acknowledge those other 172 students from high school. I have to admit that many of my graduating class were not like me and very much like those I teach. Finally and perhaps most importantly, when I think back to all of the successes that I had as a student, all the times that I overcame adversity, I have to attribute much of that success to those who surrounded me: my parents, my teachers, my fellow students. When I think back and say "I was not like that as a student," perhaps I was. I was fortunate enough to have the right external support to do what I did.

After my conversation with Anne I was left with a number of questions: By all accounts I was a good student; however, I did not possess any real passion for learning and certainly benefited from and needed external supports to be as successful as I was. Is it fair of me to expect so much from my students, both the good and the struggling, when

I do not know what type of external support they have? The answer is “yes and no.” I believe that it is crucial that I maintain high but fair standards for my students. I cannot accept the lowering of standards to give students and teachers a false sense of achievement. It is my job as the teacher to maintain the standards. However, I must now acknowledge that it is also my job to support these students as much as possible to help them achieve. Is it my job to convince them to try? Should I have to ask them to learn?

Must I entertain them to keep their attention long enough to teach them something? No. Since I became a teacher I have come to understand that to learn means to change. Change is a very personal thing and ultimately each individual must decide if they are willing to undergo that change, no matter how large or small it may be. To revisit my question above, should I have to ask them to change? No, but I should be able to give them a good reason why. Perhaps this is one of the reasons I have experienced so much difficulty with my Consumer students in the past. With all of my filters I saw no need to give them a reason for learning. But these students have been “rejected” by mathematics in the past and if anyone needs a reason to try it’s them. If this is true, then as a teacher I now believe I have a moral imperative to start to change the way I look at what I do in class. I need to make sure that I have provided them with enough external structure to support their learning. In a way this fits very well with what I believe about teaching mathematics. I am not teacher-centered, nor student-centered; I am subject-centered.

I believe in making the subject I teach the focus of my classroom; teachers and students should explore the subject of mathematics together. The only problem is I may have forgotten that I need to give my students a reason and support so that they can join

the exploration.

In this chapter I have tried to paint a picture of my students and me in the different contexts of the courses that we are engaged in. These different pictures combined to form a mural. In chapter 5 I step back from the mural and attempt to explain what it all means. I will present my findings from this research. I will identify the tensions that I was able to observe and name. I will speak to the issue of identity—my identity as a teacher and as a researcher.

I will also acknowledge those questions that still exist and the new ones created but not answered during this process.

CHAPTER 5

Conclusion

Why do I find it so difficult, uncomfortable, to transition into and teach Consumer Mathematics? This is the question that has driven my thesis from its inception. The process of researching and writing my thesis has generated an increasing number of new questions. What is the nature of mathematics in a high school classroom? Is it important for those who teach and learn mathematics to care about the subject's nature? What is identity in the classroom; can it be altered, should it be altered? Can a teacher study his or herself in their own classroom setting objectively? Can this research be of any use to others?

None of these questions have easy answers; perhaps they do not have just one answer. I do not have answers to many of these questions but as I tell my students you will never find an answer until you ask the question. Some of what I have learned from this thesis has helped to shine a light on these questions so that I may better understand them. What follows is my attempt at answering the question that started this whole journey. What tensions and processes must a teacher go through to change their identity as they enter and engage in different courses with different students?

The focus of this question is the tensions and processes; identity is the backdrop. Tensions are highly personal, they are mine alone. The tensions that I seek are not between me and my students or the curriculum. I have come to realize that the tensions that I seek are intrapersonal.

Other teachers may see aspects of the tensions that I describe in their own teaching; however, I do not believe that another teacher could take my tensions wholly and completely and claim them as their own. The processes are what I did to bring my tensions to the surface so that I could look at them, examine them and ultimately decide what to do with them. I believe that the path I took to reflect on my own teaching and the learning of my students may be examined and used to help other teachers seek answers to their own questions about teaching and learning.

Tensions

Questions have a way of piling up faster than you can find the answers to them. There are questions about the teaching and learning taking place in my classroom that I am beginning to recognize as existing solely based on the data that I collected. I have chosen only those that are relevant to the question at hand. In this thesis my identity has played an important role at every step and to a lesser extent so have the identities of my students. Throughout this entire process I have used Helms' (1998) identity paradigm which consists of four distinct components, all of which are interconnected: beliefs and values, deliberate actions, expectations, and a future sense of self and society. As I examine what I believe are the factors involved in creating the tensions that I experience when teaching in a Consumer Mathematics classroom, I will continue to use Helms' identity paradigm to frame my discussions.

Throughout my research I have been operating under the belief that my pre-research identity as a teacher and as a learner allowed me to "fit" better in a Pre-Calculus, academic mathematics classroom.

As I try to explain the tensions present when I teach a Consumer Mathematics course I will, when possible, use the contrast between my data from the Pre-Calculus students and from the Consumer students. My goal is to highlight the tensions, not resolve them; when and where I think I have come to a resolution I will share that.

When I began this process I expected to find a number of factors that I could describe as tensions that were hindering me from feeling fully self-actualized in the Consumer Mathematics classroom. I expected that my Pre-Calculus students would appear drastically different from my Consumer students, thus the students' characteristics could be pointed to as one of the tensions. This did not happen. In fact, in many ways these two groups of students looked similar. In both sets of teacher journals I complain about students not doing enough work outside of class. Both classes had students who were often disengaged. In both classes I had students tell me that without my evaluative role as their teacher they probably would not do any of the work I had assigned. Both groups were mark-driven. Overall, there were perceptible differences between the two groups, just not as many as I had expected.

If the students were not that dissimilar, then where did the tensions that I felt come from? As I looked at my data I slowly realized that what I thought would be many separate factors may be one factor with many interconnected pieces. The tensions that I experience when teaching in a Consumer Mathematics classroom are the result of my own fundamental beliefs about the nature of teaching, learning, and mathematics.

In my Beliefs and Values Statement I explained that I have adopted a metaphor for teaching and learning from a line in Robert Frost's poem *The Secret*: "We dance around the ring and suppose, but the secret sits in the middle and knows."

The “we” are my students and I and the secret is the mathematics that we study. I count myself as one of the dancers and thereby remove myself from the expert role of the teacher that is present in so many teacher-centred models. When I chose to adopt this model I did so because I believed that it removed barriers between me, my students, and the subject that I teach. I do not believe that I was aware of the ripple effect that it would have on the other aspects of my role in the classroom. In this model I join the learners as a more experienced dancer and work to help facilitate their learning as they try to understand more and more about the secret (mathematics). After doing my research and thinking back over all of my past experiences in both the Consumer and Pre-Calculus classrooms it has become clear to me that this model of teaching fits far better with the curriculum and nature of my Pre-Calculus students than with a Consumer classroom.

Over and over again my students in the Pre-Calculus classroom affirmed the fact that they chose to be there. At the end of Grade 9, the Pre-Calculus students chose to enter this stream of mathematics. When asked why, the students responded with statements like: “I chose to take precalc in S2 because I believe I will need it if I decide to take engineering” (Todd), or “ Pre-Calculus is a course that opens many doors for future opportunities” (Tanya). These students were looking ahead and planning for their future; they had future expectations and they made a choice that would help them meet those expectations.

These are the students who have been successful in mathematics, who feel confident in their mathematical ability. This is familiar to me as it is very much the situation that I encountered as a student. Mathematics was not an obstacle for me in school, partly because I had aspirations that I knew would require me to take higher level

mathematics. In terms of identities I can relate to their future sense of themselves, I have been there as a student and as a teacher I want the same for them. Upon entering my classroom these students do not need to be convinced to join the dance—they just needed an opportunity.

After talking with my Consumer students and reading their journal entries I am not convinced that they had a choice when they agreed to take Consumer Mathematics. Saying they had a choice implies that there were other options open to these students. When asked why they chose Consumer Mathematics they told me: “If I didn’t stick with consumer I would have failed any other course” (Justin). “I initially took Pre-Calculus but failed with a 10% so I took consumer mathematics” (Melanie). “I chose to take Consumer Math in S2 because I didn’t know how to do the Applied math and Pre-Calculus, I just heard that the other stuff was a lot harder and it’s really for the smart people” (Aaron). Choosing to take a mathematics course because you failed another course or you believed that you could not complete the other options is not really making a choice. These students did not talk about future goals in the same way that my Pre-Calculus students did. I believe that these students come into the Consumer classroom feeling like they had no real alternative and they continue feeling that way until they graduate. These students, almost without exception, did not write about a future that involved further study of any kind.

My past experiences as a student and the filters that I uncovered during this process make it very difficult for me to relate to these students on this issue. As a teacher I believe in education and I believe that these students would be far better off in life if they pursued some form of postsecondary education.

My identity does not fit with these students' reality. It is my identity that causes me as a teacher to expect that my students should join me in my exploration of mathematics. I invite these students to join in the exploration as I do with the Pre-Calculus students. It is my Consumer students' reality that hinders their ability to join me. All things being equal these students lack the past experience and confidence that is so important if they are going to feel capable of joining me in that exploration. For many of my students mathematics is something that is done to them, not something that they have any control over. As their teacher I am expecting them to do something that they are not prepared to willingly do and so they do not participate in a manner that I find acceptable. My beliefs and expectations do not match with my students' experiences in mathematics.

