THE EFFECTS OF CULTURE ON MATHEMATICS EDUCATION: A COMPARISON OF GRADES 4 TO 6 MATHEMATICS CURRICULA IN BRITISH COLUMBIA AND MÉXICO

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Abstract

The purpose of this project is to investigate the influences of culture on mathematics education through a comparison of the Integrated Resource Package for mathematics, Grades 4 to 6 for the province of British Columbia and México's *Plan Educativo de Matemáticas* document for Grades 4 to 6. Comparing mathematics curricula in Canada and México involves investigating the philosophical, historical and cultural theories and factors which have affected education in both countries. This research demonstrates how several major theories regarding the historical and philosophical influences on education in each locale provide a conceptual foundation for explicating the cultural dimensions of discovered similarities and differences between the Integrated Resource Package for mathematics, Grades 4 to 6 for the province of British Columbia and México's *Plan Educativo de Matemáticas* document for Grades 4 to 6. The research topic emanates from practice and the findings are directed both towards change in the researcher's view of mathematics curriculum and toward practical suggestions for improving practice. The conclusions include suggestions for teacher professional preparation and for on-going development in the British Columbia mathematics world.

Keywords: comparative research; intended curriculum; culture; institutional theory; liberation theory; epochal history; constructivist learning; pedagogy; implementation; mathematics; numeracy

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Finally, I want to thank all of my students who have inspired me to continue to search for better ways to serve them and support them in their learning journey.

Dedication

I dedicate this work, so as my life, to our gracious Heavenly Father who has shown His incomprehensible mercy on our human race through the work of Jesus Christ.

Table of Contents

List of Tables

List of Figures

Chapter 1.

Introduction

Topic of Research

This research is a study in comparative education that will inquire into the extent to which culture has an effect on the intended curriculum in mathematics education. According to Cuban (1976), curriculum is a very ambiguous term (p. 2). Cuban (1976) defines curriculum as the "intentional experiences within the school planned for students. This includes what is taught (embracing, as well, theories that determine the content), how knowledge, skills and attitudes are taught and the materials both teachers and students use" (p. 2). This author makes the reader aware that this definition "implies that what is taught is necessarily learned" (p. 2). Cuban (1976) defends this narrow definition of curriculum because it enables the researcher to identify "different degrees of influences upon theory, content, instruction and materials" (p. 3). I have chosen to focus on the intended curriculum, because the teachers usually develop their instructional programs using the official curriculum that describes the way educators ought to provide mathematics education. The official curriculum is generally expressed to the teachers through "documents or statements of various types" (Mullins, Martin, Gonzalez, & Crostowski, 2004, p.164) which are developed by the Ministries of Education in the different jurisdictions. They include guides, guidelines, frameworks, etc. which "together with supporting materials, such as instructional guides and mandated textbooks, are referred to as the *intended curriculum"* (Mullins et al., 2004, p.164). There is a difference between the intended and the implemented curriculum. Mullins et al. (2004) explains that "in many cases, teachers need to interpret and adapt the intended curriculum to their perceptions of the needs, abilities, and interests of their students, and this evolves into the *implemented curriculum*. (p. 164). I have the intention to accomplish the comparative study by analysing the intermediate mathematics intended curricula for Grades 4 to 6 in México and British Columbia and researching whether culture has any impact on these curricular documents. The study will be situated in the discipline of cross-cultural comparison. It will involve a philosophical-historical comparison that will include the fields of mathematics, curriculum, pedagogy, philosophy, history, and learning framed within the cultural context of different places and cultures.

As part of this study, I will use Charles Taylor's (2004) concept of "social imaginaries" (p.23). Taylor defines a "social imaginary" as "the way people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations" (p. 23). This meaning is much richer than simply the idea of "intellectual schemes people may entertain when they think about social reality in a disengaged mode" (p. 23). Taylor's (2004) reason for coming up with the new term of "social imaginary" is that he perceives that modernity itself has created a problem constituted by the "historically unprecedented amalgam of new practices and institutional forms...., of new ways of living....; and of new forms of malaise..." (p. 1). He proposes to think of "multiple modernities" (p. 1) so as to account for the reality that "other non-Western cultures have modernized in their own way and cannot properly be understood if we try to grasp them in a general theory that was designed originally with the Western case in mind" (p.1). I am using the construct of social imaginaries because it aids us in understanding the importance of cultural influence as a philosophical tool. This idea that other cultures may have modernized in their own way underlies and justifies my investigation of the influence of culture on curriculum.

Situating the Researcher

The reason I have chosen to research the intended mathematical curricula for Grades 4 to 6 in British Columbia and México is embedded in who I am, what my practice has been, the cultural background I have been given, and a keen desire to improve my practice and the practice of the community of learners that I am involved with. Thus, at this point I ought to give to my readers the courtesy of introducing myself. I am a member of the tail end of the Baby Boomer generation. I was born in México City into a family of European immigrants of Dutch and German-Swiss descents. This combination of situational facts has given me a very unique experience and cultural identity. In México I was part of a visible minority. I, therefore, have experienced some of the drawbacks and benefits of being a visible minority. Because of my cultural background and visible difference, I was not accepted by the Mexican society as one of their own, but because of the fact of having been born in México, the Dutch and Swiss societies always viewed me as different. From early on, I have felt myself to be a sojourner on this planet. This has influenced my perceptions and philosophical understandings and the lens through which I see the world. For me, being a member, or belonging to a social group never had great importance but it was the ideals of truth, honesty, integrity, and justice that formed the building blocks that formed my identity. Even as a child the earthly reality about the lack of these virtues vexed my spirit continually.

Because of my visible difference, my parents deemed it safer to send my older sister and me to a private, secular school in México. My father had an aversion to religion because of the deep pain of soul he lived through as a youth in Holland during the Nazi occupation and because of the atrocities he witnessed and was subjected to. So, the choices of schools for my sister and for me were very limited. There was an American private school and a German private school that were both secular. The choice was clear, as my father still had a deep resentment towards the German people; my sister was sent to the American school. My sister was a very strong willed child who was academically quite advanced. The American school did not know how to deal with her and she became unmanageable. Within the week of her starting school, my parents were informed that my sister was psychologically disturbed and needed professional help and would not be welcomed in that school until she received the help she needed. My mother, being a wise and informed parent, did not take this counsel at face value, but opted to send my sister to the German school *for a trial week* to see if the diagnosis would be replicated. The result was staggering. She was placed in the care of an excellent educator who immediately saw that she was just very bored with what her peers were doing and promptly promoted her to a higher grade level, a move that happily challenged her to learn. The result was that despite my father's aversion, both my sister and I were sent to the German school for our basic education. We both finished high school with both the Mexican program and the German *Abitur* (Gymnasium diploma).

My experience in this German school was not as positive as my sister's. I had been very sickly during my early childhood. I was plagued with one pneumonia or bronchitis after another from the time I was two weeks old until my fifth year of life. At times, the doctors gave my parents little hope for my survival. Therefore, my coordination was very poor and in general I was a late bloomer. Academic work was not my *forté*. I also was gifted with dyslexia and a hearing processing disorder. With the persevering, inexhaustible help and support of my mother, I was able to eventually compensate for my personal characteristics, but the first eight years of school were a nightmare for me. This experience has given me empathy for students who struggle in our educational system and an insight into how to possibly help them. Eventually I learned the rules of the *education game* and with the encouragement of one of my high school teachers ended up being the top student in the last year of high school.

During my childhood, my relationship with my sister was quite turbulent. When it came time to decide what profession I would choose, it would be anything but teaching and education, the field that my sister was involved in. I enrolled in engineering and after the scheduled six years graduated as a mechanical, electrical, electronic engineer from the National University of México (UNAM) with honourable mention. During these years, I earned my pocket money by tutoring elementary and secondary students in mathematics, physics, and chemistry. In the last two years, I became a tutor for mathematics at the university and also became an assistant professor teaching electronics laboratory to some of my peers as I had worked myself ahead of the program. Talk about an awkward situation.

After graduation I became employed as an engineer at a factory that was a subsidiary of an American multinational. At this time, I met my wife, a Canadian art student who was finishing her degree in México. We were soon married. This changed my life, as my in-laws orchestrated my immigration to Canada. Being young, and quite alienated by the political realities in México, I embraced the opportunity to come to Canada. I came with the awareness that the College of Engineers in Canada would not accept my qualifications and would not even allow me to challenge them. Our new life in this country began for me as a manual labourer. We built our home, and as we were finishing this project, I became severely ill. For nine months I was bed-ridden. The service I got through the medical system was well intentioned, but ill advised. The doctors did not diagnose my problem correctly. It was ironically a naturopathic practitioner who, without any medical tests, just by looking at symptoms diagnosed my medical condition as a tumour in the thyroid. After a couple of years I had the tumour removed and was able to start again with my working life. During my illness I realized that manual work would now be out of the question, as my strength was very limited. Also during this time I had ample time to reconsider some of my attitudes and I came to the conclusion that doing what my sister did suited me fine as I recalled how pleasant the times of teaching in México had been for me.

At this juncture in my life I decided to pursue seriously the profession of educator. I enrolled in Simon Fraser University's Professional Development Program (PDP) after taking a few college courses that were required. In 1990 I began my journey as a British Columbia educator. I worked both in the public school system as a teacher on call and as a part time teacher in an independent school. Drawing from my expertise, I taught most of the curricular subjects both at the elementary and high school levels. After 10 years in this arrangement I decided I wanted to teach full time in the public school system. I began as a mathematics and science high school teacher. After one year in this position, the British Columbia provincial government embarked on cost cutting measures and eliminated over 2,000 teaching jobs. My position was one of them and in order to maintain employment the next year I ended up teaching a split 4-7 class, 90 km away from home. I commuted every day with a colleague and the principal to this rural small school. We forged a great community of learners during our commuting time, and we thereby enriched each others' professional lives. After one year I lost my position again and have been teaching Grades 4 to 7 in different combinations for the past five years.

It was during these years that I came to the realization that something was lacking in our educational system. When many students as young as fourth graders loathed school already, something had to be amiss. This painful realization, which resonated with my own experience as a child, propelled me into the quest for further education. I enrolled in a masters program in education and after finishing, I continued my quest for learning at the doctoral level. For many years I have been vexed by the intended curricula we have to follow. The intended curricula in some subjects missed the mark. It either was too extensive, stipulating that teachers had to cover far too much to be able to teach it to mastery, or the assessment paradigms were counterproductive for a large number of students. It always reminded me of the Mexican popular proverb that says "That he who grabs too much cannot squeeze it tight". As I endeavoured to give my students a renewed sense of joy in learning, I have encountered much resistance from administrators and parents because I try to make learning enjoyable. This personal experience and practice, combined with my idiosyncratic thirst for truth and justice have awakened in me the curiosity to compare what we are directed to teach, how we are directed to teach it, and how we are directed to assess it with what is prescribed elsewhere. My natural tendency was to compare what I did at present, with what I experienced in the past as a student and as an educator in México, and what I perceive to be a more effective way of learning. At the same time, I have become aware of the lens I look through, which in Taylor's (2004) words would be my personal social imaginary that drives my thought and decisions. It is neither the British Columbia social imaginary, nor the Mexican social imaginary, nor the European social imaginary but a social imaginary constructed by the unique set of circumstances that I have lived through. Nevertheless, having lived in British Columbia more than half of my life, and having been raised in the Mexican society, I do understand and know the social imaginaries that characterize both these cultures.

Very much in line with cross-cultural comparison studies, my research intends to explore the conditions that may have exerted influence on theory and practice used in Mexican and British Columbia classrooms, the intended curricula, and concomitant pedagogy. I have chosen to narrow the focus of this research to the knowledge subset of mathematics and the teaching/learning paradigms of the Intermediate Grades 4 to 6 because of my background and practice. The students in these grades are on average between 9 and 11 years old. I have chosen to concentrate on the intermediates Grades 4 to 6 because these years are transitional years between the Primary years and the Secondary years. In other words, the Intermediate curriculum builds upon the foundations established in the primary years, providing an understanding of what students have learned during the early years, while at the same time laying the foundation for what will be learned in the Secondary years. Thus, the study of the Intermediate grades provides a wide lens for informing me whether and how culture influences the intended curricula in both stages.

The second reason why I have chosen to focus on the Grade 4 to 6 curricula is that presently, and for the last five years, I have been teaching in British Columbia's public education system with the assignment of teaching Grades 4 to 6. I have been immersed in this intended curriculum, as it is embedded in my daily practice, thus providing me with a close personal connection. Mathematics has long been one of my preferred fields of teaching, as I consider learning mathematics to be one of the most important aspects of education. In my opinion, it provides the tools for students to become resourceful problem solvers and analytical thinkers. In both the pure and applied sciences it is an essential way of doing business. But also for any citizen, mathematics provides the knowledge of how to budget properly for business or daily life.

As a mechanical, electrical, electronic engineer and as a teacher I have learned to appreciate how pivotal mathematics is for the modern person. I have chosen to compare the British Columbia and Mexican mathematics curricula because I was born and raised in México, I was schooled in México, I taught mathematics and electronics in México, and have lived in British Columbia over half my life and have raised my children here. Spanish is one of my mother tongues and I was raised in the Mexican culture. Furthermore, I have taught in British Columbia for more than 17 years in the independent and public school systems, in both the elementary and secondary settings. This background enables me to understand both cultures well, in particular in the field of mathematics education. I also have been a member of my school district's Numeracy Taskforce since its inception in 2003.

A further reason why I have chosen mathematics as my field of study is that there is a popular misconception that mathematics transcends cultural backgrounds

(Bishop, 1991). I think that the intended curriculum is a possible vehicle that may give us the opportunity to generalize to the broader issue of whether and how culture has an influence on mathematic education. Therefore, this choice of focus appears to provide me with an advantageous platform for research.

Contributions This Study Will Provide

As I have explained above, the questions which I propose to research come from my practice and my life experiences. The findings that this research will produce are meant to change this researcher's view and understanding of the intended mathematic curriculum. At the same time, they will yield practical suggestions on how to improve this researcher's practice, as well as the community of learners of which I am a part.