What is it that keeps these students engaged in learning (dancing)? What is their motivation? In both the Consumer and Pre-Calculus course the answer appears to be the same, individual self-interest. In neither group was there any strong evidence that students were motivated to complete their assignments and study for tests because it was the right thing to do. Rather, both groups appear to be motivated chiefly by the grades they received on assignments, quizzes, and tests. Although their motivations appear to be similar they behave very differently. My Pre-Calculus students for the most part work hard to achieve the best mark possible. In contrast, my Consumer students appear to be less concerned with maximizing their personal achievement and more concerned with making sure that they have enough marks to get the credit. I would argue that this difference may in part be due to the students' apparently different future expectations for themselves.

As a student I was motivated by marks. I was one of those Pre-Calculus students who wanted to get the best grade I possibly could; it was the mark that mattered not the learning. It was not until well into my postsecondary education that I realized that what I learned while taking a course was far more important than the mark I received at the end of the course. I now view learning as a noble endeavor that should be undertaken because it is the right thing to do. The more time I spent in the classroom the more entrenched my filters became. I began to believe that as a student I strove for understanding and worked hard and persevered until I did understand. This understanding then produced the good grade that I achieved. This perception was not only faulty but, as I have found, it seems to have led to me positioning myself such that my Consumer students could never fit with what I viewed good students to be. I was completely unaware of this shift in perception until after I met with my critical friend and we began to look at my Educational Autobiography.

This new perception did not present a perceivable problem as long as I remained in a Pre-Calculus classroom. My Pre-Calculus students were motivated to do the best that they could and get the highest possible grade. They asked questions, came for extra help and worked hard to do well. As their teacher I interpreted this as a genuine interest in learning the material. Thus not only did these students fit well into my paradigm for teaching and learning, they fit my perceived personal history.

Any student in my Pre-Calculus class who did not fit this mould and who rejected my initial offers for assistance was quickly dismissed as “not a Pre-Calc kid.” The research done in my classroom agrees with this analysis; repeatedly my Pre-Calculus students spoke about the importance of doing well and getting high marks.

Their first priority was not the learning but the marks that they would receive by doing well. I got the sense that many of them did not care why they were doing what they were doing so long as it would get them the best mark possible. As their teacher I instinctively knew how to tap into this desire or need for high marks and I used it to motivate them to do better. I found myself making more and more comments like “Watch out—they [provincial markers] will take a mark away on the exam if you . . .” or “Make sure you focus on this for the next test.” I used their fear of not doing well to motivate them to study and seek extra help, which I gladly offered.

I feel that I need to comment on a statement I made in the last section. I did not realize until I was preparing this conclusion how often I had made remarks similar to “. . . is not a Pre-Calc kid.” If a student did not fit with my perception of how a good Pre-Calculus student should behave, then I dismissed him/her as being misplaced. What has struck me was how easily I have done this in the past in the Pre-Calculus classroom. If this is my solution to a student who does not fit my perception of what a good student should be, then what was I ever going to do in a Consumer classroom? At least in the Pre-Calculus classes there were two “lesser courses that those poor students could attempt.” When faced with a room full of Consumer students I could not as easily say “. . . is not a Consumer kid.” There is nowhere else for that student to go.

My past experiences and the perceptions of who I was as a learner have biased me toward the importance and value of the Pre-Calculus curriculum. I am uncomfortable with the fact that this is true, but it is. What I will do with this information and how I will come to resolve it remains to be seen.

It was not until I was asked to teach more Consumer Mathematics that my new perspective on learning in high school was challenged. In my Consumer Mathematics classrooms I found that many of the students did not want to work hard to achieve the best grade that they could. My Consumer students wanted to do only what was necessary to pass the course and move on. When asked what their learning goals for the course were, 7 of my 11 volunteers wrote that their goal was to pass the course so they could graduate. Only one of the 11 wrote about learning the mathematics that would be taught. Every student wrote about studying hard and asking lots of questions; however, rarely did a Consumer student ever come for extra help unless they were forced to by a parent or me. From my perspective these students were unmotivated and uninterested in learning. I have often joked that these students seem to view my class as a video game where if you collect enough points you get to go to the next level.

More than one of my Consumer students wrote about failing mathematics courses in the past; some failed numerous times in elementary and middle school and yet they were moved along. Most of them struggled with a very challenging Grade 9 curriculum and passed with the minimum score, some on their second attempt and some in summer school. These students did not display any of the characteristics that I believed a good student should possess.

Their actions in my classroom certainly did not convince me that they were interested in the learning apart from the need to pass the course. Some students, most notably Mark, seemed to do just about everything short of dropping the course to ensure that they would fail.

As I came to see from my research, my students were very pragmatic in their approach to what they chose to do and not do: “I [only] do some assignments for the marks” (Drew).

Trying to convince these students of the nobility in learning was misguided and in hindsight rather humorous. My main tool for motivation—fear—was now of little or no use. These students did not expect to get great grades; they expected to do poorly on tests and exams: “I am not very good with tests and exams so that sets me back in all of my courses” (Miranda). Many of my Grade 12 Consumer students would ask what mark they would need to have so that they could fail their exam and still pass the course. Their expectations were that they would do poorly on my exam. My fear tactics were futile. I wanted these students to engage with me in the mathematics and explore the subject; they wanted to survive.

It would be wrong to assume that since these students are not motivated by marks and seem to derive little satisfaction in learning for the sake of learning that they are unconcerned about their education. On the contrary, many of these students want to do well but they need other methods to help them feel that their efforts would be worthwhile. I was surprised during the course of my research how often teacher–student relationship seemed to be appearing in the Consumer student journal entries and interviews. It is no surprise that students will work harder and more diligently for a teacher that they like, that they have some relationship with other than strictly student–teacher.

I do not have sufficient evidence from my student data for me to be certain; however, five of my Consumer Mathematics students mentioned that who the teacher was to them was important to their ability to succeed in the classroom.

If Consumer Mathematics students are not mark-driven in the same way that Pre-Calculus students are, then perhaps the key to their motivation can be found on a more interpersonal level.

I have chosen to make mathematics the focus of my classroom. As I explain in my Beliefs and Values Statement, this does not take away from my role as the teacher or more importantly my students' roles as learners. I adopted this view to try to lessen the distance or ease one of the tensions between my students and me. In my Beliefs and Values Statement I made the claim that I value the choice that the Province of Manitoba gives students as to which type of mathematics they wish to study in Grades 10 through 12. As I wrote that, I was absolutely sure that this was a choice that I valued. I do not believe that all students should be required to study the same mathematics in high school. Part of this statement really caused me concern and led to what I felt to be an incongruence between two of my beliefs. While I am in favor of giving students options for all of the reason previously stated, I was not convinced that Consumer Mathematics was actually a mathematics course. I am still inclined to view the Consumer course more as a course about numeracy and how to use and relate to numbers in commonly encountered situations. I do not see the richness and complexity that I love about mathematics in this course.

In the past I have been guilty of attempting to make the mathematics in Consumer more complicated than it is intended to be, frustrating my students and ultimately myself. This was my attempt at maintaining my identity, a Pre-Calculus teacher in a Consumer classroom.

With mathematics being given such an important role in my classroom, and my belief that what I was required to teach was not really mathematics, two of my beliefs were in direct opposition to one another, creating tension.

I believe that mathematics is mankind's method for understanding a larger set of universal truths that exist completely independent of human thought or action. When we study the arc of a soccer ball after it is kicked we are able to create an equation to describe its motion. We can make predictions and base decisions on the information from that equation. I have a hard time reconciling this view of mathematics with what I am supposed to teach in the Consumer classroom. I feel that this is a very elitist view of what mathematics is. I have trouble admitting this is what I believe, but it is and it has a real effect on me when I am asked to teach Consumer Mathematics. Teaching students how to find the unit price of an item in a grocery store is important but somehow it did not make it into my definition of "mathematics." After all, where is the depth?

I do not believe that anyone is completely consistent in all of his or her beliefs and values; we are all to some extent walking contradictions. This being said, once I recognized the contradiction I had a choice: let it be or try to resolve it. To allow a contradiction to exist and not try to resolve it would speak to the integrity with which I was living my identity. This area was too important to just let it be. How can I authentically teach an entire course when I did not value the subject matter in the same way that I value other courses' subject matter? When I first named and confronted this contradiction I was in the middle of writing my Beliefs and Values Statement.

I recall sitting at my computer wondering what I was going to do. How I could honestly state one belief when I knew that I held another that seemed to be in direct contradiction was beyond me. After much thought and time I was able to reconcile these two beliefs with one word, "communication." In the example of the soccer ball being kicked I believe that we are using mathematics to communicate a universal law. What I needed to do was extend that idea of communication to cover all areas involving numbers.

This shift seems minor, almost not noteworthy, but it has had a major effect on my presentation and expectation in the classroom from Grade 9 through to Advanced Placement Calculus. Any time that we are using numbers for any purpose we need to be aware of the fact that we are communicating ideas to another person. Now I often talk to my classes about presenting their mathematics for an audience and making sure that what they are writing is clear to that audience. I believe that this shift will allow me to walk into a Consumer Mathematics classroom and teach the curriculum without making it more complicated to satisfy my need for something interesting to focus on. Instead I can work with the students to make sure that they are able to communicate their work effectively and efficiently. Now when I teach unit pricing, the depth that I once sought can be realized in the students' efforts to communicate the ideas well.