Furthermore, this research intends to augment the literature available in comparative studies in education. I have not found any comparative studies that have been undertaken between the elementary educational fields in México and British Columbia. There has been considerable comparative work undertaken with countries such as Japan and Singapore. A comparison with México might provide an interesting counterpoint. At this point, the question may be asked about the validity of engaging in a comparative study between a national and a provincial educational system. Nevertheless, as we take a closer look at both curricula, we discover that México has a national intended curriculum that is used for the whole country, while in Canada, education being a provincial jurisdiction, each province has its own intended curriculum, and there are no national curricular standards. Even Mullins et al. (2004) in the TIMMS study of 2003 includes the provinces of Ontario and Quebec, which participated in that study, as separate entities to be compared with the rest of the world, and among themselves (p. 7).

Finally, this research may produce some suggestions for educators' professional preparation and development in the British Columbia mathematic world.

Literature Relevant to Mathematics, Culture, and Mathematics Education

The context of daily practice and what drives it is explored in the relevant readings to help understand how culture is intrinsically related to education. This research builds on the findings of Pepin's (1999) case study. This study is about the ways in which mathematics teachers' classroom practice in England, France and Germany are embedded in their epistemologies. She asserts, "many of the conditions that exert influence on human thought and practice within classrooms are neither visible nor readily identifiable" because they are often "'unperceived' and often unvoiced principles, philosophies and beliefs that unwittingly penetrate the educational enterprise" (p. 128). Taylor (1991) calls these influences the "horizon of significance" (p. 52). In a later book, Taylor (2004) identifies these influences as being part of the "social imaginary" (p. 23) which every person in a culture possesses. In the ambit of classroom practice, Lortie (1975) posits that teachers' schooling experience and long *apprenticeship observation* exert great influence on their pedagogical practice. It is to be assumed that different countries provide teachers and learners different apprenticeship observation experiences that are based in the educational philosophies and cultural traditions of each jurisdiction in a specific historical period. Therefore, the existence of a complex relationship of such forces is very likely. One of the invisible but powerful frameworks is the epistemological beliefs and theories of teachers and learners. Pepin (1999) states that teachers often conflate beliefs with knowledge; therefore researchers who study teachers' knowledge also study teachers' beliefs (Grossman, Wilson, & Shulman, 1989). In mathematics, educators desire to understand and explain the development of mathematical knowledge and to observe and explicate the unfolding of mathematical knowledge in mathematicians, educators and learners. The classroom practitioner is vitally interested in researching mechanisms that evoke such cognitive developments in learning.

Pepin's (1999) findings were quite interesting, as she discovered that in England "teachers did not view formal mathematical notation or expressions as a means by which to educate their pupils to think in a logical way" (p. 139). In Germany, logic was considered as "the principal element of mathematics, and they tried to include it into their practices" (p. 139). In France "rigorous proof was part of the curriculum ... logical reasoning was regarded as the main element of mathematics, in practice as well as in theory" (p. 140). With respect to the realm of philosophies of education, in England the philosophical orientation "was on the utilitarian pragmatic side ... combined with the individualistic and child-centered view" (p. 140). In France, they espoused a mixture of three philosophies: "mathematics teaching as important for 'training the mind'...for work preparation ... [and] personal exploration was to be facilitated" (p. 140). In Germany, she found two operant philosophies depending on which school she investigated. The *Gymnasium* held to the "old humanist" orientation, while the *Hauptschule* espoused the "technological pragmatist view" (p. 140).

Christine Knipping (2003) has a very interesting comparative study in mathematics entitled *learning from comparing.* She takes five qualitative comparative studies in mathematics and endeavours to understand how *covert culture* shapes mathematics education in different contexts. She states that comparative studies aid us in becoming "more aware of our own implicit assumptions concerning the learning of mathematics…" (p. 283). The first aspect she focuses on is "experiencing learning differently" (p. 282). She opens with the statement that "education is not the same everywhere … even within the same country" (p. 282). She raises the question of how culture influences mathematics and the learning process, identifying the challenge that "culture exists at two levels … the 'overt culture' … and [the] 'covert culture'" in which the "'covert culture' … actually shapes our learning and our learning of any subject matter" (p. 183).

The second aspect is "students' perception of educational differences" (p. 283). One of her studies found that the French students valued educational success through the "ladder of progress" (p. 284) while the English students were influenced more by "social class differences … negative peer group influences [that] opposed school values…" (p.284). Although there were similarities in both countries in the "role and structural position of 'pupil', there were, nevertheless, striking differences in their perceptions of what it meant to be a pupil…" (p. 284). The third aspect is "teachers' beliefs and practices" (p. 284). This was also the focus of Pepin's study.

The next aspect focuses on "mathematics classroom in comparison" (p. 286). Knipping (2003) summarizes one of her studies' findings as *scientific* orientation in German classes versus the *pragmatic* in England. In Germany, they give great importance to theoretical mathematical considerations, while in England the purpose and practical are dominant. In Germany, great importance is given to deductive reasoning by the introduction of new mathematical concepts and class discussion directed by the teacher. In England, theorems are often formulated from examples. In Germany, individual work is uncommon, while in England it is dominant. In France, mathematical knowledge is presented "open to question, challenge and discussion" (p. 285) which develops in the learner mathematical thinking by developing and understanding concepts and mathematical reasoning.

The TIMMS 2003 study will also provide a buttressing framework for developing some of the comparison criteria that will be used in comparing the intended curriculum between these two jurisdictions.

Relevant Literature in the Cross-cultural Field

The European Union has been engaged in comparative studies since the 1980s. Hantrais, the former director of the European Research Centre, who dedicated much of her research to comparative educational research, delineated the importance and usefulness of such studies. She identified their weaknesses and strengths and researched the historical roots of such studies. Hantrais has published a number of comparative studies about many aspects of education in European Union countries, such as *Cross-National Research Methods in the Social Sciences.* Kubow and Fossum (2007) have also compiled several studies of education around the globe in their book *Comparative Education: Exploring Issues in International Context.* Kubow and Fossum (2007) analyse the educational reform that several countries, Hong Kong, Israel, Brazil, South Africa, England, Germany, Japan, and the United States have undergone. These authors place their work in the context of the globalization process and how this process is affecting and will continue to affect education around the world. They quote Crossley (2000) who states, "It is now increasingly difficult to understand education in any context without reference to the global forces that influence policy and practice" (p. 324). As we endeavour in British Columbia to understand the changes we are experiencing, comparative research may shed light onto the dynamics of these changes. It will help this researcher to understand how to maximize the positive potential that change brings and how to best understand how to incorporate the changes in the culture I am immersed in.

Gerald Gutek (2006) has gathered contextual/historical educational accounts of several countries, including México and the United States in his book *American Education in a Global Society.* Gutek (2006) gives historical and administrative overviews of the educational systems and structures in several countries, which include the United States, the United Kingdom, France, the Russian Federation, México, Japan, the People's Republic of China, India, and Nigeria. He describes and summarizes the characteristics and challenges which each educational system faces at the moment and which they need to address. For the United States, he concludes that the educational system is paradoxical because, although there is no national program in the United States, powerful trends have "produced standardization throughout the country" (p. 209). For México he concludes that a persistent dilemma is that of "quantity versus quality" (p. 235) which has been paramount throughout its history and as well in other developing countries. This research will enable me to make a counter point to the already available research on how educational goals can be best implemented in the culture within which I work.

Ratna Ghosh (2004) has written an interesting article, *Globalization in the North American Region: Towards Recognition of Cultural Space,* in which the cultural differences between the three NAFTA signatories are revealed as well as the consequences these differences have for education. Gosh (2004) states that there are great disparities between México and Canada. One of these is the wide difference in the rates of participation in higher education. Furthermore, language use "puts México and Quebec ...at a disadvantage" (Ghosh, 2004, p. 91). These "practical issues" which stem from the educational differences impact "equity, accessibility and quality in terms of acceptable minimum standards, accreditation and mobility" (p. 91). Furthermore she posits that English Canadians and Americans tend to be individualistic and *doers*, while French Canadians and Mexicans tend to be characterized by collectivism as they are group oriented and they tend to be *be-ers* (p. 92). Mexicans also "tend to accept the power of their superiors and will work the way their bosses want them to" (p. 92). As "orientations people have in culture and values...have implications on behavioural and attitudinal differences" (p. 91), she makes the case that "recognition of cultural space would involve international and intercultural dimensions in content and methods of pedagogy, as well as in defining the standards of excellence by widening the knowledge base to other cultures" (p. 96). The author conceptualizes the need to redefine values considering emerging understandings of knowledge, culture, difference, and identity. Ratna Ghosh's research helps me understand the intricate complexities that I have to sort out in my personal professional practice, as I understand better some of my own background. It also furnishes me with the tools to understand the differences in the intended curricula I am comparing.

Research Question

The purpose of this study is to discover, describe, and understand the differences and similarities between the British Columbia and Mexican mathematics curricula, and therefore the differences and similarities between aspects of teaching/learning in Grades 4 to 6, and how the cultural-historical differences between these two cultures have influenced the similarities or differences discovered. The focus of this research is how the intended curriculum in mathematics has been shaped by the historical/ philosophical/ cultural realities in these two locales.

The research question which I propose is: What are the similarities and differences in the curriculum documents for mathematics in Grades 4 to 6 in the British Columbia's recently released mathematics—Kindergarten to Grade 7 (K to 7) Integrated Resource Package—and its counterpart, the *Plan Educativo de Matemáticas,* the mathematics education plan in the Mexican curriculum document?

The secondary question is: What are the philosophical, cultural, and historical factors that may help to explain the similarities and differences in these curriculum documents?

Methodology

This research will explore how socio-cultural settings influence the intended mathematic curriculum. The manner in which this research will proceed will be by following Pepin's (1999) model of comparison in cross-cultural mathematic education. This task will be accomplished by identifying principles, concepts and categories within the mathematic intended curricula of British Columbia and México and comparing the similarities and differences between them.

The following steps will be taken:

1. Justify the comparative method in research.
2. Compare the socio-cultural historical contexts in British Columbia and México.
3. Summarize the main features in the content and general format of México's *Plan Educativo de Matemáticas* document for Grades 4 to 6.
4. Summarize the main features in the content and general format of the British Columbia Integrated Resource Package (IRP) for Grades 4 to 6.
5. Identify the possible cultural/historical principles which guide the philosophy of mathematic education on both locales as a basis of socio-cultural comparison.
6. Use Pepin's (1999) model to compare the possible epistemologies reflected in the intended mathematic curricula in British Columbia and México.
7. Enumerate the possible categories which I will use as a basis for comparison. These include: (a) availability of the documents, (b) the format of the document, (c) the content and sequence of the intended curriculum, (d) the prescribed pedagogy or philosophical current of education, (e) the use of manipulatives, (f) the amount of learning time allotted for specific parts of the curriculum, (g) the intended learning outcomes for students, and (h) the teaching resources for teachers.
8. Summarize the key findings.
9. Suggest implications for curriculum and practice.
10. Suggest possible future topics for research in this area.

Chapter 2.

Importance and Justification of the Comparative Method: Comparing Two Curriculum Documents

Importance of Cross-cultural Comparative Research in Education

To justify why I have chosen to conduct this research through a cross-cultural comparative lens, I will draw on the work of international researchers who have chosen and defended this approach. Hantrais and Mangen (1996) define comparative research as a study where "one or more units in two or more societies, cultures or countries are compared in respect of the same concepts and concerning the systematic analysis of phenomena, usually with the intention of explaining them and generalizing from them" (pp. 1-2). With the information and data collected, comparisons will be made to "gain a greater awareness and a deeper understanding of the social reality" (p. 2). Hoffmann (1999) states that cultures are "distinct, bounded, and incommensurable entities with controlling power over individuals and groups" (p. 465). She continues to argue that in its broader sense, education is more than formal schooling and that education studied as a cultural process "requires that attention be focused on the ways teaching and learning are cultural activities, embedded in a cultural context and embodying cultural meanings and values" (p. 468). The two cultures and educational systems the study will examine are the educational cultures in British Columbia, Canada, and the educational culture of México.

Cross-cultural comparative research has been undertaken since the nineteenth century by anthropologists, philosophers, sociologists and political scientists. Comparative studies have been useful for examining social phenomena and analysing whether similar phenomena can be attributed to the same causes. According to Hantrais (1995), this type of research has developed analytical frameworks for examining and explaining "social and cultural differences and specificity" (p. 2). In recent times, cross-cultural studies have been contextualized as a way to learn and understand more about different societies, their institutions, and their structures. They serve as well to assess varied mechanisms used in different places for dealing with common problems and to evaluate the transferability of policies between different countries or governments. Other researcher like Maurice, Sellier, and Silvestre (1986) posit that the researcher works is to identify the specificity of institutional structures and social forms in different places and cultures, endeavouring to explicate the differences by examining the wider social context.

To understand how comparative research may be conducted, Hantrais (1995) explains that comparative research could be "intended to be explanatory" (p. 2), it can use the inductive method by "starting from a loosely defined hypothesis and moving towards their verification" (p. 2), it can use the deductive method by "applying general theory to a specific case in order to interpret certain aspects" (p. 2), or it can be demonstrative in which case it is "designed to confirm and refine theory" (p. 2). This work endeavours to apply general theory to the specific case of the mathematics curriculum in Grades 4 to 6 in British Columbia and México to interpret whether culture has been an influencing factor on the respective curricula.

In my view, it is important to understand how comparative studies can propel the understanding of educational theories and trends that are practiced by teachers. Inciarte and Villalobos (2004) assert that through comparative research we can acquire consciousness of where we are in education, where we are going in this field, and understand the reasons why we are where we are, thus enabling us to choose with knowledge the direction we think we should steer towards. Furthermore, they argue that comparative studies provide us with significant contributions when engaged in educational reforms or change.

The research undertaken by Kandel as cited by Perez (2000) explains that comparative studies have the aim of discovering the differences between the causes that account for the varying education systems in different locales. Their real value lies in the analysis of the underlying causes that determine the development of a system in comparison to other systems. These underlying causes Marquez (1972) calls the intangible forces as well as the spiritual and cultural contexts that are the foundations of educational systems, and for which comparative studies demonstrate an appreciation.