Tensions Summary

I began this thesis in the hopes of being able to identify and expose the tensions I was experiencing in the Consumer Mathematics classroom. It was naive of me to think that during this investigation I would be able to leave other areas of my teaching life

untouched. As I examine the tensions that I have just explained I am taken back by how little they have to do with just my Consumer students and their class.

As I tried to discover what was different about the Consumer classroom and its occupants from my Pre-Calculus students, I began to see more similarities than differences. Yes, there are distinct and important differences, but the tensions that I uncovered do not situate themselves easily in one classroom or the other. I have felt each of these tensions to some degree in both classrooms.

One tension cannot be claimed as exclusively belonging to the Consumer or Pre-Calculus classroom. It is also true that these tensions are not mutually exclusive; rather, they are connected and dynamic. In a way this process is very much like Heisenberg's Uncertainty Principle. In essence what Heisenberg said was that when "studying subatomic particles the process of observation itself changes the object being studied" (Brennan, 1992, p. 138). By identifying these tensions I have learned valuable lessons about myself as a learner and as a teacher and these have changed who I am, changed my identity. This makes the process of clearly naming each tension difficult. What follows is my effort to do just that—name each tension.

- **Paradigm tension:** My choice of teaching and learning paradigm from Palmer (1998) caused me to further align my identity as a teacher with students who choose to take Pre-Calculus. I believe this is due in part to my students' past experiences in school, especially mathematics. Pre-Calculus students enter my classroom more prepared to engage in my style of teaching and learning.

- Perception tension: Over time the facts and reality of who I was as a learner were shaped and molded by my experiences, forming perceptions of the past. Contributing to these perceptions was the presence of four filters (chapter 4, p. 108). These perceptions and filters caused me to position myself in such a way that it was very difficult for a Consumer student to match my definition of a good student.
- Motivational tension: Due in part to my past experiences as a learner and personality I use achievement as my chief motivational technique in the classroom. This is most evident and effective in the Pre-Calculus classroom. Students in the Pre-Calculus class are often also motivated to maximize their levels of achievement in the course; making my techniques somewhat effective. What I found was that my Consumer students, although concerned about marks and grades, are not motivated by achievement. These students do not expect to achieve at a high level in mathematics, so my constant focus on high level achievement is not effective with them.
- Nature of mathematics tension: My understanding and belief about the nature of mathematics plays an extremely important role in my approach to teaching in the classroom. The Consumer Mathematics curriculum did not match well with what I considered to be important mathematics. As a teacher I did not value the material that I was charged to teach.

After confronting this truth and working to shift my views on the nature of mathematics I am now able to find value in the curriculum and my teaching in the Consumer classroom.

Processes

As stated earlier, the purpose of this thesis is to examine the tensions and processes that a teacher must undergo to change his or her identity as he/she enters and engages in different courses with different students. I have attempted to shine some light on the tensions that I found to exist in my own teaching and interactions with my Consumer students.

Part of the thesis process is to present my research to others and have them reflect on and judge my work. I know that this process and the result that I have just discussed have had a profound effect on my teaching. I am confronted, though, with the question as to whether or not the research that I did and participated in is valid and of worth to others.

“Action research is a collaborative approach to research that provides people with means to take a systematic action in an effort to resolve specific problems” (Berg, 2001 p. 180). In my research I have tried to do just that, systematically look at a problem that I identified in my own teaching. Action research is complicated; there is a definite blurring of lines between subject and researcher. According to Berg this is inevitable since most action research is carried out with the intent of changing or improving the situation that initially inspired the research. Action research has four stages: identifying the research question, gathering the information to answer the question, analyzing and interpreting the information, and finally sharing the information with the participants.

Since I am the subject and author of my research my thesis is best described as a self-study, a label I embrace. I believe that my research belongs inside of action research. If I lacked anything it was the collaborative aspect. As educators we spend great portions of our working lives alone in classrooms with students. We have no means of peer evaluation and my experience with formal administrative evaluations leaves much to be desired. Our specific problems are just that, specific to us and our teaching. Teachers need to be able to look at their own teaching practices objectively and critically so as to make informed decisions on how to continue and improve their practice; this research is my attempt at this process.

I believe that teachers can and should collaborate with other educators and researchers whenever possible. Time, however, is the one constant that no teacher seems to be able to control; leaving our classrooms to work with outside researchers or other teachers is not always available to us, or in the best interest of our students. I believe that making use of critical friends and mentors is one powerful way to incorporate collaboration into research like mine. In the case of this research I was fortunate to have a critical friend who was able to provide me with excellent insight at just the right time in the process.

Process Summary

Earlier in this thesis I commented that I hoped that what I was doing could serve as a possible road map for others who were thinking about undertaking the same process. What follows is a brief description of that process.

As I was nearing the completion of my graduate work I began to search for a thesis topic. It would be almost a year before I was able to find a topic that I felt I could engage in wholeheartedly. It was during this year that I began to notice that I never felt truly comfortable in the Consumer classroom. I thought often about this problem and made several attempts to change aspects of what I did in the classroom but none had the effect I was looking for. Out of a desire to determine if my identity as a teacher was the issue in the Consumer Mathematic classroom I initiated this research.

Once my research question was realized I spent time reading and reflecting on some of the work done by other educators and researchers around the ideas of teacher research and identity: Connelly and Clandinin (1999), Palmer (1998), Blankstein (2004). I also attempted to predict what my research might look like and give these plans some theoretical underpinnings.

By far the most important part of my pre-research preparation was my search for a model of identity, which was ultimately provided by Helms (1998). Helms' model became the scaffolding that I needed to plan, carry out, and analyze my research.

I wrote my Beliefs and Values Statement before collecting any data from my students. I did this so that later when I looked back at all of my data I would know that the beliefs and values that I espoused were not influenced by the data that I was collecting. This was a deliberate attempt on my part to prevent any bias in my data. I intentionally chose not to create a Beliefs and Values Statement that was all-encompassing. Rather, I chose to focus on what I held as core beliefs in three areas: teaching, learning, and the nature of mathematics. My intention for writing these documents was to provide myself with a baseline, a pre-research foundation.

When you are working at a project that is so intimately connected to who you are and what you do on a daily basis it is impossible to keep your thoughts and beliefs about a subject or idea static.

Both of these documents proved to be valuable in the creation process and later as forms of data. I began with my Educational Autobiography and chose to focus on any incident that I could recall that involved my own learning. As pointed out by my critical friend, the autobiography document is really about both my current perception and my interpretation of my past. To this end one must admit that the document itself is rather biased. In my case the bias proved to be as useful to my research as did the factual historical portions.

What you believe is central to Helms' model of identity. As Connelly and Clandinin point out, what matters most to who you are in the classroom is not necessarily the reality of what happened to you in school as a student but what you believe happened to you and your interpretation of those events.

The second document that I created was my Beliefs and Values Statement. In writing this document I felt it important to try to identify what I believed and valued about teaching, learning, and the nature of mathematics. Outside the contexts of this research thesis I believe that a document like this one should change and be altered often as the teacher gains new and better understanding of who they are in relation to their craft. Since it is very possible that a document like this can become about everything and nothing at the same time, it is important to identify your core beliefs and values. By being intentionally selective you are in a way being forced to identify your non-negotiables. These are the beliefs and values that you most closely identify with.

For me it was important that this document be as internally consistent as possible. It was my attempt to maintain a sense of congruence that led to my greatest learning.

In my active research phase I used three different methods of generating data: personal journals, collecting student writing and student interviews. In educational circles the term “reflective practitioner” has made its rounds; underneath all of the jargon I believe there are some important principles for my profession. One of the simplest ways I believe that a teacher can be a reflective practitioner is to journal about their experiences in the classroom.

All of the research being done on student writing in the classroom and its benefits for learning can be related to teachers and the importance of writing for their own learning. In the short term, the journaling allowed me to reflect on the activities of the day and look ahead to the next lesson. I used it as a venue to think about issues that arose in the classroom that day. Often I would get ideas about my teaching methods just from writing in my journal. In the long term the journal provides you with a history of your thinking and actions in a classroom. Again, this is personal and will be biased, but over a few days or weeks you may notice patterns in your writing, focuses that you were not aware of.

In my research I very much wanted and needed to have data come from sources outside of myself. The most natural place to look for this data was my students. I asked both of my classes if they would be willing to volunteer to have their words and thoughts used in my writing. It was important that I reminded the students that their participation would not have any bearing on their place in my classroom. The students who volunteered were ultimately asked to write three additional journals for me about topics

that related directly to my research. I was conflicted about these extra journals; the teacher in me did not want my students to focus their energy on anything that was not going to be of benefit to them. The researcher in me had questions that I wanted answers to. In the end I believe the teacher in me won out. I would not feel comfortable asking students to write a journal unless I felt that there was the potential for their learning. In some instances, this limited the types of questions that I asked. I chose to conduct my interviews after the exams were completed.

In the interviews I was looking for information about who I was in the classroom. I wanted to avoid if possible any conflict, perceived or otherwise, surrounding the students' final grade in the courses. In each class I was able to sit down with three students and talk briefly about their perceptions of the course and my teaching. It was difficult for them to talk about me as a teacher, especially when it came to places where they found my teaching to be less than what they needed it to be. I realize that this type of questioning places the students in a very awkward position and as such I chose not to pursue the line of questioning if I felt the students were too uncomfortable. If I were to do this portion of the research again I believe that I would find a third party to conduct the interviews, perhaps my critical friend.

In many ways the role of critical friend is most important for a research project like this one. Admittedly there are biases that run throughout this research. I do not know that it is possible to be completely objective about oneself. By allowing a critical friend to interact with the data and comment on what they see, you are allowing those biases to be pointed out. In the case of my Educational Autobiography this is exactly what happened. I was unable to see a pattern that existed in my data.

With the help of my critical friend I was able to identify the pattern and through our conversations dissect it and ultimately learn from it. I do not think that in a self-study like this the author should concern him/herself with trying to identify every possible bias. Instead I believe that job is best left to the person who is assuming the role of critical friend; the researcher needs only to be open to the feedback they receive. This process will only work when and if there is mutual respect and trust between the researcher and the critical friend. This is not the type of relationship that can be artificially created nor can it be created overnight.

There are many different approaches to analyzing data like that created in my research. I chose to use coding, memoing, and sifting to extract the most critical aspects from each of the data sources. Much of my analysis consisted of repeatedly going over the data in search of patterns. Once I identified what I thought might be a pattern I tried where possible to confirm my hunch with other sources of data. Much of the analysis took place between what I would call formal analysis sessions. I often spent time reading over the data or reorganizing it in different ways, looking for patterns. Most of my productive thinking occurred once I had left the data for a day or so, while I was still thinking about what I had read but not looking directly at it.

Once my analysis was complete I began to try to formulate an answer to my research question. In more traditional research these conclusions are then judged based on a number of criteria; methods of collection, reliability of data, reproducibility, and to what extent the result can be generalized to similar situations. McMillan and Wergin (2002) put forward the idea that in action research the purpose is not necessarily to generalize to other situations, as is the goal in more traditional types of research. Rather,

the purpose of action research is to objectively look at a situation in such a way that you can inform future decision-making when faced with similar situations. The fact that my research provides me with insight is important but only to the extent that my claims are valid and reliable.

Stringer (1996) asserts that in action research validity should not be the end in mind but rather plausibility. Are the conclusions that have been made plausible, do they accommodate all of those involved in the research? I would argue that although I agree with Stringer there must be a sense that the conclusions are based on evidence gathered in a way that eliminates the possibility in a reader's mind that what they are reading is based purely on speculation and unfounded hypotheses. I have made every attempt throughout my research to be transparent about what I was doing and how I was doing it. When and where possible I have attempted to use multiple sources to confirm what I see as tensions present in my teaching in non-academic classrooms. I can say with full confidence that the tensions I have identified have given me much to think about and have already begun to affect how I teach and interact with all of my students, not just those in the Consumer classrooms.

Final Remarks

Each of the tensions I mentioned earlier in this chapter has brought me to a place where I must examine something about what I believe, what values I have inside and outside of the classroom, what I should expect from others, and more importantly, what I should not expect. In short, each tension has provided me an opportunity to shape my identity as an educator and a learner.

My intention was to identify the tensions that exist in the hope that perhaps I could alter my identity so as to become a better teacher for a specific group of students. After identifying the tensions I am not convinced that a change in identity is called for or recommended. In some ways I wish that I was able to give instructions from my research on how to alter who you are in the classroom to best suit the students that you are teaching.

If I were to give instruction like these I would be ignoring the immense complexities of classroom dynamics. In every classroom there are up to 30 unique identities that have to come together to work and learn and experience new ideas. I do not see how it is possible to alter who you are to accommodate all of these different relationships, not to mention those that exist between teacher and curriculum and students and curriculum.

So where does this leave me? As I look back at the definition of identity that I gave in chapter 3 (p. 50) I realize that my identity will never fit with all aspects of what I am expected to do in any given day. I now have a better understanding of the different aspect of identity as explained by Helms' (1998) model. I do not agree with Connelly and Clandinin's (1999) multiple stories if they are intentionally created and perpetuated. I agree with Palmer (1998) that our identities should be dynamic and adaptable as long as the changes that are being made maintain your identity's integrity (wholeness). By intentionally searching for answers regarding the cause of the tensions that I felt when in a Consumer classroom, I feel that I can enter into that environment having a better understanding of who I am and who my students are.

This new understanding will allow me to bring my identity to them so that I can remain integral and at the same time provide them with a more coherent and appropriate learning experience.

EPILOGUE

I worry about the young people we teach. For so many of them the influence of the teachers in their lives is lost among other social and societal influences. For teachers to reach our students we must learn who they are and who they want to become. We will have to look past their differences from us and ignore their looks of disinterest, for inside every student is a learner. It is only after we acknowledge the learner that we can connect with them and begin to adapt our interactions appropriately to aid them in their journey. This process of adaptation can only be sustained if as educators we ask hard questions about who we are and why we do what we do. If we are to teach with integrity then self-knowledge is crucial. We cannot wait for others to give us answers to problems in our classrooms. We as educators need to feel empowered to search for our own answers. I am not suggesting that teachers need to solve all of their own problems; this expectation would be furthering the isolation teachers already experience.

After working through my thesis, I see the role of critical friend as a way out of the isolation. I strongly recommend to educators committed to professional growth to build and nurture this type of relationship. I have benefited greatly from this experience as a teacher and as a thinker. I hope that what I have recorded in this thesis can be of some help to others as they ask and engage with difficult questions, searching for ways to be true to themselves and their students.

“You need only claim the events of your life to make yourself yours. When you truly possess all you have been and done . . . you are fierce with reality”.

Florida Scott Maxwell

(Quoted from Palmer, 1998, p. 29)

REFERENCES

- 12Manage, rigor and relevance in management. (n.d.) *Johari Window*. Retrieved June 2, 2007, from www.12manage.com/methodsluftinghamjohari_window.html
- Berg, L. B. (2001). *Qualitative research methods for the social sciences*. Needham Heights, MA: Allyn & Bacon.
- Brennan, P. R. (1992). *Dictionary of scientific literacy*. New York: John Wiley & Sons.
- Blankstein, A. M. (2004). *Failure is not an option: Six principles that guide student achievement in high-performing schools*. Thousand Oaks, CA: Corwin Press.
- Britzman, D. P. (1992). The terrible problem of knowing thyself? Toward a poststructural account of teacher identity. *Journal of Curriculum Theorizing*, 9(3), 23-46.
- Carpenter, J., Gorg, S., & Martin, W. G. (Eds.). (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.
- Chance, L., & Stewart, C. (1995). Making connections: Journal writing and the professional teaching standards. *The Mathematics Teacher*, 88(2), 92-95.

- Chapman, K. P. (1996). Journals: Pathways to thinking in second-year algebra. *The Mathematics Teacher*, 89(7), 588-590.
- Connelly, F. M., & Clandinin, J. D. (1999). *Shaping a professional identity: Stories of educational practice*. New York, Teachers College Press.
- Cooney, T. J., and Hersch, C. R. (Eds.). *Teaching and learning mathematics in the 1990s*. Reston, VA: National Council of Teachers of Mathematics, 1990.
- Crosswhite, J. F. (2007). Better teaching, better mathematics: Are they enough? *Mathematics Teacher*, 100(5), 312-314.
- Dobson, J. (2001). *Bringing up boys*. Wheaton, IL: Tyndale House.
- Friedman, L. T. (2005). *The world is flat, A brief history of the twenty-first century*. New York: Farrar, Straus and Giroux.
- Frost, R. (1942). *A witness tree*. New York: Henry Holt.
- Gaarder, J. (1996). *Sophie's World*. New York: Berkley Books.
- Goleman, D. (1992, May 12). Jurors hear evidence and turn it into stories. *New York Times*, pp C1, C11.

Helms, J. V. (1998). Science—and me: Subject matter and identity in secondary school science teachers. *Journal of Research in Science Teaching*, 35(7), 811-834.

Hill, S. A. (1989). *Everybody counts: A report to the nation on the future of mathematics education*. Washington, DC: National Academy Press.

Holly, M. L., Arhar, J., & Kasten, W. (2005). *Action research for teachers: Traveling the yellow brick road* (2nd ed.). Columbus, OH: Merrill Prentice Hall.

Lakoff, G. (1987). *Women, fire and dangerous things: What categories reveal about the mind*. Chicago: University of Chicago Press.

Lavigne, A. (2004). Retrieved, July 18, 2004, from <http://click2music.ca/avril/index.jsp>.

LeGere, A. (1991). Collaboration and writing in the mathematics classroom. *Mathematics Teacher*, March 1991, 166-171.

Manitoba Education and Training. (2000). *Senior 4 Consumer Mathematics: A Foundation for Implementation*. Winnipeg, MB: Author.

Manitoba Education and Training. (2000). *Senior 4 Pre-Calculus Mathematics: A Foundation for Implementation*. Winnipeg, MB: Author.