Therefore, as Inciarte et al. (2004) continue to explain, in comparative research the existence of exogenous characteristics like geography, economy, social structures, science, religion, as well as endogenous characteristics such as internal configurative forces need to be analysed carefully to comprehend the pedagogical realities in education. In this way, comparative educational research is a scientific endeavour that opens a dynamic relation of epistemological interplay where the cognitive rules represent historical constructs that are reflected and manifested in a real and active process.

A methodology in comparative research is expounded by Hantrais and Mangen (1996), who argue that one of the values of comparative studies is that they enable the researcher to confront their findings "in an attempt to identify and illuminate similarities and differences … in search for possible explanations in terms of national likeness and unlikeness" (p. 3). This comparative research will adopt this focus or lens. Another great value of comparative studies is the fact that the researcher is "forced to adopt a different cultural perspective, to learn to understand the thought process of another culture, and to see it from the native's viewpoint while also reconsidering their own country from the perspective of a skilled observer from outside" (Hantrais & Mangen, 1996, p. 3).

To know which variables we ought to use in such research, Samuel (1985) posits that in comparative studies, time and space are the main controlling variables. Gutek (2006) indicates that in today's world we cannot afford isolation in education. He writes that to "no longer care what is happening elsewhere, is no longer rationally, nor educationally defensible…" (p. 138). He continues to argue that comparing enables us to "both understand a broader perspective as well as look inward and get a clearer picture of what is taking place in … education" (p. 138).

As my area of research is education, following Kincheloe's (1991) recommendations would be beneficial. This scholar's recommendations include that the teacher-researcher should endeavour to gain philosophical guidance through analysis of the views and accepted theories which are relevant to the specific topic in question. Using Kincheloe's words, the "critical teacher" or researcher, who is interested and proactive in his or her professional development, proceeds to delineate the assumptions of the current research orientations, dissenting views and other knowledge sources, so as to reveal how philosophical-cultural constraints affect teachers, schools, curriculum and society's expectation of education. The researcher must select which particular area to study, so as to see schools, classrooms and learning from a unique perspective. The researcher continues by making use of a wide gamut of research strategies, striving to understand the information collected within a system of meaning. This helps develop an awareness of the presuppositions and theories which guide practice so as to elucidate a wider cultural perspective. Finally, the researcher emerges as a practitioner of personal and social transformation.

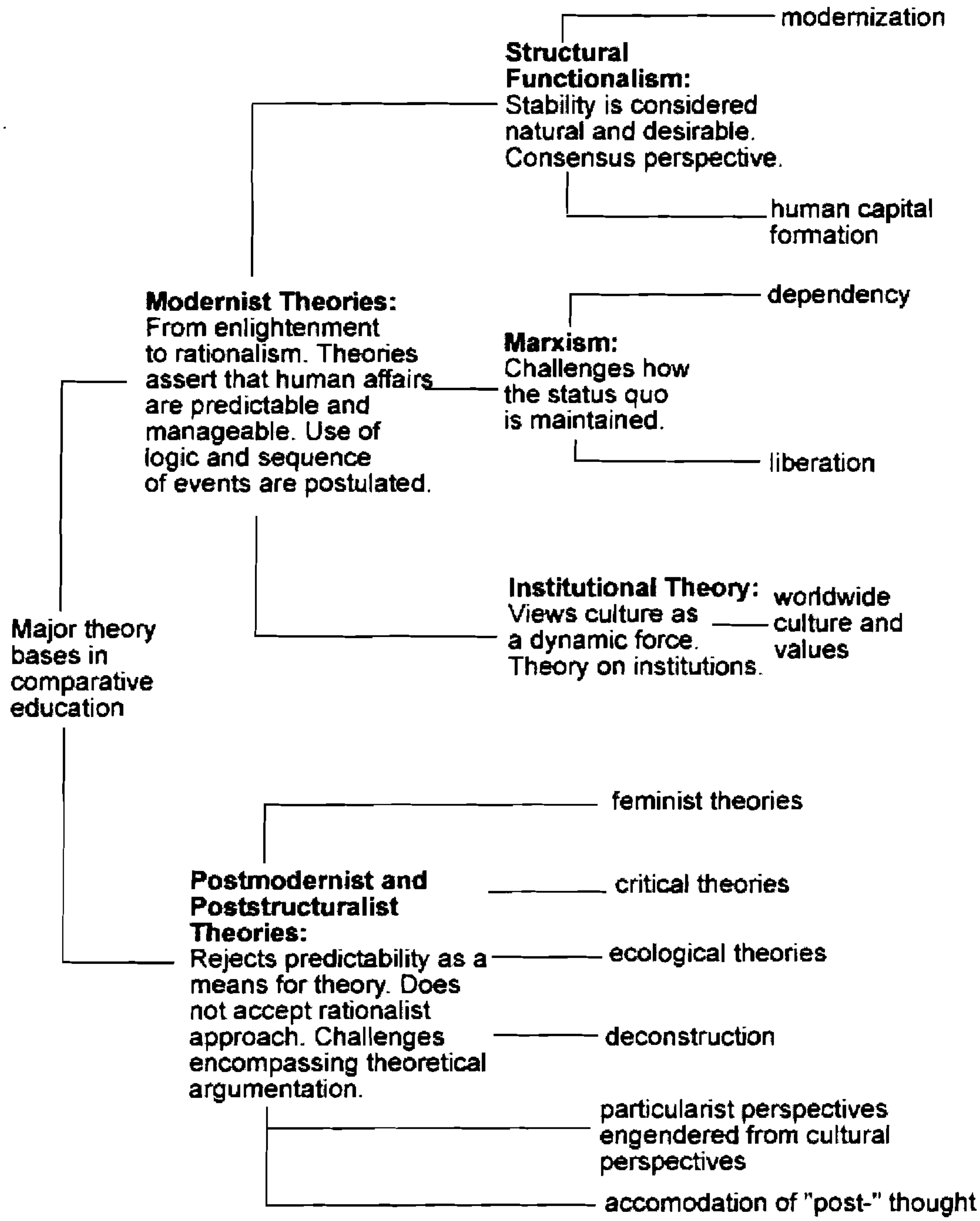
Theoretical Underpinnings for Cross-cultural Comparison in Education

The cultures and histories of particular locales arise in the context of and are intimately intertwined with broader philosophical views. Thus, before examining in detail the socio-cultural and historical contexts in México and British Columbia, we shall look briefly at two philosophical theories that may prove helpful in understanding some aspects of the development of educational thought in México and British Columbia. To situate these two theories, I have included below a chart of some major theories that have underpinned educational thought.

The two theories to which I will be referring are the Liberation Theory and the Institutional Theory. They are threaded through the comparative analysis and may provide the theoretical basis for understanding some of the similarities and differences between the British Columbia and Mexican curricula.

Figure 1.

Major Theoretical Influences in the Field of Comparative Education



Liberation Theory

The dependency theory postulates that elites in less developed countries are able to maintain the social inequalities to remain in power or to consolidate it, so as to expand their advantage to the detriment of the less privileged members of their society (Frank, 1972; Frey & Song, 1997). Liberation theory builds on this premise, and proposes that radical change in cultural, economic, and political structures is imperative to enable a positive change to occur in less developed countries. This theory postulates that change is achieved through educational endeavours that must start and conclude with the oppressed groups in the less developed countries. It is noteworthy that it was Paulo Freire who articulated the liberation theory. The goal of liberation theory is what Paulo Freire called *conscientization* or consciousness raising of the oppressed groups, which would result in an awakening, mobilization, and self-actualization (Kubow & Fossum, 2007, p. 55). As Schugurensky (1998) writes, "conscientization (consciousness-raising or critical awareness), [is] the ability to critically perceive the causes of reality" (p. 1). In terms of education, liberation theory postulates that "the teacher becomes a facilitator, the traditional class becomes a cultural circle, the emphasis shifts from lecture to problem-posing strategies, and the content, previously removed from the learners' experience, becomes relevant to the group" (Schugurensky, 1998, p. 1). In some prominent ways, liberation theorists consider education both "the means and the end of education" (Kubow & Fossum, 2007, p. 56). Freire criticized the traditional educational paradigms, noting that "the teacher is the subject of the learning process, and the learners are its objects; the role of the teacher is to *deposit* contents in the mind of the learner, as if it were a tabula rasa to be filled with information" (Schugurensky, 1998, p. 1). This practice was considered by Freire to be oppressive and unacceptable and one of the paradigms of social reproduction employed by the elites. In contrast he advocated a liberatory or emancipatory practice which was rooted in dialogue between learner and teacher and employed critical thinking and social transformation. Freire (1969) writes: *"Lo que importa, realmente, es ayudar al hombre a recuperarse. También a los pueblos. Hacerlos agents de su propia recuperación. Es, repetimos, ponerlos en una posición conscientemente crítica frente a sus problemas" (p. 50).* "What is important, really, is helping men to recover. As well the communities. To make them agents of their own recovery. It is, we repeat, to put them in the position that is consciously critical to their problems" (p. 50).

For Freire literacy was central in achieving his aim. He "claims that reacting the word cannot be separated from reading the world" (Schugurensky, 1998, p. 1). So literacy is more than the mastery of language: it becomes a citizenship issue in which people should take control of history. Freire was adamant that "the departure point of any educational process is not the world of the teacher, but the world of the learner" (Schugurensky, 1998, p. 1). According to Freire (1997) the role of the educator is to foster the conditions in which the learners enter into a deep experience between themselves and their peers and between themselves and the teachers. They enter this deep experience as "a social and historical beings, thinking beings, that are communicating, transforming, creating, fulfilling dreams, able to feel deep anger because they are able to love. To take the position of subjects because they are able to recognize themselves as objects" (p. 42). For Freire "learning is a creative adventure … much richer than simply repeating a given lesson … to learn is to construct, reconstruct, to verify so as to change, which is not able to be done without taking risk and is an adventure for the spirit" (p. 68). Liberation theory is included here because of its significant influence on education in Latin America, including México.

Institutional Theory

"[I]nstitutional theory was initially developed as an alternative to the structural and conflict arguments about education's role in society" (Wiseman & Baker, 2006, p. 5). As the worldwide educational phenomenon was becoming apparent, institutional theory emerged as an intellectual endeavour, which identified education as an institution (p. 3). Institutional theory is built on the precepts and traditions of sociological inquiry. Meyer et al. (1977, as cited by Wiseman & Baker, 2006) consider "institutions as the building blocks of any human society" (p. 4). These are part of the "institutionalized culture that creates and spreads commonly held models of the individual and the social organization (formal and informal)" (p. 4). This theory evolved from the need to understand the empirical observations of the worldwide educational changes. "Institutionalists argue that the constructed *cultural norms* of modernity—rationality, individualism, equality, progress—come to pervade institutions isomorphically, both within and among nation states" (Hartley, 2003, p. 445). The isomorphic convergence of policy in the institutions is procured through three modes: coercive, mimetic, and normative. Before exploring these modes, I owe the reader the definition of isomorphism. In Hawley's (1968) conception, isomorphism is a process that constrains and forces one group in a population to take the likeness of another group of the population when their environmental conditions are similar. DiMaggio and Powell (1983) state that institutional isomorphism takes place when "organizational characteristics are modified in the direction of increasing compatibility with environmental characteristics" (p. 149). They continue reasoning that isomorphism could be the result when "nonoptimal forms are selected...or because organizational decision makers learn appropriate responses and adjust their behaviour accordingly" (p. 149). Coercive isomorphism is achieved through incentives provided by organizations (governmental or private) if an institution adopts a desired reform, and through "formal or informal pressures ... [are] exerted on organizations by other organizations upon which they depend" (DiMaggio & Powell, 1983, p. 150). Mimetic isomorphism may be "a response to uncertainty" (DiMaggio & Powell, 1983, p. 151) and happens when policies are copied because they are readily available, have been researched or tested, and appear to be sensible, in vogue, or seem to easily fulfill a need or solve a challenge being experienced. Normative isomorphism "is a result of professionalization" and is interpreted "as the collective struggle of the members of an occupation to define the conditions and methods of their work..." (DiMaggio & Powell, 1983, p. 152). It deals with governance by providing a vehicle by which changes occur without the institution possessing the legal authority to make them happen (Hartley, 2003, pp. 445-446).

Institutional theory has three advantages. First, it incorporates culture as "a dynamic causal force in determining educational development" (Wiseman & Baker, 2006, p. 5), especially referring to world culture and the influence it exerts on formal education. It also has brought a focus on the examination of curriculum and the values it promotes through worldwide education. Institutional theory also furnishes us with a rationale for novel empirical descriptions of untheorized or yet unreported factors in education, like "the isomorphic change in school structure, curricular content, and educational impact occurring over time" (Wiseman & Baker, 2006, p. 6). Finally, institutional theory establishes the relations between worldwide education, national educations, and more local aspects of schooling. This approach allows for context and perspective to emerge, paving the way for institutional theory to formulate theory about the reasons for education in contemporary society (Wiseman & Baker, 2006, p. 6).

Furthermore, the concept of world culture enables educators to survey the "larger 'institutionalized' trends", and to situate education in the "wider cultural meanings of economic contexts" giving "legitimacy within the global community [as] the result of meeting internationally recognized standards for democratic nations" (Wiseman & Baker, 2006, p. 7). Considering education from an institutional perspective, it becomes apparent that it could be regarded as a world culture. Kamens, Meyer, and Benavot (1996) articulate that "highly institutionalized world ideologies—models of society, education, and their interrelationship—used to rationalize widespread educational expansion also provide standardized depictions for the curricular content of 'modern' society" (p. 117). This educational philosophy may help educators understand the evolving changes which are occurring in the educational front at an accelerated pace in different locales.

Chapter 3.

Socio-Cultural and Historical Contexts: México and British Columbia

Theories about the Relationship between Culture and Education in México

México has a long, interesting, and violent history. To be able to acquire a notion of the educational transformations México has undergone and to understand how its culture has influenced these transformations, Maria Teresa Yuren's model of epochal historical periods will be helpful. By epochal, Yuren (2006) uses Agnes Heller's definition as "the term…to refer to symbols and values that originated in a given historical period and that are significant in the present era" (p. 23). Yuren (2006) endeavours to employ history as a means to "understand elements that are significant for the present era" (p. 23). In her work she overlaps "educational policies that emerge from the state apparatus … in which three dimensions came into play: theoretic, regulatory, and ideological" (p. 23). She coins the term "educational projects" and defines it as the moments in history when "power relationships are modified and there are new social forces that redefine the values and meaning of the project, or when there is a change in the philosophical choices from which the representations come" (p. 24).