Mason, R. T., & McFeetors, J. P. (2002). Interactive writing in mathematics class:

Getting started. *Mathematics Teacher*, 95(7), 532-536.

McIntosh, M. (1991). No time for writing in your class? *Mathematics Teacher*,

September 1991, 423-433.

McGehe, C. A. (1991). Mathematics the write way: Writing in Mathematics class adds up

to success in my classroom—and it can work in yours, too. *Instructor*, April 1991, 36-38.

McMillan, J. H., & Wergin, J. F. (2002). *Understanding and evaluating educational*

research (2nd ed.). Columbus, OH: Merrill Prentice Hall.

Mighton, J. (2003). *The myth of ability: Nurturing mathematical talent in every child.*

Toronto: House of Anansi.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand

Oaks, CA: Sage.

Miller, D. (1991). Writing to learn mathematics. *Mathematics Teacher*, October 1991,

516-521.

Miller, D. (1992). Begin mathematics class with writing. *The Mathematics Teacher*, 85(5), 354-355.

Palmer, P. J. (1998). *The courage to teach: Exploring the inner landscape of a teacher's life*. San Francisco: Jossey-Bass.

Palmer, P. J., & Livsey, R. C. (1998). *The courage to teach: A guide for reflection and renewal*. San Francisco: Jossey-Bass.

Paulos, J. A. (1988). *Innumeracy: Mathematical illiteracy and its consequences*. New York: Vintage Books.

Pimm, D. J. (1987). *Speaking mathematically*. London: Routledge.

Pugalee, D. K. (1997). Connecting writing to the mathematics curriculum. *The Mathematics Teacher*, 90(4), 308-310.

Sergiovanni, T. J. (1992). *Moral leadership: Getting to the heart of school improvement*. San Francisco: Jossey-Bass.

Shakespeare, William. (1993). *William Shakespeare: The complete works*. Edited by Gramercy Books. Newark, NJ: Random House.

Swaffield, S. (2002). *Contextualizing the work of the critical friend*. Paper presented at the 15th International Congress for School Effectiveness and Improvement (ICSEI), Copenhagen. Retrieved May 28, 2007, from <http://www.educ.cam.ac.uk/ifi/ICSEI/swaffield.pdf>

Tillotson, G. (1996). *Writing across the curriculum*, Retrieved May 20, 2004, from <http://www.engl.niu.edu/wac/>.

Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, 72(2), 131-171.

Zimmerman, J. (Ed.). (1993). *State of the art: Transforming ideas for teaching and learning mathematics*. Washington, DC: U.S. Government Printing Office.

APPENDIX A

Educational Autobiography

Many educational theorists and most teachers with whom I have spoken agree that how a teacher experiences education as a student will have a real and lasting effect on how they teach. My purpose in writing this educational autobiography is to explore my past educational experiences.

I will not be commenting on social situations during my school years. I will instead focus on my memories of learning experiences. The majority of these experiences took place in a formal education setting; however, I will not exclude any learning experience that took place outside of school. For the purpose of this writing I will not edit out any memory or incident that fits the above criteria. I will refrain from adding any commentary as I write; rather, I will do my best to describe each incident in as much detail as possible.

The question of accuracy must be addressed when we rely on memory to write a piece such as this. In this instance I am going to assert that the accuracy of the memory is less important than the impact it has on me. In other words, how I remember the incident is more important than remembering it accurately. I make this claim based on my belief that we are influenced and act according to past experiences and if those experiences are stored in our memories, then the determining principle must be impact and not accuracy. When possible I will try to support my memories with artifacts from my education in early, middle and senior years. These artifacts will take the form of school report cards and anecdotal comments from teachers.

According to my mother, I told her on my first day of kindergarten that I would walk to school on my own, and so it began. There was never a time in my life when I questioned the importance of education. Both of my parents are university-educated and both hold graduate degrees in their chosen fields. Education was always held in very high regard in my family. My parents had high standards for both my brother and me. They did, however, differentiate between us, setting different expectations for each of us based on their perceptions of our ability and aptitude. I never questioned my plans after high school; university was the only option. I am not sure if this was self-imposed, peer-influenced or a by-product of living in my home. I do not even remember entertaining the idea of taking a year to travel or work after Grade 12.

In Grade 2 I encountered my first standards tests. I remember thinking it was “cool” because the teacher made such a big deal about the test and what kind of pencil we had to use to colour the little bubbles in. It must have been some type of diagnostic test to make sure that my classmates and I were on track or at grade level. This was the first time I had ever filled out a bubble sheet. The test had a number of parts; I liked the little stop signs at the end of each section telling us when to stop. I do not remember if I found the test easy or hard. I do remember my teacher’s reaction the next day. That night, after the test, my best friend and I worked on drawing some pirate ships. I was very proud of my drawing and could not wait to show my teacher. The next morning I went to show her my drawing and she was rather cross with me.

She told me that I did not finish my test from the day before and that I had to go and finish it—right now! Somehow I had left out an entire section of the test; this is the first memory I have of testing or of a teacher being upset with me over my work.

I can remember taking the paper back to my desk and finishing the rest of the question during *O Canada*. I have no idea why I left the questions blank in the first place. There does seem to be evidence that I was perhaps not the most conscientious student in my earlier years: "Often times, he [Andy] needed to be reminded of his carelessness and untidiness of work" (Mrs. Luchack's comments in my Grade 3 report card).

In Grade 5 I had my first male teacher. Mr. Hamilton was a tall man with grey hair and a very large personal presence. Mr. Hamilton was the most serious teacher I had to that point. Before we could go for recess we often had to line up and he would ask us a mathematics fact like 6×7 . If we got the right answer we could go for recess; if we got the answer wrong we were sent to the back of the line with a "better luck next time." He would often walk around the room and quiz the class on facts. He carried a steel pen and would tap us on the head if we got the wrong answer.

It was during Grade 5 that I received my one and only D, a mid-term mark based mostly on a test about astronomy. I do not remember getting the test back or even being upset about the mark until my parents saw the D on my report card. In my family, we often had family meetings, most of which were focused on the never-ending war between my brother and me. The night we brought our report cards home my parents sat my brother, who was in Grade 1, and me down for a talk. We never got prizes or paid for good grades. It was expected that we would do our best. I remember my parents talking about how they were disappointed not with us kids but with the grades that we had brought home. The message was clear: grades are important. It was about this time that my parents started to teach me how to study.

Every time I had a test I was to bring home my notes and they would help me make study cards or notes and then quiz me on my facts. My parents often knew more about the parts of a flower or the nitrogen cycle than I did. I remember spending what seemed like hours making the notes, reading them and being quizzed by whichever parent was home.

In my academic career, if there is one glaring omission in my education it is the ability to spell. Often I would memorize the words for the spelling test, spell it correctly on the test and then spell the same word three different ways on an assignment the very next day. "His weekly spelling test were good, but he often does not carry this over to his daily writing" (Mrs. Sims' comments on my Grade 2 report card). As I look through my old report cards there are numerous references to my troubles with spelling: "I would like to see Andy work on his day to day spelling," wrote Miss VanBerkel in Grade 4.

In Grade 8 we were in social studies working on a unit about Egypt when Mr. Colish called me to his desk. I remember the class being very loud and active as we were finishing our projects. My teacher showed me a vocabulary test or assignment on which I had as usual misspelled numerous words. Mr. Colish was the first teacher, to my memory, to ever tell me straight to my face that I needed to get help with my spelling. I was an A student at the time and had achieved exemptions on all of my junior high exams up to this point. I was convinced that spelling was not all that important!

As a teenager often does, I dismissed him quickly, telling him that I had never been able to spell, that I never would be able to spell and that I did not really care that I could not spell. At that time I wanted to be either an architect or an engineer and I did not need spelling for either of those careers.

Mr. Colish tried to explain to me that someday I would wish that I could spell better. There was no convincing me of this fact. I now find it remarkable that I do not remember him offering me any help with my spelling or setting me up with a resource teacher to work on my spelling.

Frank was a curmudgeon and I say this with great admiration. Frank was a World War II veteran who lost part of his left leg on D-Day while storming the beaches of Normandy. Frank was a member of my father's church congregation and for many years my first employer. Due to Frank's injury, Veterans Affairs paid me to shovel his snow and mow his lawn. It was a sweet job for a 14-year-old. I made \$15 each time I shovelled or mowed. Some winter months I made up to \$120.00 just shoveling his driveway. In all honesty, Frank drove me crazy; he used to sit and watch me work. Every time I missed something he would pound on the window and point to a section of snow he wanted moved or some grass that I did not trim closely enough. Often his pointing was accompanied by a rather large smile. He took great pleasure in being my foreman. In spite of all my frustration I will always remember what Frank told me one day. He said, "If you're going to do a job, do it right the first time." I am sure that Frank was not the first person to try to teach me this lesson. He was the first person to reinforce it with every pound on the window and every point of his cane. To this day when I feel like skipping steps to get a job done quickly, I think of Frank.

At the end of my Grade 9 year I was given the option of enrolling in a number of advanced courses. Most of my friends were enrolling so I chose to as well.