Her research identifies six educational projects which begin in 1821, the time at which México became independent from the Spanish colonial yoke, and became an independent, sovereign nation. In my appraisal, she misses two previous epochs, which still do exert an important influence upon México's present existence. These two epochs which I consider indispensable are the Pre-Colonial educational project (distant past–1521) and the Colonial educational project (1521–1821). Then come Yuren's (2006) six educational projects, which are: "the enlightening project (1821–1833), the civilizing project (1833–1867), ...the positivist project (1867–1917), ... the revolutionary project (1917–1939), the developmental project (1939–1988), and the modernizing project (1988–present)" (p. 24).

The Pre-Colonial Educational Project

Before the European conquest, México was inhabited by many Mesoamerican Indians, who were engaged in conflict which emanated from the desire to control and rule rival groups. It is note-worthy that many of these groups developed, in Gutek's (2006) words, "sophisticated and intricate cultures" (p. 305). Enrique Dussel (1980) describes the Mayan educational system that was "undertaken by every family, not only by the kings and nobles....but by every family" (p. 18). This educational system was "proverbially efficient" with respect to the "fulfilling of the sexual rules, the veracity of the words, and the respect for the property of others" (p. 18). The Aztecs had a stratified society in which the ruling class enjoyed a religious education that "emphasized astronomical calculations, calendar reading, and ritual" (Gutek, 2006, p. 305). As we can see, this educational project was based on the social and religious beliefs of the individual Mesoamerican Indian societies. In a subsequent chapter, I shall discuss the possible link of this pre-colonial era to the modern day educational philosophies espoused in México.

The Colonial Educational Project

Then came "upon the Ameroindian cultural world the conquest by the European" (Dussel 1980, p. 18). In México this conquest came at the hands of the Spanish *conquistadores* who were in search of quick riches in the form of gold and silver. In 1521 México became officially a Spanish Colony, a cruel, vicious rule that lasted until the end of the independence war of 1821. This epoch was influenced and marked by the Middle Ages philosophy, in which monarchs and rulers were said to have divine appointment. Therefore, what they decreed was followed with little or no objection. This philosophy also espoused the belief that the divinely appointed monarch should conquer and proselytize the world.

From the time the *conquistadores* arrived in México, they ruthlessly killed and decimated the indigenous population without mercy. Stannard (1992) describes graphically how the Spaniards killed and pestilence decimated the indigenous people: "... overall in central México the population fell by almost 95 percent within seventy five years following the Europeans; first appearance—from more than 25,000,000 people in 1519 to barely 1,300,000 in 1595. And central México was typical" (p. 85). Four catholic missionary groups, the Franciscans, the Jesuits, the Dominicans, and the Augustinians came from Spain to proselytize the *heathen creatures*. San Bartolome de las Casas, one of these missionaries, fought hard with the ruling *conquistadores* to have the Indians classified as human beings and not as beasts of burden. During the Middle Ages, the only social group that had the power to limit the monarch's edicts was the church leadership. Gutek (2006) states that the missionaries sought to "shelter the Indians from the ruthless exploitation" (p. 305) by the *hacendados*, who were the occupying military officers who had been granted large estates or *haciendas* by the king of Spain. After the atrocities that Spanish conquistadores had committed, they used the indigenous women as sexual pleasure objects. This is quite a contrast to the French Canadians who intermarried with the native population. From the sexual exploitation the *mestizo* was born. Dussel (1980) describes the cultural vicissitudes of the offspring of *donia Malinche,* Cortes' lover, who "gave herself voluntarily to the Conquistador, but who as soon as she was not useful anymore, *forgets her*" (p. 20). The *son*, who is born from this relationship "does not forgive his mother and abandons her to seek his father" (p. 20), becomes a cultural metaphor in which the "culture ignores itself as dis-tinct, that has not been yet dis-covered" (p. 20). This period also saw the emergence of distinct social groups. The Spanish first generation immigrants were the elite; then the *criollos,* who were the descendants of the Spanish born in the colony who did not intermarry, formed the upper middle class, and then the *mestizos*, and Indians, who were the serfs. During this time-period, education was in the hands of the Roman Catholic Church. This educational system had two main functions: to educate the upper class male progeny according to the dominant "ecclesiastical and patriarchal rubric" and to Christianize the native population (Gutek, 2006). It created the first *colegio mayor Santo Domingo* in 1538 and the first University in México in 1553 (Dussel, 1980).

Bradley Levinson (1999) summarizes the cultural formation of this era as "hierarchical holism" which he defines as:

> a social system in which proper relations of authority, rooted ultimately in ecclesiastical and patriarchal imperatives, sustains the organic hierarchy of the "body of God" and his earthly appointments...[which] also draws from the hierarchical model of the largest indigenous pre-Hispanic polities. (p. 137)

We will try to find the reflection of this era in our present day educational system in México in a later chapter.

The Enlightening Project

This epoch began when the independence war with Spain had concluded. This era would be modeled after the European Enlightenment philosophy, entwined with a commerce based economy with pre-capitalist foundations. The state became a constitutional republic in which "women, illiterates, and the poor were excluded from citizenship" (Yuren, 2006, p. 25). There existed a rivalry between the conservatives, who sought to maintain their privileged status, and the liberals who "were influenced by Enlightenment and continental European ideology, especially French liberalism with its emphasis on private property, individualism, and rational progress" (Gutek, 2006, p. 306) as well as formal equality before the law. Autonomy was the hallmark of this period. Yuren (2006) describes the educational part of this project as one in which education "appeared as a process having consistency in the instruction and formation of those who would continue to forge the new nation, promote the public moral, and the exercise of citizenship" (p. 26). In theory, they instituted a free, uniform public education for all citizens that would foster the learning of all necessary things.

The Civilizing Project

In 1833 the church's dominance over education began to erode when congress gave the "executive power the authorization to organize public teaching in México City and its federal territories" (Yuren, 2006, p. 26) and at the same time the "religious foundation of the University of México was abolished" (Gutek, 2006, p. 307). This was a turbulent era with internal fighting between what Dussel (1980) calls the "two parties, the retrogressive and the revolutionary, the conservative and the progressive, each of which is highly represented by a civilized city by diverging modes nourished by different fountains" (p. 22), and an independence movement in Texas fostered by the United States of America which finally annexed this sovereign territory. This sparked disputes about the border, which culminated in the US-Mexican war which took place from 1846 to1848. México lost this war and as a result, the Mexican president Santa Anna had to concede almost half of México's territory to the US. After Santa Anna's resignation, Benito Juarez, the only indigenous person in México to become a president, was elected. Benito Juarez had a strong sense of social justice that possibly was inspired by his religious beliefs and the French Revolution ideology. It is interesting to note that he held Episcopalian beliefs in a predominantly Catholic society. He separated the state from the Catholic Church and diminished the power of the military, both of which still enjoyed great power over all social and political structures, as well as great privileges. This brought a backlash from the conservative forces in México, which continued the infighting in the country. In1861, Benito Juarez proclaimed a moratorium on foreign debt payments, and México was promptly invaded by Great Britain, Spain, and France. The first two settled and left the port of Veracruz, but the French sent their army in under the command of Maximilian von Hapsburg under the auspices of Napoleon III. The invasion ended in 1867 with Maximilian's beheading. Nevertheless, this invasion brought to México French educational ideas that were readily integrated by the Mexican upper classes (Gutek, 2006, p. 308).

Despite all these conflicts, the Mexican government managed to continue its educational journey. According to Yuren (2006), the educational project had to choose between "civilization and barbarism". This conception clearly points to the modernist premises of logical reason that asserts that human affairs are predictable and manageable, as it uses logic and the natural sequence of events. They chose civilization. Nevertheless, until Benito Juarez's time, "educational institutions served the needs of México's ruling elite" (Gutek, 2006, p. 307). Juarez's government brought about real educational reforms through which, in Yuren's words, "they tried to overcome their shameful past—indigenous and colonial—by emulating advanced countries, such as the United States and France" (p. 26). Following the liberal tenets, education was mandatory and free for elementary public education. It became utilitarian, endeavouring to obtain the maximum amount of good for the majority, including moral and civic instruction and training, fostering the scientific enterprise. This project also sought to give education to women and native people. Nevertheless, its universality was illusory, as it was not put into practice, and lost its "social and dialectical validity" (Yuren, 2006, p. 27).

The Positivist Project

This epoch is characterized by the positivist philosophy espoused by México. In the political arena, we find Porfirio Diaz becoming the sole ruler aided by an oligarchic military and territorial strong men. He was a cunning and ruthless leader who ascended from humble origins (Spanish father and Mixtec mother) through the army by winning many important battles in the Mexican—US war and the liberation war from the French invasion. On the economic front, Diaz worked hard to modernize México by fostering science and technology. This held true to the modernist theories that were evolving in the Western World, which rested on the scientific enterprise to advance technology. Diaz catered to the *hacendados* or rich landowners and financed most of the development through the exports of raw materials. He also promoted industrialization in the cities, though was uncomfortably conscious of the growing economic influence of the United States in México.

The educational vision for this time-period was freedom, defined as "a scientific, religious, and political emancipation" (Yuren, 2006, p. 27). This entailed the unified "development of physical, intellectual, moral and esthetic faculties" (p. 27). The tenet of free public primary education was supported and expanded by establishing national standards and secularization of education was furthered by restricting the church's influence over education. Nevertheless, less than 25% of the school age population attended classes due to the exploitative structures established by the oligarchic elites. This repression and exploitation of the peasants combined with the dictatorial ruling style of Diaz eventually led to a mass revolution against the established privileged group. This insurgence in 1910 was led by Ignacio Madero, a Berkley educated upper class man, who intended to have Diaz share his power amongst a greater circle of people (Vaughan, 1975).

The Revolutionary Project

The revolutionary movement concluded and culminated in the Constitution of 1917, a document which would be foundational for the vision México embarked upon over the next 20 years. In Dussel's (1980) words, "the revolution affirms anew the mother, ... the Latin-American culture which has been gestating for five centuries, the forgotten, negated popular culture..." (p. 23). México's politics turned to nationalism that tried to bring social rights to all. Stacey (2002) describes this new nationalism as glorifying "the country's indigenous past and its contemporary political leaders" (p. 571). Through the shift in the ideological mindset of the time, for the first time in Latin America, statues of pre-colonial heroes like Cuahutemoc, Moctezuma and others were erected which celebrated the splendour of the Pre Columbian civilizations and achievements (Stacey, 2002, p. 571). México became a federal democracy headed by the president, who under the slogan "effective suffrage, not reelection", would be elected every six years (Yuren, 2006, pp. 28-29). The social ideals still strongly resembled the French Revolution ideals. The economic structures were semi-corporate in which the state became an auditor, arbitrator, and employer. During this epoch, the number of women employed by industry declined to half of what it had been before the revolution (Vaughan, 1977, p. 150). It also emphasized national economic development through stressing economic modernization.

On the cultural side, this epoch was characterized by a national sovereignty coupled to an anti-foreign sentiment, which developed into an anti-imperialist and protectionist stance. During this time-period four philosophical forces competed for acceptance: the liberal reformists who worked towards political liberal reform, the social reformists who sought agrarian reforms, the nationalistic current which defended liberal institutions and a strengthened central presidential system, and the traditional current which was counterrevolutionary and tried to undo the revolutionary accomplishments (Gutek, 2006, p. 309).

In the educational field, the revolutionary project stripped the Roman Catholic Church of its last vestiges of influence, forbidding religious instruction and the participation of the clergy in schools. "Only through the agency of a 'strong and expansive state' could Mexican educators hope to overcome sharp social divisions and forge a modern nation...[justifying] a strong federalization of popular education"

(Levinson, 1999, p. 142). Education would be free and compulsory, though the latter was utopian, as many of the few school buildings had been damaged by the revolution, and there were very few or no schools in the rural areas. There was great emphasis on making the population literate, and companies, mines, and the agro-business were required to school their workers. The educational goal became to instruct citizens with a Mexican national identity emphasizing a strong sense of social justice, evolving from the redemption of the oppressed to dignified living, then to guaranteeing individual and social rights. The ideal was to educate citizens who would bring glory to the nation through hard work, delivering people from ignorance, creating linguistic and cultural identity, bettering the lot of the Indians and peasants, setting individualism aside, and thereby forming a new society. Therefore, emphasis was placed on a curriculum that accentuated México's history and geography and on technical, vocational, and practical programs (Yuren, 2006, Gutek, 2006.). At the end of this project, México turned mildly leftist under the presidency of Lazaro Cardenas who stressed social equalization. This president saw the merits of Marxist ideas, but was cognizant of the social and political constraints that did not allow him to promulgate radical reforms in his country. Therefore, in education, the curriculum exalted the virtues of a socialist society.

The Development Project

The new president Avila Camacho ushered in this epoch in 1939, who reestablished the liberal rather than the socialist ideology. There were calls for more equality of opportunity and socioeconomic mobility. This era initiated the development of modern industry and technology in México through capitalist development with a nationalistic sentiment, thus espousing modernism. The government took pride in guaranteeing social rights, and consolidated its central power through concession, agreement, repression, and negotiation. The political forces underwent a reorientation due to the foreign relations constraints and the fallout of the cold war through the proximity to the United States and Cuba. There were revolutionary movements of trade unions and students, like the movement of '68 that culminated in the massacre of Tlaltelolco. Dussel (1980) attributes this occurrence to the revealing "of a past we believed buried but which is alive and erupts within us in public, which appears masked and armed, we don't know who it is, but it is destruction and vengeance" (p. 23).

The educational project of this era is based on the idea of economic development as an imperative for peace and happiness for all. It has a two-fold objective, to control the revolutionary educational project and to change the educational focus so as to foster economic development. Educational planners increased their attention to secondary and higher education during this period. This educational project would be dominated by the human capital *corrientes.* Education sought to promote the values and habits that would be congruent with modern society. They augmented it with the notion that through the expansion of production and technical capacity, wealth would be generated which would help reduce the social inequalities and improve the quality of life for many. The better preparation and education of the young generation rested upon the notion that education is synonymous with having skilled workforce preparedness.