At the Grade 10 level the advanced courses offered were Science, Mathematics, and English. Due to my poor spelling and almost nonexistent grasp of grammatical rules,

I opted out of the English. I was especially excited about the Mathematics course with Dr. Grant. I had heard about him from older friends and I was looking forward to having him as my teacher. The first day of class we all filed into Dr. Grant's room with our binders and pencils ready for a challenging year. We filled up the empty seats in the classroom and waited for Dr. Grant to arrive. Moments before the class was to begin a new teacher, Mr. Shamanski, came into the room and announced that he was going to be teaching the advanced Grade 10 mathematics course and we were all to follow him to his room. I felt cheated and the rest of the class seemed to be feeling the same way. Who was this guy? Was he qualified to teach Advanced Mathematics? Needless to say it was a rough year for all of us, the teacher included.

I can remember when Mr. Shamanski first introduced rational functions. The class was lost and for whatever reason we were not following his explanations. I know that a number of my classmates went home to complain about him to their parents. I heard that a number of the parents called the school to complain. I am sure that I did my share of complaining to my parents; however, my parents were always strong supporters of school authority figures. Their response was not to call the school; instead, my mother and I sat at the kitchen table for hours working on rational functions together. My mother loves mathematics and I got the sense that she enjoyed all of the work we were doing. That year I remember writing a test for Mr. Shamanski that included a question that ended with division by zero.

The correct answer, therefore, was "error" or "undefined." A protest arose from the class that this was an unfair question and went on much longer than it should have. We were more and more convinced that this guy was a quack.

That year we wrote our final exam in June. I remember thinking that it was the most difficult exam that I had ever written. I remember sitting outside the classroom door waiting for him to mark the exams. As he finished marking each exam he would call us in and show us our marks. People kept going into the room and leaving upset, which resulted in the loss of several students from our Advanced Mathematics class. I passed the exam with a mark in the low 60s. My final mark was 80% and there was a 5% bump for all advanced courses. This was the first year that I remember having to work hard in mathematics class. This is also the only mark that I remember from that year of school. I am not sure how I would have fared without the help I had at home.

The next year we got Dr. Grant as our teacher. I was confident. I was one of the students who made it from last year. The curriculum in Grade 11 was different from now. I am not sure what topic we started with, perhaps trigonometry. I do remember that in the first three weeks we had two quizzes and I got 40% on both. The first time, I rationalized that it was a new class with a new teacher and I was just not prepared for the quiz. With the second 40%, I ran out of excuses. I was obviously in over my head. I can remember getting the second quiz back and thinking, "What am I doing in this class? Dr. Grant must be thinking the same thing." The day we got the second quiz back I stayed after class and told Dr. Grant that I did not think I could handle this class. I wondered if he thought I could drop his course and still get into a regular Grade 11 mathematics class.

I am not sure what his exact words were but the option of me dropping was quickly taken off the table. Dr. Grant started to ask me about my study habits. How did I take notes in class? What did I do when I had a question? I was told to go home, sit at the kitchen table and get to work.

Dr. Grant told me that he would keep an eye on me in class. I did what he said. I remember that year sitting at the dinning room table and doing question after question. Dr Grant kept up his end of the deal as well. I remember not too long after our conversation as we were moving through some class notes that Dr. Grant stopped to ask if there were any questions. As he waited to see if anyone would ask a question he looked directly at me and raised an eyebrow as if to ask, "Are you good?" I nodded and we continued. I doubt if anyone else in the class even noticed the interaction. I finished that year with a mark in the high 80s and a new sense of what it meant to work hard.

My Grade 11 English teacher seemed to have a strange way of marking. It did not seem to matter what students handed in, they always got the same mark. I can remember working on a set of questions with a friend of mine. When I say "working together," it was more like I did the homework and he copied my answers. We handed in identical answers. I got 8 out of 10 and he got 6 out of 10. It seemed to us that our marks in the class were dictated not by the quality of the assignment but on the merit of the first few assignments we handed in. So, if my first assignment was 80% that's what I seemed to receive on all of my assignments.

In Grade 11 I decided to take the regular chemistry class instead of the advanced class. What a class! The teacher mispronounced most of the students' names from the first day on. He gave notes by reading the textbook to us and if you got on his bad side you were doomed.

To be fair to the teacher, we were no picnic. What I remember most was wanting to do well in the class without being singled out by this teacher. This was impossible. I remember on one occasion, he asked me in front of the entire class if I understood a topic

we were studying. I said “yes” and the next thing I knew I was at the board explaining it to the entire class while he sat at his desk. I remember writing tests in that class for which the majority of us had access to a copy of both the test and the answers beforehand.

This teacher used the same tests year after year. He required us to hand-copy the test after we wrote it with the correct answers so that we could study for our exam. It was easy to find students in the school who had already taken the class and get a copy of each test. I knew about the copies but I tried my best not look at them before writing the test. Others in the class would study only the copies of the tests they could get, most of which were full of [imperfections? mistakes]. Rarely did anyone who had copies of these tests do all that well. I remember one instance when I had done well on a test. My friend had missed a question and was looking at my test to see what he had done wrong. Our answers were similar so my friend took his test up to the teacher and asked what he was missing. The teacher called me up to his desk with my test and compared our answers in front of us. He said, “If Mr. Hirst has it, it must be right.” My friend got his marks and I was again singled out.

After Grade 11 I was excited to go on to the Advanced Mathematics class in Grade 12. I do not remember the exact conflict but for some reason my course selections prevented me from taking Grade 12 Advanced Mathematics.

When Dr. Grant got wind of this he came to me and a handful of other students in the same position and offered to teach us Calculus at the same time he was teaching the second half of the Advanced Placement course. That second semester Dr. Grant taught the two courses at the same time in the same room. I think we had four students in the calculus half of the class.

The four of us sat in one row with an empty row between us and the AP class. Dr. Grant would start one class on one board and then move to a second board to start the other class. Class was very much "Do questions 1-40 on page 143." I became good at calculus mechanics but my understanding of the subject was almost nonexistent. I think this somehow reflects much of my early education.

"What do you want to do after high school?" was a question that we as Grade 12 students were hearing more and more as our final year came to a close. On one particular day it was our English teacher asking us and as usual I had my answer all ready. I was going to the University of Manitoba to become a computer engineer. One by one we went around the classroom sharing our plans for the future. After we had all taken a turn Mr. Clausen commented on the fact that not one of the 25 or so of us had mentioned that we wanted to be teachers. He asked us to raise our hands if any of us ever considered becoming a teacher. I don't know if any hands went up. I do know that mine certainly did not. Mr. Clausen went on to say that he thought some of us might make excellent teachers and he was sure that at least a few of us would do so. When he said this I felt like he was looking right at me. I was so convinced that he was talking to me that I actually shook my head "no" as he finished his last statement. I was going to be an engineer!

In high school I had a myriad of different types of English teachers, none more bizarre than Mr. Gajadhar. He liked to present himself as some sort of mystic.

He would go up and down the rows in class and let loose little facts about us that I am sure he found in our school records. For example, if a student gave a silly answer he might comment almost to himself, "That's what I get for asking a Pisces." Sure enough, the student who gave the answer would be born in March. Mr. Gajadhar also had the very

unusual ability of being able to write with both hands, connecting his sentences in the middle. I learned years later that he learned this skill as a T.V. weatherman in Toronto when he had to write backwards on clear Plexiglas weather maps.

What I remember most about Mr. Gajadhar was his insistence that we look beyond the obvious. He was always trying to expose us to the background or history of the piece of literature we were studying. He used to dictate vocabulary lists to the class and then tell us the Latin or Greek root of the word. None of this ever stuck with me. But it was cool watching him walk around the room with his glasses in his hand looking up at the ceiling and talking about these far-off topics. Knowledge for Mr. Gajadhar was valuable, learning for the sake of learning, not because it was going to be question 3 on the next test.

By April of my last year in high school I had already been accepted into the faculty of Engineering at the University of Manitoba. My plan was to work throughout the summer and start back to school like always in September. September arrived, I had selected my courses, purchase my books and arranged my car pool; I was ready. Three weeks later I was looking for a way out. For the first time that I can remember I did not want to go to school.

Thoughts of taking a year off were, for the first time, becoming more frequent. The course work and pace were challenging and the professors were more distant. No longer did I have a Dr. Grant checking up with me.

But I expected all of this: this was university, this is why I had worked so hard in high school. I could not understand why I was so dissatisfied with my current situation.

I remember going back to my old high school during this time to volunteer as a coach for one of the school teams. While I was there I began to talk with some of my old teachers, not about my university woes but about their jobs. A few days later, sitting in my living room talking with my parents about my "crisis," I told them that I thought I had figured out what I wanted to do. I wanted to teach mathematics like Dr. Grant. I finished my first year of university in Engineering and the next year transferred into the faculty of Education.

In June of 1999 Dr. Grant walked out of the classroom for the last time. That September I walked into the classroom for the first time. I took his place, no longer the student; I was now on the other side of the desk. I was the teacher.

APPENDIX B

Beliefs and Values Statement

Introduction

Monday morning, the homework from last week is being collected and for the first time Tom doesn't have his done . . .

Saturday night, while marking papers you find yourself marking the same work handed in by four different students . . .

Thursday afternoon, last period of the day, Tamara, sitting in the back of the room puts her head down again to go to sleep . . .