The Modernizing Project

With the emergence of the economic crisis in 1982, Mexican policies began to shift towards the neoliberal economic policies of privatization and free trade. In this manner México slowly and deliberately entered into globalization. Productivity and efficiency became the imperatives that were superimposed on all objectives stated in official documents and which began to eclipse the formal goals of equality and democracy.

The educational project was characterized by competitiveness, as mechanisms were established which suffused competition for obtaining resources. Everything began to be evaluated, that is, schools, programs, organization, productivity, etc., to qualify for financing. The impetus was to improve the quality of education, raise the level of schooling among the general population making secondary education compulsory, increasing the participation of the community, and gradually decentralizing the educational system. This decentralization is described by Maria T. Tatto (1999), as having a "distinct approach to improve the effectiveness of the educational system", as it is "devolving power and decentralizing the educational system in a centrally controlled and hierarchical fashion" (p. 281). Rangel and Thorpe (2004) state that the educational "objectives appear to be the same and are congruent with the international tendencies" (p. 570). These realities may point strongly to what the institutional theory postulates. In the 1990s, the privatization and rationalization of costs continued to be advanced, which had the consequence that many professionally trained students could not find jobs and entrepreneurs without education could make more money selling tacos. This reality has had a negative effect on the educational morale of students and may explain the information portrayed by the economist (2007), in which Mexican students scored at the lower end of the Organization for Economic Co-operation and Development surveyed countries. Altogether, these changes also brought an increase in poverty. Thus, México had fully joined globalization. The educational project, which originated with UNESCO, now stressed life-long education, embraced the discourse of training, self-training, and inter-training in an existential version influenced by Heidegger, Habermas, and Levinas.

In 1993 the new Education Law, *Ley General de* Educación, was promulgated, and still is in force (Yuren, 2006; Gutek, 2006; Levinson, 1999). These changes imposed by the new educational law bear the influence of Freire and the institutional theory in a readily recognizable manner.

Theories about the Relationship between Culture and Education in Canada

Using Yuren's (2006) epochal historical periods we can delineate seven epochs in British Columbia. The first would be the Pre-Colonial Educational Project (distant past-1790), the second project was the Colonial Educational Project (1790-1871), the third project was the Imperial Educational Project (1871-1898), the fourth project was the Democratization Educational Project (1898-1917), the fifth project was the Industrialization Educational Project (1917-1946), the sixth project was the Developmental Educational Project (1946-1980), and finally we have the Modernizing Educational Project (1980-present).

The Pre-Colonial Educational Project

The Pre-Colonial Educational Project is composed, like the Mexican one, of many First Nations Peoples, who had complex hierarchical societies based on the abundant natural resources they harvested for their survival. Some of these nations were patriarchal and some matrilineal. Some nations were fierce warriors; others were peaceful and only used warfare for defence. Barman (2004) describes that "complex trading relations often developed between the different tribes and bands, leading to varied local economies" (p. 17). Through the pre-colonial times many nations warred with each other re-claiming and losing territory: at times they had pacts and alliances, at times there was intermarriage so as to consolidate. Barman (2004) states, "rivalry over control of trade goods and routes sometimes erupted into conflict and open warfare" (p. 17). The education of the offspring usually was conducted through the oral tradition, the fabrication of utensils and weaponry, the building of red cedar canoes, long houses, and on the coast, the totem poles. Hampton (1995) describes, "each Indian nation had its own forms of education. Generally, these traditional Indian forms can be characterized as oral histories, teaching stories, ceremonies, apprenticeships, learning games, formal instruction, tutoring, and tag-along teaching" (p. 8). Until British Columbia's last curriculum, there seemed to be little connection to this past history; nevertheless, we shall endeavour to show in a later chapter some connections for Aboriginals in the present intended curriculum.

The Colonial Education Project

This project began when the Spanish claimed what later became part of coastal British Columbia as their colony. This was the culmination of many exploration expeditions that originated in San Blas, Nueva Espania (today's México). At Nootka, the Spanish explorers had built a fort, which became the focal point of controversy between Spain and England and almost precipitated both countries into war. Spain eventually abandoned British Columbia under the terms of The Nootka Convention in 1795, after which it lost complete influence over the region (The Free *Online Encyclopedia of Washington State History*, 2006).

Later the English explorers reached British Columbia by land and, by 1821, it was administered through several trading posts by the Hudson Bay Company. This company had the mandate to trade with the Aboriginals, but not colonize them in the violent conquering way that the Spaniards used in Latin America. Intermarriage was discouraged, though many factors of the Hudson Bay Company Forts did have relationships with Aboriginal women with whom they procreated offspring. Many of these women and children were abandoned when the factors moved back into *civilization*. Nevertheless, these lands were considered part of the British Empire and were subject to all the British laws and rules. Fort Victoria was established in 1843 to assert British rule over the western lands, as the expansionistic ambitions of the United States were claiming the whole Oregon Territory. This dispute almost precipitated war between the two neighbours, but was settled through the Washington Treaty because the United States was involved in the Texas war with México. So the 49th parallel became the official recognized boundary between the United States and Canada, with the whole of Vancouver Island remaining British domain. The British established the Colony of Vancouver Island which also encompassed the mainland. In 1850 the first aboriginal land treaties were signed, but at the end of 1854 only 14 treaties had been formalized totaling 3% of the island's area. At that time the treaty process was abandoned because it was deemed too expensive and unnecessary by the British crown. In 1856 the first elected assembly was established (Sisson, 1959).

When the gold rush began in 1858, a separate colony was established in the mainland to ensure that the United States would not claim this area due to the heavy influx of American miners. By 1866 both colonies were amalgamated into one because of the Gold Rush decline, which severely shrank the governments' revenues. In 1867 four colonies of British North America became the Dominion of Canada under the North American Act. One day after the proclamation of this act the United States procured Alaska by buying it from Russia. In the following years there was pressure exerted on

British Columbia by the United States to make an economic alliance between Alaska, British Columbia, Washington, Oregon, and California. In the light of the stagnant economy, high public debt, and few settlers, Governor Musgrave and newspaper man Amor de Cosmos campaigned hard for British Columbia to join confederation. After lengthy negotiations and the promise of a railroad to link Ottawa with Vancouver, British Columbia joined confederation in 1871. At the time, the province had 32,000 inhabitants of various ethnic origins (Sisson, 1959).

The first educational enterprise was conducted by the Christian churches, who conducted this noble duty in a non-sectarian or partisan way. Sisson (1959) writes that in 1861 "John Robson ... was to become a foremost champion of popular and constitutional government … and from the first he insisted that a system of public education should be set up and that it should be non-sectarian in character" (p. 375). This was to take the form of an "inter-denominational system of education upon a broad and liberal basis" (p. 375). This era was guided by the Enlightenment thought of the time which still was heavily influenced by the Christian Protestant tenets of the Church of England and other Protestant factions. The first school act in British Columbia was enacted in 1865, an "*Act Respecting Common Schools"* (p. 378) in the Vancouver Island Colony. In the mainland colony the governor, Seymour, did not establish an educational act as he "would not for a moment have considered any act which deprived parents of all responsibility for the education of their offspring" (p. 378). Once the two colonies were united, they got a new school act in 1869 that was subsequently amended in 1870. The total school population numbered only in the hundreds.

During this epoch, British Columbia joined confederation, and came under the jurisdiction of the British North American Act, which made Aboriginal peoples "wards" of the government. As such Aboriginals were eligible for federally sponsored schooling. Barman (1995) explains that the Act "combined economics with racism" (p. 58). As at the time when this was enacted, Aboriginal people still inhabited most of the land newcomers wanted to settle. "The rhetoric of the day, premised in biological determinism, assumed that persons who were non-White were inferior by virtue of their race alone and so incapable of using the land to best advantage or otherwise determining their own destiny" (p. 58). Initially education was seen as a way to *civilize* the Aboriginals and to "amalgamate them into the general community" (p. 58). To achieve this goal, "the residential school became viewed as the best means to achieve that goal, by separating the young from their families and thereby from the old ways" (pp. 58-59). This historical background still bears its imprints in the education of Aboriginal children in our province.

Imperial Educational Project

This epoch was characterized by the colony endeavouring to find its new status as a province of Canada's Dominion and to learn how to govern with the new privileges and responsibilities. Under the new political arrangements, the first Legislative Assembly with 25 members was elected, "the Canadian Governor General, on behalf of the British Crown, appointed a B.C. Lieutenant-Governor ... who then called upon one of the elected Members of the Legislative Assembly (MLA) to form a government" (British Columbia Legislative Assembly, 2005, p. 6). The first Premier resigned within a year, due to a non-confidence vote, thereby validating the existence and principles of responsible government. The second premier, De Cosmos, ensured that the crown would not meddle in the internal affairs of the legislature by excluding the Lieutenant-Governor from all legislative business. During this epoch, the elected representatives were independent, and usually represented personal interests, rather than the public good.

On the educational scene, 1872 ushered in the "province's first non-denominational free public elementary school system..." (British Columbia Legislative Assembly, 2005, p. 7). This act reaffirmed the non-sectarian policy in schools and "the clergy were no longer free to use public property before or after school hours to disseminate their particularities in dogma" (Sissons, 1959, p. 380). Consistent with modernist thought, education became very important. Johnson (1964) eloquently describes this mindset: the objective of the Public School Act of 1872 was "to give every child in the Province such knowledge as will fit him to become a useful and intelligent citizen in after years" (p. 45). In the next six years, 45 school districts were set up across British Columbia. In 1873, school became compulsory and Fleming and Raptis (2005) recount that "public schools are entirely a new feature; and parents themselves, in some instances require being educated" (p. 175). In 1876, a head tax was imposed on every male inhabitant of the province to pay for the increasingly costly school system. In the same year the first high school in the province was established.

This educational project sought to give "all individuals with different creeds" and "minority groups ... equal rights under the law, equal protection from the state in those rights" (Sisson, 1959, p. 387). Nevertheless, the societal biases and prejudices were strongly present and Aboriginals, Chinese and women were not allowed to vote and did not enjoy the same privileges as the British or French descendants. For example, Chinese workers were paid only half the wage that Caucasians received for work in railroad construction. The transcontinental railroad did arrive in Vancouver in 1886, the first health act was enacted in 1888, and the construction of the parliament buildings was begun in 1895. This was decisively an epoch of nation building under the umbrella of the British crown and in keeping with the modernist imperatives.

During this educational project, educational responsibilities were put squarely on the provincial governments. They were responsible to bear the cost, "organizing, managing and inspecting the operations and practices of a system maintained at the local level by elected boards of trustees" (Fleming & Raptis, 2005, p. 176). Naturally the government became very interested in public accountability as it had to prove that the educational system offered both quality in education and efficiency in its operations. This was a logical consequence of modernist rational thought, which posited that human affairs are predictable and manageable. "Schooling was equated with progress, ... the task of redeeming society, or 'salvaging the lowest classes', ... 'could not be left to chance'" (Fleming, 1991, p. 187). There were various methods of oversight established, the first being the collection of information from schools coupled with inspections. There were also exams administered by the provincial authorities. Statistical analysis became prominent in this era of the scientific enterprise, but data collected just entailed number of students who attended school every day.

Concerning the education of aboriginal children Barman (1995) gives the following account: "Since young Indians were not yet legally compelled to attend school, they had to decide themselves if they wanted a formal education" (p. 339). Aboriginal children had very few possibilities for formal education. "According to the Department of

Indian Affairs, only 'in few instances' across Canada could 'Indian children attend the white children's schools'" (p. 340). The reality was that "a very marked prejudice exists, I might say, generally among the whites against association with Indian children" (p. 340). Concerning Aboriginal education, during this period many Aboriginal students went to residential schools. Those who were able to go to public school were, in Barman's (1995) words, "prohibited by law from going beyond the elementary grades" (p. 64).

The Democratization Educational Project

This era was ushered in by the fact that the political landscape in British Columbia became unmanageable. The independent elected representatives were unable to garner sufficient support from the legislature to govern; there was constant infighting and bickering among the elected representatives. This period lasted till 1903, during which time two premiers were dismissed by the Lieutenant-Governor, who in turn was replaced by Prime Minister Laurier, and then another premier was dismissed. In 1903 the province had the first election involving political parties, following the example of other political jurisdictions in Canada. This was, as well, a period when immigration increased, fostered by an aggressive immigration policy established by Laurier. During this time British Columbia's population increased from 162,000 to 464,000 inhabitants. The federal government had established a policy of inter-provincial trade, in which British Columbia also partook. This continued to foster the desired political and social stability through rational change. During the First World War, British Columbia had the highest per capita enlistment in Canada—0.9% of the population went to war.

This educational period saw accountability measures refined throughout the province. Information about all students in the school was collected and forwarded to the education department in Victoria. This had the aura of scientific study, which so dominated this era's philosophy. By the turn of the century, British Columbia's "schooling was unified, monopolized, standardized, professionalized, and controlled by the state" (Fleming, 1991, p. 187). The information collected was expanded to include students' grades in all "branches of study...with marks of deportment, and finally, the pupil's rank in class" (Fleming & Raptis, 2005, p. 178). In 1911 the provincial examinations were revamped and two sets put together, one for rural and the other for urban students. During this period "a very rapid expansion of secondary education" (Johnson, 1964, p. 61) occurred. Many of the "high schools springing up throughout the interior were one-room, one-teacher schools" (p. 62). Many of the high school courses included technical subjects, manual training, domestic science, agricultural education, and physical education (pp. 65–68).

The Industrialization Educational Project

After the war, Canada experienced a spiralling expansion of business. In particular, technical and industrial advances helped elevate the standard of living in Canada. British Columbia also enjoyed the benefit of this era. This province also had a brief episode of prohibition, which was abolished after two years because it was nearly impossible to enforce. In 1917 British Columbia gave women the right to vote, and in 1929 the first social assistance legislation was introduced. Simultaneously, by the end of the war, "government—through the Education Office—had moved into areas to do with training, employment, and social welfare that historically had been family matters" (Fleming & Raptis, 2005, p. 190). In 1923, the federal government prohibited Chinese immigration. In 1929, the great depression started and every aspect of the province's economy was adversely affected. By 1931 the province had a 31% unemployment rate and went through a period of civil unrest. The government tried to mitigate the hardship and created relief camps where the unemployed were put to work on public works. In 1934 the first minimum wage was imposed but unemployment still was the cause of civil unrest which arose because of the social conscience advanced by Marxist and social Christian thought. The advent of World War II ended the depression and British Columbia enjoyed a great influx of workers to the coast. For the first time women were welcomed in the labour force. The economic boom brought tranquility in the political and social arenas and the Marxist influences waned from the majority of the public's mind. Instead modernization became more prevalent, and influenced political decisions in the development of the industrial complex.

On the educational front, centralized oversight of the expanding system flourished. "The emergence of a diversified economy ... demonstrated that the grade one to eight curriculum was insufficient for business purposes and the classically based high school curriculum was increasingly irrelevant" (Fleming & Raptis, 2005., p. 184). Therefore, the educational system adapted to what the "new society" needed and the methods of education began to change to keep pace with the modernization theories. "In educational terms, progressivism meant democratizing and modernizing schooling, as well as broadening the programmes and the functions of schooling" (Fleming, 1991, p. 189). Among the changes ushered in was standardized testing. Johnson (1964) states that "further and fuller curriculum reforms were to be shaped under the leadership of Dr. Weir himself" (p. 112). The curriculum was lauded as "to be the most up-to-date in Canada" (p. 113). With Dr. Weir as education minister, Sutherland (1995) writes that administrative reforms were instituted in which "the province standardized the curriculum and the time allotments for each subject, adopted the notion of the junior high school, eliminated high school entrance examinations, tightened standards for admission to the Normal schools and promoted school consolidations" (p118). During this time the government had two further objectives, "to sort and classify students in the interest of making instruction and organization more efficient—two objectives which...spoke to the order, rationalism, and scientific preoccupation of the progressive mind..." (Fleming, 1991, p. 189). John Dewey's theories became accepted in British Columbia's educational circles, in which "Dewey's dictum that education should not constitute 'preparation for life' but' life itself'" (Fleming, 1991, p. 189), became theoretically accepted. Nevertheless, in the classroom, Sutherland (1995) posits that "education had become formal" (p. 119), which meant that teachers still drilled students in the old fashioned pedagogy. This resistance to change, Sutherland (1995) charges, was due to the lack of "appropriately educated and trained teachers and appropriately sized classes" (p. 119). During the depression years rural schools had a very difficult time because these roadside schools were "characterized, in many cases, by unpaid inexperienced teachers and hungry children, who sometimes, had little more than Eaton's mail-order catalogues as primers for reading" (Fleming & Raptis, 2005, p. 189). By 1939, C. B. Conway was hired and became "an agent of modernization. His statistical expertise and experience in developing standardized and other forms of tests promised a beginning of a more rational and enlightened system for evaluating and managing the performance of provincial schools" (Fleming & Conway, 1996, p. 295). In fact, British Columbia became the first province in Canada to have an educational research bureau. By 1939 British Columbia had over 120,000 students and more than 4,000 teachers (p. 301).

At the beginning of this epoch, Kuran (2000) indicates that Aboriginal children between the ages of 7 and 15 were mandated to attend school, mostly residential schools.

The Developmental Educational Project

The post war era saw a social change in Canada. In British Columbia, the first sales tax was introduced to pay for social security. As well the first Hospital Insurance Act was introduced and, in 1954, was transformed, so it would be paid by the public purse through an increase of the sales tax. During this epoch minorities like the Chinese, Aboriginals, Japanese, Hindus, Doukhobors, Mennonites and Hutterites, which had been discriminated against in the past, were enfranchised. During the W.A.C. Bennet era, British Columbia expanded its infrastructure and enjoyed a relatively peaceful and prosperous time. At the end of this epoch, British Columbia steered back into a socialist minded government.

In the educational project, this epoch saw a rapidly expanding educational system with an increase in the student and teacher populations. At this time, "the Canadian public school was judged by government and the public to be an institutional success" (Fleming, 1991, p. 191). Between 1947 and 1967 the student population almost tripled and the teacher-population almost quadrupled (Fleming & Conway, 1996, p. 304). This propelled continual and intense provincially mandated "testing to assess scholastic standards in British Columbia" which showed by 1947 that "in general students in this province were farther ahead in reading ability than their counterparts in America" (Fleming & Raptis, 2005, p. 187). Nevertheless, Dr. Conway "was quick in scolding the teaching profession for accepting low standards...[and] castigated provincial teachers for the poor showing of students" (Fleming & Raptis, 2005, p. 189). This might have been the result of some harsh critics in the 1950s that "condemned public education for its anti-intellectual tone, its dominance by professional educators, and its often undemocratic method in preparing and selecting pupils for careers" (Fleming, 1991, p. 192).

The 1960s brought changes to the social needs for higher education and the University of Victoria, Simon Fraser University and the blueprint for the community college system were established (Fleming & Conway, 1996, p. 308). Some other changes are described by Fleming (1989) in the following terms: "A century of government domination in British Columbia schooling had created a bureaucratic ruling class…who were now under siege … beliefs and values, as well as the legitimacy of long-standing institutions, were being questioned as perhaps never before" (pp. 60-61). As Fleming puts it "general intellectual and social climate that held that all things were possible, caused governments at all levels to mount ambitious programmes designed to reduce social and educational inequities previously ignored…" (Fleming, 1991, pp. 192-193).

From 1972, when the New Democratic Party was elected, the British Columbia educational system experienced many deep changes, both in philosophy, as well as in its structure of organization. Pressure groups forced government officials to respond to "equity and access issues ... Pressures from these constituencies and others—including women and various ethnic and minority groups …" (Fleming, 1991, p. 193) besieged the educational establishment. These constituencies demanded that the government change the focus of the education system from "the superintendent, the principal, and the teacher ... to center ... around the teacher, the parent, and the child" (Fleming & Conway, 1996, pp. 309-310). At the other end of the spectrum Barman and Sutherland (1995) call our attention to the fact that part of British Columbia's society "became more conservative with a concomitant demand on the part of parents that the school system reduce its diversity and increase its accountability" (p. 420). Curriculum and assessment were changed; certification of high schools was transferred to local school districts and "graduation requirements were gradually relaxed to allow a more formative than summative approach to assessment" (Fleming & Raptis, 2005, p. 193). The British Columbia Teacher's Federation (BCTF) gained power and social acceptance. It was able to convince "parents and the public that 'input measures' such as higher salaries for teachers, smaller class sizes, and other improvements in learning conditions were more salient and credible measures of educational quality than the standardized measurement of student performance ... higher thinking, creativity, and love for learning defied measurement by standardized tests" (Fleming, 2003, p. 218).

In 1969, Kuran (2000) tells us that the partnership in the residential schools between the government and the churches ends and the federal government takes full control of the schools. By this time, 60% of Aboriginal children are enrolled in the public school system.

The Modernizing Educational Project

This epoch began with Canada's Repatriation of the Constitution under the Trudeau mantle. It ushered in what R.I. Martin (2003) calls an era of "judicial supremacy ... in which judges behave as if they possess unlimited power and are not subject to any legal constraints" (pp. 6-7). In British Columbia this had the effects of curtailing Van Der

Zalm's political career and resulted in the introduction of the Land Claim process by the First Nations who sought to reclaim their lost territories which they never had legally ceded to the crown. This fact alone has had economic and social implications for this province, as issues about the rights of First Nations are still being determined by unelected provincial and federal judges. The province experienced a shortage in revenue that was solved by the Van Der Zalm government by introducing a restraint program which later led to "board resistance, and in some instances, open rebellion against provincial authorities" (Fleming, 1989, p. 74). During this era, NAFTA also came into existence. It has not lived up to its expectations, as British Columbia has found out by the United States actions, like the imposition of tariffs on lumber. Nevertheless, this economic treaty has propelled us into the globalization era. In the latter part of the 1990s, neo-conservative views emerged "which favoured a more restrained approach to government's role in public and private life and much greater emphasis on measuring the 'outputs' achieved by public spending" (Fleming, 2003, p. 225). Under Premier Campbell's government, the globalization imperative took the form of the rationalization of resources and massive lay-offs in the civil service, which also affected education at all levels.

This educational project began with "an ambiguity about 'who should govern what'" (Fleming, 2003, p. 227). British Columbia was experiencing a recession in the resource industries, "which greatly reduced provincial revenue while public sector costs, particularly in health care and education, continued to mushroom" (Fleming, 2003, p. 227). In 1983 the last residential school in Tofino closed (Kuran, 2000). Local districts were given authority over senior administrative appointments, thereby changing the organizational character of the Ministry of Education. This forced the provincial authorities "to devise new ways to govern the system without a tangible administrative presence" (Fleming, 2003, p. 222). In 1988 a Royal Commission on Education was conducted by Barry M. Sullivan which culminated with the Year 2000 report. Barman et al. (1995) describe that this report emphasized, "education is a lifelong process ... not limited to an institutional setting" (p. 422). This concept "did not capture the public imagination" (p. 423). In the beginning of the 1990s, the Year 2000 ideas were quietly pushed aside, and the then Premier M. Harcourt "committed the Ministry of Education to putting greater emphasis on 'the basics' and job related curriculum, giving parents a set of standards against which to measure their children's performance..." (p. 424). In the 1990s the tug-of-war between the civil service and the political domain was evident in that the education minister's office became an "organizational carousel in which few elected or appointed officials held seats for long" (Fleming, 2003, p. 234). There emerged discontinuity with the "major ministry restructuring every two years and episodic downsizing ... [because] schooling had become too large a public investment and too large a political issue to be consigned to the care of civil servants ... " (Fleming, 2003, p. 235). "Put another way, the present social perspective remains ambiguous at least if defined in traditional philosophical or political positions" (Fleming, 1991, p. 194). At this time the public also demanded better accountability of learning by students and the Foundation Skill Assessment for Grades 4, 7, and 10 with provincial exams for grade 12 students were introduced. The beginning of this millennium brought the neo-conservative reality of *efficiency* which Stein (2001) defines as "cost-containment" (p. 97). We also can identify institutional thought taking over through the last 5 to 10 years. One of the consequences of this new philosophical theory was that the K to 7 curriculum has been just re-written with substantial changes in mathematics.

Chapter 4.

The Mexican Intended Mathematics Curriculum

Summary of the Main Features of the Mexican *Plan Educativo de Matemáticas*, Grades 4 to 6

The *Plan Educativo de Matemáticas* and the British Columbia Integrated Resource Package (IRP) have completely different formats. The Mexican document was originally published in 1993, and has been subsequently re-printed every year since. Each teacher is provided by the Mexican Ministry of Education with six books which contain all the requirements and information of the *Plan Educativo de Matemáticas* for the grade level he or she teaches. First there are two books entitled *La enseñanza de las Matemáticas en la escuela primaria: Lecturas* (Balbuena Corro, Block Sevilla, Davila Vega, Schulmaister Lagos, Garcia Montes, & Moreno Sanchez, 1995) which translated is "The teaching of mathematics in the elementary school: Readings" and *La enseñanza de las Matemáticas en la escuela primaria: Taller para maestros* (Block Sevilla, Schulmaister Lagos, Balbuena Corro, & Davila Vega, 1995) which translated is "The teaching of mathematics in the elementary school: Workshops for teachers". The first of these two books contains readings for the educator; the second one contains problems to be resolved by teachers so as to construct their understanding of the processes needed for mathematics learning. These two books contain about 200 pages each and are the same for all intermediate teachers (Grades 4 to 6). These two books offer the teacher pedagogic and didactic guides and readings, and challenge educators to work through them, either individually, or in a professional community of learners, to foster reflection in all teachers. Then there is a teacher book that is grade specific, for example, the *Libro para el maestro: Matemáticas Cuarto grado* (Mateo Calderon, 1994), Book for the teacher: Mathematics Fourth grade. This book is an extension of the former two books, with the difference that this book addresses the salient themes of the grade specific curriculum. It gives didactic and pedagogic reasons for the suggested strategies and understandings used to create the *plan educativo* for each specific grade level. The fourth book provided by the Mexican Ministry of Education to each teacher is a detailed guide of specific important concepts, strategies to be used, and assessment formats for each unit of the student consumable workbook. It also provides a summative assessment test for each unit. The fifth book is the student consumable textbook. The sixth book is *Plan y programas de estudio. Educación Básica, Primaria, 1993,* that is a curricular overview of all the learning outcomes for each grade, which helps the teachers understand the scope and sequence of what they ought to teach.

The following are some noteworthy characteristics of these six books. They are all very well explained, and mostly the readings are unambiguous and clear. These writings are supplemented with numerous charts, graphs, pictorial representations, geometric designs, and photographs. The books for the teachers are all in black and white, but the teacher guide and the consumable textbook are very colourful and attractive. All the books have colourful, attractive, and to a certain extent, enigmatic covers, which are meant to arouse a certain amount of curiosity and desire to peruse them. Finally, it is interesting to note that all the books bear clearly visible warnings that these books are distributed free of charge and that their re-sale is prohibited.

Teaching of Mathematics in the Elementary School: Readings

This book has a foreword which explains that this material is among the materials used in the "National Program of Permanent Actualization" (Balbuena Corro et al., 1995, p. 3) for all elementary school teachers. The intent of this program is to support the teachers in their knowledge and didactic methodology, so they can strengthen the quality of their professional work. This resource can be used in a variety of ways, according to the personality, learning style, and teaching style of each teacher.

In the introduction of this resource, its four goals are stated: to give the necessary information for the development of several activities which are explored in later workshops; to offer elements which will favour the better comprehension of the current focus of teaching in the elementary schools; to offer current literature about mathematics in accessible form for the teachers; and to present materials which will precipitate teacher reflection about their practice, contributing to the teacher's academic and pedagogical formation. It also explains that these readings are by no means exhaustive and the readings follow the same order as the workshops given in the second companion book. As the title suggests, this book is a compilation of different articles by different authors.