As a teacher I am governed by a number of external structures and organizations, my school culture, divisional policy, social expectations, provincial curriculum . . . the list goes on. In the above situations my actions will most likely not be governed by any of these externals. How I act and react in my classroom with my students is very much a by-product of what I believe and value. In this section I will attempt to identify and explore the central beliefs and values that pertain to my teaching.

Helms (1998) places beliefs and values as the central dimension of her model of identity. In her article, Helms does not discern the difference between a belief and a value.

It is clear in her writing that they are unique, separate, and yet belong together. According to the *Cambridge Advanced Learner's Dictionary*, a belief is “the feeling of certainty that something exists or is true”; values are related to “the importance or worth of something for someone.” For instance, I believe that all students deserve equitable learning opportunities. In accordance with this belief I value the three different levels of Mathematics currently offered in Manitoba to high school students.

Thus, values are based on beliefs but there is not necessarily a one-to-one relationship between the two. One belief may relate to a number of different values. An individual's beliefs and values are dynamic concepts. They must be able to bend and flex as individuals grow and learn.

In recording my beliefs and values I am very aware that this may become an exercise in futility. It would be easy to write a beliefs and values statement that any number of teachers could sign their names to. For example, the statement “Students should receive homework” is one that I can certainly agree with; however, is this belief central to who I am? There is a saying: “A man who stands for everything stands for nothing.” If I am trying to understand my identity as a teacher, then I have to be selective in what I record as my values and beliefs. With this in mind I am going to attempt to record my core beliefs, my non-negotiables. In so doing I will not mention many other important beliefs but hopefully I will have a better understanding regarding my core motivators. I have decided to organize my writing into three categories: what I believe and value about teaching, learning, and the nature of mathematics. To assist me in this process I have chosen to reflect on a number of questions posed by Parker Palmer and Alan Blankstein (Appendix A).

The act of teaching is a personal endeavor and has everything to do with how I relate to my students and to my subject. I imagine that if you came to observe me in my Pre-Calculus class you would probably categorize me as a “top down” teacher. This is a teacher who spends most of the class dispensing knowledge to his/her students and evaluates them on how well they are able to repeat that knowledge back to him/her.

For decades formal education in the classroom has focused on the teacher and their expertise. The teacher has been the interpreter of the subject; all knowledge flowed through them. Students have been viewed as receptacles waiting to be filled with the teacher’s knowledge; the teacher and his or her knowledge is very much at the centre of this style of teaching. The major criticism of this type of teaching is that the students are passive actors in a play that very much requires their full participation. Any educator will tell you that students must engage in their own learning to be successful.

As early as the late 1800s a new type of teaching started to emerge, where the students are placed at the centre of the learning process. Aptly named “child-centered” pedagogies have been used by the likes of Parker, Parkhurst, and Dewey. Starting in the 1960s, a new form of child-centered teaching started to emerge based on the theories of Piaget and Vygotsky called constructivist teaching; this pedagogy takes the teacher out of the expert role and places them beside the students with the responsibility of “co-constructing knowledge with students, acting as conceptual change agent, mentoring apprentices through the zone of proximal development, and supporting a community of learners” (Windschitl, 2002, p. 135).

The major drawbacks of constructivist teaching are twofold: interpretation and implementation. Constructivism started as a theory of learning and has been modified to become a theory of teaching. The transition has not been as smooth as one would hope. Ask 10 teachers what it means to be a constructivist and you will inevitably receive more than a handful of interpretations. Even with an agreed-upon interpretation, implementing the changes needed to become a truly constructivist teacher has proven to be very difficult. "Among experienced educators, this type of instruction [constructivist] is difficult to put into practice. In a study of 24 schools (elementary, middle, and high schools) that were engaged in teacher reforms, Newmann and Associates (1996) found that the most progressive teachers scored considerably below the researchers' highest levels for constructivist pedagogy and that the mean by subject area and grade level and overall mean scores were considerably lower than the mid point of the researchers' index" (Windschitl, 2002, p. 144).

In my mind neither model fits with who I am or what I believe about mathematics and learning. Both these models place the students and the teacher in an unnecessarily oppositional relationship. To some extent this is unavoidable; it is my job to determine how well a student has learned the material that is required of them. As with the majority of conflicting theories both sides have their pluses and minuses. I find it interesting that neither theory says much about subject matter, so I introduce a third option from Palmer's book, one that I subscribe to and one that I have not encountered in other books. Palmer (1998) offers a different model. In his model he removes the teacher (teacher-centered) and the student (child-centered) from the central role in learning and places the subject there.

By doing this you can reduce the us-versus-them dynamic in a classroom. The teacher no longer has to be the final authority on all knowledge (teacher-centered) and the students do not have carte blanche to take their learning in any direction they please (extreme child-centered). By placing the subject as our focal point we can as a group learn and explore the subject together. The best metaphor for this model that I have read comes from a Robert Frost poem, *The Secret Sits*: “We dance around a ring and suppose, but the secret sits in the middle and knows.”

The dancers are the learners and the secret is the subject that they are studying. As a teacher I see myself as one of the “dancers” who has been dancing a while longer than the rest. This extra experience means that I have something to share with my fellow dancers but I certainly do not have all of the answers. I like this metaphor because it gives “the others,” my students, a very active role; they too have to be dancing. These beliefs have real implication regarding what I value from my students. I value students who are curious, who can think independently, who want to participate in the dance (learning) and make it their own. This view of learning and teaching fits well inside my ideas and theories on the nature of mathematics and the nature of high school mathematics (Figure 2).

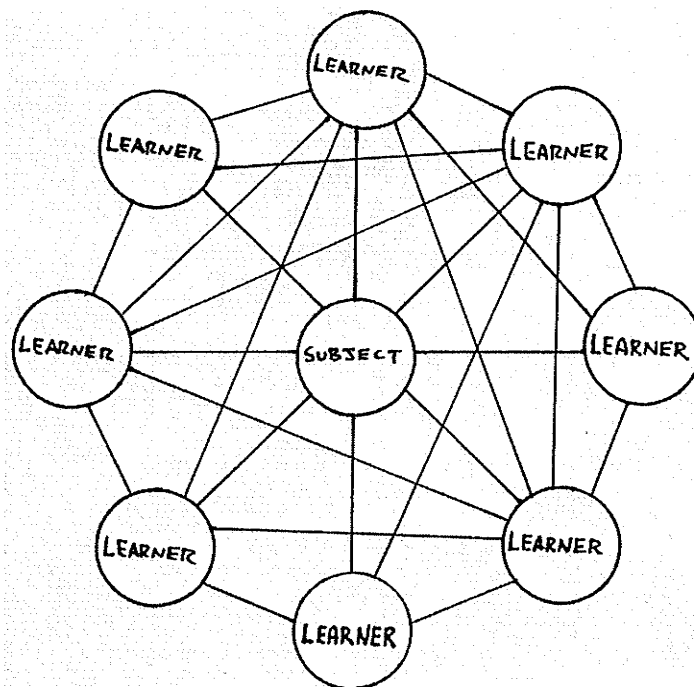


Figure 2. Visual representation of my theory of teaching, based on a poem by Robert Frost, taken from Palmer (1998).

The nature of mathematics has been discussed for millennia and in general it is agreed that there are two main philosophic views about the nature of mathematics. The first view is that mathematics exists as a separate entity from human consciousness; in this sense mathematics is timeless and is not dependent on human interpretation; it exists as it is. This has been dubbed the Platonic view as it places mathematics in what Plato called the “world of ideas.” “It contains the eternal and immutable patterns behind the various phenomena we come across in nature” (Gaarder, 1996). As mathematicians discover and develop “new” ideas they are in actuality uncovering what has always been. The British mathematician and physicist Roger Penrose once said, “Mathematical truth is not determined arbitrarily by the rules of some manmade formal system,

but has an absolute nature and lies beyond any such system of specifiable rules.”

Believers in the Platonic view of mathematics would assert that mathematics is a universal language.

The second popular philosophical view of mathematics is that mathematics is a human invention, a formal set of rules that we as humans have developed to explain the everyday actions of the world around us. Someone who believes in this model of mathematics would agree that there might well be a different system of rules and ideas that would explain our world just as well as mathematics. Immanuel Kant subscribed to this philosophy when he said, “The ultimate truth of mathematics lies in the possibility that its concepts can be constructed by the human mind.”

As for my personal beliefs I am of two minds. There are certain undeniable facts that exist without human consciousness that are in my mind mathematical; for example, the orbital paths of the planets around the sun.

On the other hand there are certain mathematical truths that exist based on human inventions; for example, the relationship between economic theories and calculus. If I had to choose, I would fall on the side of the Platonic view that mathematics is independent of humans and that when we discover new mathematics we are in reality uncovering a new piece of a very large puzzle that has already been put together.

As a teacher of mathematics I need to find the place in my theory of mathematics for high school mathematics and be able to answer the question, What is the nature of high school mathematics? I do not have a problem placing high school mathematics into my theory of mathematics as a whole.

The nature of high school mathematics has a decidedly different flavour to it than the large-scale theories of mathematics that I have just described. In many ways high school mathematics is used as a gatekeeper. Those who pass through the gate are granted certain privileges, a high school diploma and acceptance to certain postsecondary programs. Your freedom to choose what to pursue after high school in part depends on the mathematics you studied. To a lesser extent high school mathematics is an agent of numeracy, teaching students how to cope with the ever-increasing demand for “number sense” in our technological world.