The first reading entitled "The mathematics which has been expelled from school" (pp. 7–20) is a reading which poses deep questions for reflection which emanate from embedded stories to which any Mexican educator will be able to relate. The reading begins with two stories, one of a 37-year illiterate woman, who never went to school, who has 10 children ranging from ages 8 to 22. This woman is given an every-day problem to solve which involves money. Although this woman does not read and can only recognize the numbers 1 to 10, she is able to easily solve a problem involving numbers in the hundreds. The second story is about a sixth grade student who cannot solve a simple difference problem. The question is then asked, is the first woman using math to solve her problem? The second question is, if she can solve problems without going to school, and the sixth grade student cannot determine how to solve a simple problem, "what is school good for?" (p. 10). Through the stories and questions, the reader has to become engaged with the reading. At the same time the stories and questions lead the reader to the understanding of what is currently meant by mathematics and the different aspects it encompasses. Mathematics is no longer knowing the "canonic algorithms" (p. 10) but consists rather of all the tools and flexibility that enable someone to be a successful problem solver. Through this mean, the authors introduce the concept of constructivist learning.

The second chapter entitled "Constructivism and mathematics education" (pp. 27-40) deals with the epistemology of mathematics. It explores the views of the ancient Greek philosophers and how mathematical epistemology evolved until the structural functionalist views. From there they jump to Piaget and his philosophy of education and explicate Piaget's epistemological foundations for learning. Upon these conceptions they build the constructivist approach to learning mathematics. It is posited that every individual begins with his or her world of knowledge based on their personal experience, and then manipulates, changes, develops, and finally formalizes what they learn. The authors assert that this is the way that mathematical algorithms are formed and internalized by individuals so that they can successfully be used in a variety of contexts and different problems. This reflects strongly Freire's epistemological arguments as it begins with the experience of the learner and is constructed by his or her experience with the subject matter.

Chapter 3, "Estimation" (pp. 41-50) makes the argument that estimation and complex mathematical reasoning go hand in hand. It expands the idea that solving problems and mathematical reasoning are inseparable. Estimation demands recognition and mental flexibility to be able to visualize a reasonable answer. Estimation also plays an indispensable role in checking if an answer is reasonable. Therefore the author concludes the chapter by positing that "estimation is not only compatible with mathematical reasoning, but it leads to it" (p. 48). He encourages teachers to use those few minutes we sometimes have before a break or recess to challenge the students with a "lightning" estimation problem, and so keep students' estimation abilities sharp.

Chapter 4 is a defence of the argument that pocket calculators should be integrated into the instruction of math lessons even in lower-grade classrooms. It is interesting how the use of calculators in lower grades is characterized as an emotion laden, controversial topic which needs careful consideration and reflection. The position taken by this article is that when used in an appropriate manner, this tool will enhance the comprehension of mathematical theorems in the learner. It also gives the caveat that such a tool needs to be used in conjunction with mental mathematics, so as to check the reasonableness of any answer obtained by the calculator.

The fifth chapter is a fascinating historical account of the development of the modern numeration decimal system. What is salient in the account is the cultural connection there is in the development of this system. It is interesting the way it was transmitted from locale to locale. This account also explains how there were three known places or cultures which developed the notion of the zero as a placeholder number: the Maya astronomers, the Babylonian erudites and the Hindu sages and monks. It was the latter who became very skilful in the use and manipulation of numbers, inventing systems that could enable them to easily do the six basic arithmetic operations as exemplified by Brahmagupta: addition, subtraction, multiplication, division, powers, and roots. This chapter is enriched by the Legend of Sessa. Through many examples, the different numerical challenges that the erudite astronomers faced are expounded and help the reader consolidate some of their own knowledge about numeration.

Chapter 6 explores the simple addition or subtraction verbal problems. It walks the reader through the possible verbal or conceptual combination of these problems which at the end are reduced to algebraic algorithms like: a + b =?, a + ? = c, ? + b = c, a – b = ?, a – ? = c, and ? – b = c. The book also groups them according to combination, equalization, or interchange problems. The chapter guides the reader through a reflective journey of how word problems can be narrated citing research which shows which type of formulation is easier and which one more challenging for the learner. It also explains that examples which are embedded in the experience of the learner are a perspicacious way of formulating them, so that the learner can understand them and learn the algorithmic processes through them.

The seventh chapter explicates the distinction between *easy* and *not so easy* (pp. 99-109) when either sum or subtraction is employed to solve a word problem. Using some very interesting research problems solved correctly and incorrectly by children ages 8 to 13 and eliciting their reasoning, the writer expounds why some addition or subtraction problems are easy and why others are not so easy. The easy problems are the ones where a total is sought from two contributing numbers. The more difficult ones are: ? – b = c. Learners have to reason the transposition of ? = c + b, and many students have a challenge with it. In subtraction problems, the easy ones are the ones where you subtract a number from an original amount, a – b = ?. The not so easy ones are when an initial amount is given to which another unknown amount is added and the sum is given, a + ? = c; therefore ? = c – a. Again in this kind of problems there is an algebraic transposition which many students cannot reason out. The ones who were successful understood that what was asked for was the difference between the initial amount and the end amount. Even when students answered the problem correctly, many had a hard time giving the correct reasoning for using subtraction. The chapter ends by making the reader aware that there are two kinds of problem solutions that have been categorized by Gerard Vergnaud: the numeric solution and the relational solution. It is the latter kind of solution, that allows the student to explain the different kind of problem they have to solve.

Chapter 8 introduces the discussion of mathematical communication through the use of some examples in geometry. The discussion is based on Guy Brousseau's research. In a pair of students, one is given a geometric shape that he has to describe without naming it or drawing it. The counterpart has to draw the shape based upon the description given. The drawer can ask written questions about what has been communicated to him or her. The study finds that most fourth graders will describe the shape with analogies from their daily life, like describing a trapezoid as a boat, and the size as big, medium, or small—very few will include actual measurements. The conclusion states that educators need to teach students how to accurately communicate in mathematics, and how important it is for students and teachers to include terminology which students commonly use outside of school, so they start making associations between what they learn in school and what they experience in their private lives and make the important connections between the two lives they live, so as to better retain what has been learned at school (pp. 122-123). These two chapters reflect the strong influence that French educational philosophy still has on the Mexican educational philosophy, as the researchers cited are French. Even now, many Mexican educators go to Europe and France to complete their post graduate degrees and bring the European and French thought back to México.

The ninth chapter is entitled: Van Hiele's model of reasoning as the point of reference for comprehensive learning in geometry. The writings posit that for geometric learning to take place, the learner has to go through five distinct levels of understanding. These levels have to be traversed from a lower level to the higher level for understanding and learning to take place. If one of these levels is omitted, the learner will not arrive at the understanding needed to fully comprehend and therefore, to be skilful with the material which they need to learn. The levels are from lower to higher: Level 1, the learner is introduced to the geometric objects, can recognize and classify the totality of the geometric objects according to physical properties, but does not recognize explicitly the components of the properties of the geometric objects. Level 2, the learner understands that the geometric objects possess certain unique properties, but does not identify the relationship between the properties. The student deduces informally through experimentation the relationship between the properties. Level 3 enables the learner to make logical classifications between objects and discover new properties and relationships through informal reasoning. The learner understands the importance of formal definitions of the geometric objects, but is unable to realize formal logical reasoning, and does not see the necessity for it; therefore, he does not comprehend the axiomatic structure of mathematics. Level 4 allows the student to engage in formal logical reasoning, therefore understanding the axiomatic structure of mathematics and concludes that he might reach the same results from different premises. Level 5 enables the student to manipulate, analyse and compare different geometries. The article makes us aware that this knowledge was expressed by the Van Hiele couple in 1957 through their doctoral writings. Their writings caught the attention of the Soviet educational establishment, who integrated the ideas successfully into the Soviet educational system. The Americans first paid no attention to it, but later were made aware of Van Hiele's important methodology. The methodology consists of sharing the information with students of what is going to be learned, and then having a directed orientation in it, proceeded with an explanation, free experimentation on the part of the students, and finally the incorporation of the concepts learned. The article gives a couple of real classroom examples in the ambit of geometric rotations and how Van Hele's methodology looks in practice (pp. 125-144).

Chapter 10 is an introduction to a decimal system of measurement course. It begins by explaining how measurement is a part of our daily lives in so many aspects. It is part of science, mathematics, human sciences, music, etc. Therefore, we have ample opportunity to practice measurement of all types on an ongoing basis. For these measurements through time international measurement units have been developed. The teacher is then reminded how we establish the unit of measurement according to what is being measured. For this the perception of magnitude is necessary, which has to be nurtured in a child. Measurements can be done in direct form, or in indirect form. Then it reminds readers how children acquire the perception of units, and how the decimal unit system can be manipulated to be used to conform to the measured quantity. In all this, estimation has a prominent place, as it enables the learner to develop a sense of magnitude and to understand when an estimated amount or a precise amount is required. This chapter proceeds to make us aware of the relationship between the numeration system and measurement. This chapter ends with a didactic focus on measurement in which the importance of the use of concrete materials is highlighted, the use of conventional or non-conventional units is discussed, and the use of formulas is explicated. For this last aspect, caution is advised for teachers, as the use of formulas without an understanding of the measurement concepts can prove counterproductive in the learning of children.

The eleventh chapter is the overview of a master's thesis in which it is posited that students in the first and second grade should not be expected to understand and work with the concept of fractions and equivalent fractions. The study demonstrates how students of ages 6 and 7 do not yet possess the cognitive ability to understand the concept of comparing the magnitude of fractions, even with concrete materials. Therefore, it is suggested that learning fractions be relegated to begin in the third grade with an emphasis on working through the concepts with concrete materials which students can manipulate and visualize.

The last chapter of these readings explores the significance of multiplying by 7/4. A concrete geometric problem is given to student teachers in which a factor of 7/4 can be used to solve problem, but none of the groups achieves the desired result. All the groups resolve the problem with adding parts, finding the percentage that needs to be added, or by how much numbers need to be increased, but none come up with the simple solution of multiplying by 7/4. Research from Europe is then used to buttress the findings. The conclusion that is reached is that multiplying by a fraction is a very challenging concept to grasp, and even more challenging to teach. Therefore, one of the recommendations is to leave multiplication of fractions to secondary level students and not to attempt it in elementary grades. This corroborates the Dutch school of didactic investigation's proposal, to focus on a "realistic" (p. 188) teaching of mathematics.

Teaching of Mathematics in the Elementary School: Workshops

The introduction of this second book for educators states clearly that: "children are not simply receptors who accumulate the information that is given by adults, but they learn by modifying previous ideas as they interact with new problematic situations" (Block Sevilla et al., 1995, p. 9). Therefore, for students, mathematics ought to be a tool which they recreate and which evolves as students confront problems to be solved. This entails that for learning mathematics the learner needs "to do mathematics" (p. 9), generating their own resources as they have the challenge of new problems. This reflects Freire's pedagogical approach to learning. At first, the students' resources are informal, but gradually change through their experiences and interaction with classmates and the teacher to a form of formal knowledge. Students' mathematical knowledge and problem solving are inseparable. Students do not learn mathematics and then apply them to solve problems, but they learn mathematics by solving problems. This didactic conceptualization implies that students must appropriate the significance of their knowledge, contextualize it again, that is, imbed it in situations in which the knowledge acquires sense for the learner, as he or she is able to resolve a given problem (p. 9). The workshops provide the teacher the experiences that will widen his or her mathematical knowledge of the mathematical content of elementary education. The workshops also explore problems that foster mathematical sense and the worth of mathematical knowledge. As well, didactic conditions that favour the acquisition of this mathematical knowledge are analysed. This will provide the educator an interesting, welcome, and creative way of doing and learning mathematics.

The introduction continues with an overview of all the materials provided for teachers and students in each grade accompanied by a brief description of what each of the materials provides (pp. 10-12). The next part of the introduction gives a rationale for giving teachers what they call "problem situations" (p. 12), which are activities designed to let the teacher experience the processes which students have to engage in to construct their mathematical knowledge. These problem situations are not supposed to be taken into the classroom, but just serve the purpose of letting teachers experience what kind of activities and mental processes students should engage in during the daily mathematics class, so as to construct their knowledge starting from their own actual knowledge and experience. It will as well encourage the analysis of procedures, answers, common mistakes that students make, and the strategies students could use when confronted with certain kind of problems (pp. 13-14). These activities will also familiarize the educator with the materials needed for the mathematics lessons and will show teachers the lay-out of the texts provided to students, such as an overview at the end of each chapter of the material learned as well as the many "curiosities of mathematics" (p. 14) which are mathematical games, riddles, etc.

The final part of the introduction gives five important recommendations to the reader: 1. To be able to get the most out of the workshops, these should be done with at least one colleague, but it would be better to do it with a group of colleagues who teach the same grade; 2. Though most questions will give the teacher space to answer them, it is recommended to have a copy book in which to do the drawings or expand the thinking processes in which the teacher engages; 3. Some activities ask teachers to write problems for students in certain grades; these problems should be kept in a separate problem copy book as a resource for the teacher; 4. The teacher may use a calculator for the activities, making them easier to solve; and 5. There are going to be problems that seem difficult to solve. They recommend not to get bogged down in them, but to set them aside and continue with the next section. The important part is to be engaged in the process of seeking solutions, not to find the correct solution per se.

The first section of workshops (pp. 16-101) deals with fractions. It begins with an explanation of why fractions are so difficult for students, namely, that fractions are not used very much by children in their daily lives. This has the consequence that children have very limited knowledge, and almost always, no understanding of what fractions are. They see fractions as two natural numbers, one written on top of the other. Children seldom have an understanding of what the nominator and denominator represent, why a number with a greater denominator is smaller than one with a smaller denominator, etc. Therefore, adding, subtracting, multiplying and dividing fractions are very challenging to students. This is the reason why contextualizing fractions becomes one of the most important challenges for teachers in the teaching of this concept. Teachers have to design situations in which fractions, their relations and operations, become useful tools for solving some specific problems. As the survey of contexts takes place, it will become clear that there are different situations in which fractions acquire distinct significances. Through the activities of the workshops, teachers will analyse different settings and significances of fractions, which will encourage reflections about the didactic conditions for the learning of fractions. The workshops in this section are divided into five themes with some specific activities for each of the themes. The first theme deals with the equitable sharing of things in which the parts are equal and there is nothing left at the end. The second theme is the use of fractions in measurement. The third theme is decimal fractions in measurement. The fourth theme is fractions as multiplicative operators. The last theme is fractions as the result of division. All the activities for each theme are hands on; some of the activities tie into the student consumable textbook and generate reflection on what the processes are in understanding, explaining, and using fractions in all these contexts. At the end of the chapter there are four pages of specific questions which continue to give the teacher the opportunity to reflect on the concepts of fractions.