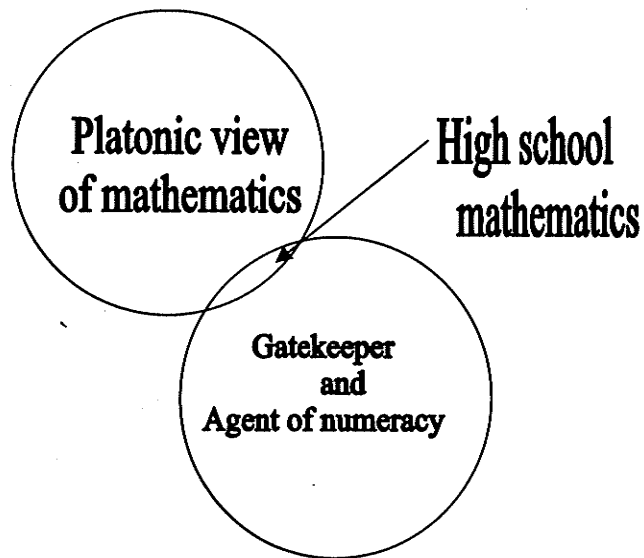


Figure 3. Positioning of high school mathematics within my view of the nature of mathematics.

In my pedagogical belief system I place mathematics at the centre. For me to maintain my integrity I must find a view of mathematics that I can “carry” with me into the different courses that I teach.

I believe that mathematics is the language of both the natural world around us and of an artificial and abstract world that we create. What other language can so clearly explain why the Earth moves and spins as it does and also be used to ensure that your UPS packages arrive as efficiently and as quickly as possible?

I believe that high school mathematics is very much about communication—teaching students how to effectively interpret and reproduce mathematics for their own personal use and for the use of others.

With the above in mind I have had a difficult time choosing what to include as my beliefs and values of learning. After much internal dialogue and debate I have decided that I can state my central beliefs about learning in two statements. First, I believe that all students can learn mathematics. On the surface of it this may seem like an obvious statement for a teacher to make; however, given our current society's tendencies toward the learning of mathematics there are many obstacles students face in learning mathematics. I feel that it is crucial that I hold this as one of my core beliefs regarding the teaching of mathematics. If this were not central to my belief system then I could rationalize not trying my best when dealing with certain students because I could deem them incapable of learning mathematics.

There is a common misinterpretation of my core belief statement that needs to be addressed. Often when people read "all students can learn mathematics," they read this to mean that "all students can learn **all** mathematics." This is not true. I do not believe that all types and all levels of mathematics are accessible to everyone.

To believe this I would have to believe that all students are cognitively and experientially created equal, which they are not.

As individuals we all have different strengths and weaknesses. There are individuals who will struggle with learning mathematics but they are capable of learning.

I value the choice that students are granted in Grade 10, when they can choose which mathematics course they want to study, and in doing so, what level of mathematics they want to study. My previous statement regarding “levels” of mathematics may not be politically correct; however, it is what I believe. Consumer Mathematics is an easier mathematics course than Applied or Pre-Calculus. Talk to any student in any hallway in Manitoba and they will readily admit to this but many of their teachers feel it is their duty to protect the integrity of the Consumer course. I am not sure why this is the case. Admitting that Consumer Mathematics is not as difficult as Pre-Calculus in no way discredits or diminishes the importance and relevance of the Consumer course. Just because a course’s content is easier does not make it any easier to teach; in fact, just the opposite may be true.

I believe that in every class there are students who learn differently from each other. We know from research that learners generally fall into one of the following categories: visual, auditory, and kinesthetic. The typical learner will be some blend of these three types. As a teacher I value the opportunity to give my students multiple ways of examining the topic at hand. I believe that regardless of the type of learner you are, the more you examine a topic from different perspectives in different ways, the more you will learn about that topic. One of the most effective ways to help a student learn something new is to give them an experience to relate to what is to be learned.

In mathematics this can be a challenge but if accomplished, I have found that the learning that takes place is deeper and richer. Since students do not all learn the same way it would be unfair to expect them to show their learning in the same way. I value the opportunity to let my students demonstrate their learning in multiple ways.

In mathematics it is important that you develop your skills and your understanding of concepts in the correct order. It is very difficult to teach students polynomials until they have mastered working with integers. I believe that it is a teacher's job to assess students' abilities and start there. This is a difficult task for a teacher to do considering the range of abilities that present themselves in any given classroom.

My second core belief is that learning is a noble endeavor that one has to intentionally choose to pursue. In this statement I am referring to a level of learning that goes beyond basic skill acquisition. The most obvious fallout of this belief is that students have to choose to learn the information being given to them. I do not care how skilled or entertaining the teacher is, if the student does not intentionally choose to learn the material then they will not learn. When I talk about learning I am talking about a process by which a student takes in information, processes and analyzes it, and makes it their own. Many students I teach never get beyond the taking-in-the-information stage, and as a result they never truly possess the information, they only serve as holding tanks for the information and often these tanks have severe leaks. One of the most common complaints that I hear from students is "It made so much sense when I saw you do the question, but when I got home I couldn't do it." I believe that this statement is true.

I believe that the students did follow what I was doing on the board but the information that I was explaining never became their own. When they got home it was not there for them to access. If this is the case, then what does it take for a student to make the information theirs? First, they need the proper foundation. I spoke before about my belief that a teacher needs to meet the students where they are. This is not always possible given the restrictions of time, number of students and curriculum. A student who possesses the correct prior knowledge will have a much better chance of making the new information fit into their system of understanding.

I mentioned earlier that it is important that a person intentionally chooses to learn. A desire to learn is perhaps the most important quality that a student can possess. Without this there is nothing that a teacher can do to help a student. What creates this desire is different for every student. Some students will tell you that they are spurred on by the grades that they will get if they succeed. Other students will say that the learning they are doing is a rung on a ladder leading them to a desired destination. A few students will admit to still possessing that innate curiosity that I believe we are all born with and this drives them to learn. There are too many students claim to have lost that curiosity. They say there is no reward in grades and that they have no plans beyond the weekend. I believe that this last group of students are often putting up smokescreens, trying to deflect attention away from the real problem.

All of the desire in the world will not be enough to create learning in an individual without the necessary effort. The type of learning that we ask students to engage in is not always natural and often takes effort.

In mathematics that effort requires that the students show up to class every day, concentrate while they are there and go home and practice what they have learned.

I do not believe that it is my job to create this desire in students. I believe that as a teacher and fellow dancer, it is my job to make the new information the dance accessible to everyone; it is not my job to dance for them.

APPENDIX C

Prompts for Student Journals

Pre-Calculus Journal Prompts

Entry 1, October 7, 2005:

Reflect on your first month of 40S Pre-Calculus. Discuss the difficulties and challenges that you have faced, and the amount of time spent outside of class working math.

Entry 2, November 10, 2005:

If you could reinvent the way that our 40S Pre-Calculus was run, what would the class look like, how would you be evaluated? The only thing you are not allowed to change is the course content.

Entry 3, December 9, 2005:

This journal entry has two parts:

- a) Explain why you chose to take Pre-Calculus in Grade 10.
- b) At the completion of this course how will you know that you made the right choice?

Entry 4: December 16, 2005:

Finish these sentences with the 40S Pre-Calculus course in mind. Please explain your answers.

a) The most important thing for a Pre-Calculus student is to . . .

b) The most important thing for a Pre-Calculus teacher is to . . .

Would either of these answers change if you were writing about a different course?

Entry 5: January 15, 2006

Create a question from any of the units that we have studied so far. Provide an answer for your question and a description of how you would teach a classmate who was struggling in the class to do the question. How do you think your explanation of the question would differ from my explanation in class, and is this difference significant to how you understand the question?

Consumer Mathematics Journal PromptsEntry 1: February 5, 2006:

What are your goals for this course? Be specific about your goals and explain how you plan to accomplish them.

Entry 2: March 9, 2006:

Reflect on your Consumer Mathematics experience thus far. Tell me about the workload, the course material and your level of personal commitment to the course.

Entry 3: April 25, 2006:

In yesterday's class a number of students seemed very frustrated. Think about how you feel/react in a math class when you are frustrated. Does your reaction help or hinder your learning? Explain.

Entry 4: May 13, 2006:

This journal entry has two parts:

- a) Explain why you chose to take Consumer Mathematics.
- b) At the completion of this course how will you know that you made the right choice?

Entry 5: May 22, 2006:

Finish these sentences with the 40S Consumer Mathematics course in mind. Please explain your answers.

- a) The most important thing for a Consumer student is to . . .
- b) The most important thing for a Consumer teacher is to . . .

Would either of these answers change if you were writing about a different course?

Entry 6, May 25, 2006:

In the last unit there were approximately 68 practice questions for you to work on. The average student in this class did 7.5 of those questions.

- 1) What value do you see in doing the work assigned in class?
- 2) Why do you choose not to do all of the questions assigned?
- 3) Are you planning to go to school after high school? Do you think your attitude towards assigned work will change, and why?