As a personal commentary, I found working through the activities very interesting, challenging, thought provoking, and at times uncomfortable. They did challenge some of my personal notions, ways of teaching fractions, preconceptions, and some of the didactics I use in my practice.

The second section of workshops (pp. 102-149) deals with the process of change. Its preamble states that in our daily lives, as well as in science, one magnitude varies in relation to another. This section analyses some of these situations of proportional change and promotes reflection on the didactic processes that will enhance the appropriation by students of this very important concept. The section is divided into three themes that provide very interesting examples of problems that allow students to construct their understanding and knowledge about proportions. There are also questions for the teacher to reflect upon and examples of researched classroom situations that demonstrate the different thinking processes of those students. The first theme investigates proportional and non-proportional change. It furnishes five very interesting and thought provoking activities for the educators to engage in. The second theme is percentages. Again four excellent targeted activities are given for the educators to work through and reflect upon. The third theme is inverse proportionality that gives the educators two activities to engage in. The section finishes with the question of what the educator has learned. This involves further problems to be resolved by the teachers. Once again, all the activities for each theme are hands on and some of the activities tie into the student consumable textbook and generate reflection on what the processes are in understanding, explaining, and using proportions in all these contexts.

The third section of the workshops for teachers deals with the handling of information (pp. 150-161). The section opens with the statement that in the present we receive a constant stream of quantitative information in statistics, graphs and tables. Therefore, it is necessary that students from elementary age are initiated into the analysis of simple information and statistics and learn to understand the context in which they are given, such as documents, propaganda, images, and particular texts. This section serves to acquaint the educator with the recollection, organization, and analysis of information from the first grade of school. This section has only one theme and one activity for the teachers that tie into the different grade-level textbooks. It also makes it clear to the reader that graphs, statistics, and tables are commonly used in different knowledge areas, such as history, geography, natural sciences, and others. To understand the information given, students will need to learn the context in which they are given and the intended goal for which the information has been given. The section ends again with an overview of what the teacher has learned in the form of exercises to be solved by the reader.

The final section of the workshops for teachers is prediction and chance. This section endeavours to give us the possibility to construct and utilize mathematical knowledge to predict which occurrence is more probable. Many situations in life help us predict the outcome of an event without actually quantifying it. This section again has one theme with six activities that tie into the student textbooks in different grades. It closes with the overview section of what has been learned. This section also has a few problems to solve that could be given to students of fifth or sixth grade. It makes for fun reading, engaging the reader in what is being reflected upon.

The final two sections of the book of workshops are the answers to all the problems which are given throughout all the workshops and the bibliography used in the development of the workshops.

Each grade has a package that consists of three books: *Libro para el maestro,* which is the book for the teacher, the student consumable textbook, and the *Plan y programas de studio; Educación Básica. Primaria, 1993* is a study plan for teachers. These three books form a comprehensive package that contains the intended curriculum for each grade.

Study Plan and Program:
Elementary Basic Education 1993

This resource book is given to the elementary teacher only once, while the intended curriculum is current. It is the overview of all the mathematics learning outcomes for all grades in the elementary school. It provides the educator with an overview of what they teach in the students' educational journey.

This book begins with a historic overview about the right that all Mexicans have to access an elementary education of high quality, which through Mexican history has been recognized as a fundamental right. School ought to be for everyone, with equality of access, with the aim of improving the lives of Mexicans and their society. These principles have been set in motion since Morelos and supported by other Mexican historical figures including Juarez with the intention to battle against ignorance, and therefore, it becomes a public responsibility for the establishment of liberty, justice, and democracy. This right is entrenched in the third article of the Mexican Constitution, which has been supported during the last 72 years by governments, teachers, and society. This has transformed basic free education from a formal to a real opportunity for a growing proportion of the Mexican population. As México is in need of forming more solid basic education, emphasis is given to the need of students to comprehend what they read, find information in written forms, express themselves orally and in writing, and to acquire the capacity for mathematical reasoning, basic knowledge of Mexican history and geography, and the appreciation and practice of values in their personal and social lives. This propels the government to continue to renew the free textbooks provided to all elementary school students, to support teachers in their continual actualization through revaluation of their functions through an incentive package for further and continual professional development, support for the regions where there is more danger of students abandoning school attendance, and a transfer of some of the decision making to state and local governments.

Through this package of reforms in the educational system, the government seeks to foster greater literacy and numeracy in students, the scientific knowledge of basic natural phenomena and how our actions in nature can help to preserve a healthy environment balanced with a responsible use of natural resources, the formation of ethical individuals who know their rights and recognize their obligations in their personal and social lives, and develop an appreciation of the importance and enjoyment of the fine arts and physical exercise and sports. According to the third article of the Mexican Constitution, all children have the right to a complete education that gives them the capacity to acquire knowledge and the intellectual capacity for reflection, so that all students become life long learners.

The book continues with what they call the organization of the educational plan, in which it is stipulated that the school year will contain 200 days of learning, with each day having five hours of learning. Then it gives a table with the amount of time each subject needs to receive each week. For the intermediate grades, students need to receive five hours of learning in mathematics each week. This document states that the first priority of education is to endow each child with all the needed literacy skills to be able to communicate proficiently in written and oral forms, giving literacy 30% of the learning time. For mathematics, the students should be given 25% of the learning time so they will develop the following capacities: to use mathematics as an instrument for recognizing, proposing, and solving problems; to anticipate and verify answers; to communicate and interpret mathematical information; to develop a spatial imagination; to acquire the ability to estimate answers in the calculations involving measurement; to be able to use certain instruments of measurement, drawing, and calculation; and to abstract thought through diverse forms of reasoning, among others systematization, generalization of procedure and strategies. The book continues with the layout of the other subjects to be taught and the time allotment for each of them, giving a short overview of the expectations that educators and learners should meet. The document proceeds with a section in which there is a general explanation given for the manner in which each subject and grade level is organized and presented, done in a simple and compact manner. For mathematics the overview is formulated by axes of learning. Then each subject is given a section in which again the section opens with a focus explanation.

For the mathematics section, the focus section begins with an introduction. This part opens with the statement that mathematics is the product of daily human experiences and its processes consist of the sustained construction of successive abstractions. Many of the developments in mathematics were the result of the necessity to resolve concrete problems. Therefore, children also need to construct their mathematics from the concrete problems they face. As children make abstractions, they can omit the use of concrete objects. Dialogue, interaction, and reflection on ideas foster learning and the construction of knowledge. This process is reinforced through the interaction with classmates and teachers. Mathematics allows individuals to solve problems in the fields of science, technology, art, and daily life. As people construct their knowledge from obstacles they face in their daily life, students need to be given the opportunity to construct their mathematical knowledge from their daily experiences. Schools ought to furnish students with these opportunities.

The general purpose of learning mathematics in elementary school is for children to develop the already stated capacities that are repeated in this section. This part of the document continues with a section explicating the organization of the general content in the mathematical intended curriculum. It is stated that the selection of the content rests on the knowledge of the cognitive development of children and on the processes of acquisition and construction of specific mathematical concepts. The content incorporated in the intended curriculum is based on six axes, which are: numbers, their relations and their operations; measurement; geometry; processes of change; information; and chance and prediction.

Numbers, their relations and their operations are taught from the first grade with the intention to give children the significance that numbers have in diverse contexts and the different relations that numbers can have with each other. Measurement is composed of the study of magnitudes, units of measurement, and quantification that results from the measurement of those magnitudes. Geometry is designed to place the student in context with his or her surroundings, so that as this is formalized, the student perceives the representation of a plane and is able to manipulate forms in space. Information ought to give the learner the ability to select from different forms of information like texts, images, and other media the relevant data needed to solve problems. At the same time students need from early on to be able to understand the tables and statistical information they are constantly exposed to, so they can analyse and understand the data provided. Chance and prediction is taught from third grade on and should enable students to identify and use situations where chance is a relevant reality.

The document continues highlighting the changes that the 1993 *Plan educativo* has introduced, and gives a rationale for the changes made. Then the document presents an overview of all the content grade-by-grade.

Intended Curriculum Content for Grade 4

This intended curriculum for Grade 4 is divided into the six axes. The following prescribed content is:

1. *For numbers, their relations and operations.* Natural numbers which include numbers having up to five digits, their reading and writing, preceding and following number, construction of numerical series, positional value, and number line; rules for writing ordinal numbers and their use in different contexts; formulation and resolution of different problems with addition and subtraction of up to 5-digit numbers; formulation and resolution of multiplication problems, resolution of problems through different processes; and the division algorithm with a divisor of up to two digits. Fractional numbers: fraction of lengths to introduce new fractions; diverse resources to find equivalencies between fractions; fractions with denominators of 10, 100, and 1 000; comparison of fractions holding the numerator or denominator constant; placement of fractions in the number line; formulation and resolution of problems involving fractions with like denominators; conventional algorithms for the sum and difference of fractions with like denominators. Decimal numbers: Reading and writing of decimal numbers up to hundredths associated in the context of money and measurement; formulation and resolution of problems of addition and subtraction with decimal numbers.
2. *For measurement: Length, area and volumes.* Solving problems which imply measurement of lengths using the meter, decimetre, centimetre, and millimetre as the units of measurement; introduction of the kilometre as a unit for measuring great distances and treks; introduction of volume through different means in which boxes, cubes and play dough are used; formulation and resolution of various problems which imply the calculation of perimeter; resolution of problems which imply measuring surfaces using square centimetres and meters; introduction of the formula for calculating the area of the rectangle, square, and triangle; resolution of problems which imply the use of instruments for measuring like the ruler with millimetres and the measurement tape. Capacity, weight, and time: simple situations which illustrate the use of the milliliter, and milligram; use of the clock

and calendar; decade, century and millennium; the utilization of instruments of measurement like the weigh scale, graduated cylinders in milliliters and centiliter for measuring liquids.

3. *For geometry.* Spatial placement: representing point and displacements in the plane; design, reading and interpretation of sketches and blueprints; reading and interpreting maps. Geometric solids: classification of geometric solids under the criterions of face shape, number of faces, number of vertexes, and number of edges; activities to introduce the construction of geometric solids. For geometric figures: Comparing angles directly or indirectly, using the protractor to measure angles, classification of polygons according to the number of sides, equal sides, equal angles, and number of lines of symmetry; recognizing different triangles with respect to their sides and angles, that is, isosceles, scalene, equilateral, and right triangle; constructing the height of simple triangles; composition and decomposition of geometric figures; constructing parallel and perpendicular lines through different procedures; and drawing a circle with a piece of yarn.
4. *Use of information.* collecting and making tables with the data observed; representing the information in frequency tables and bar graphs; use of absolute frequency and manipulating information; analysis and interpretation of the information obtained in a small survey.
5. *For process of change.* simple problems that introduce the student to making tables of proportional change.
6. *For chance and prediction.* representing the results of aleatory experiments; representing the results of aleatory experiments on tables and graphs; using the expressions more probable and less probable in the prediction of results; engaging in games and experiments in which the results depend on chance.

Intended Curriculum Content for Grade 5

This intended curriculum for Grade 5 is divided into the six axes. The following prescribed content is:

1. *For numbers, their relations and operations.* Natural numbers which include numbers having up to six digits, their reading and writing, preceding and following number, construction of numerical series, positional value, and number line; Roman numerals; formulation and resolution of problems that lead to the decomposition of numbers into their addends and factors; formulation and resolution of problems

which imply two or more operations with natural numbers; use of calculators for solving problems. Fractional numbers: Fractioning numbers to include new fractions like seventh and ninth; using diverse resources for demonstrating the equivalency of some fractions; formulation and resolution of problems with fractions that have denominators of tenths, hundredths, and thousandths; activities which introduce mixed fractions; placement of mixed fractions in the number line; formulation and resolution of problems with additions and subtractions of fractions with equal and different denominators through the equivalency of fractions; the algorithm for adding and subtracting fractions through equivalencies; the use of fractions as proportions and division in simple situations; calculation of percentages through different processes. Decimal numbers: Reading and writing of decimal numbers associated in different contexts; comparing and ordering decimal numbers; equivalencies between tenths, hundredths, and thousandths; formulation and resolution of different problems involving addition and subtraction with decimals up to thousandths; formulation and resolution of problems involving multiplication of decimal numbers, formulation and resolution of problems involving division of natural numbers with quotients up to hundredths; formulation and resolution of problems with division of decimal numbers by natural numbers; use of calculators to solve problems.

2. *For measurement: Length, areas, and volumes.* Formulation and resolution of problems which imply the calculation of perimeter of polygons and curvilinear figures using different methods; resolution of problems which imply the calculation of area in polygons, trapezoids, and rhombuses by decomposition into squares, triangles, and rectangles; formulation and resolution of problems which imply the calculation of areas using square meters, square decimetres, and square centimetres; the square kilometre as the unit for measurement to express the surface of big areas; relation between the perimeter and area of a figure; the change of the area of a figure as a function of its sides; approximation of the area of irregular polygons and curvilinear figures using grids; measurement of the volume of a cube and some prism by counting cubic units; the cubic centimetre as a unit to measure volume; introduction of the systematic study of the metric decimal system through the multiples and submultiples of the meter. Capacity, weight, and time: Relation between the capacity and volume, relation between the cubic decimetre and the liter, relation between hour, minutes, and seconds associated with the resolution of problems; the use of measurement instruments like the dynamometer and the weigh scale; introduction of the systematic metric decimal system through the multiples and submultiples of liter and gram.

3. *For geometry: Spatial placement.* Introduction to the Cartesian Axes to place objects and beings in maps or sketches; coordinates of a point. Geometric bodies: Construction of cube and prism patterns.

Geometric figures: Construction of figures using ruler and right triangular ruler sets; use of ruler, geometry set and compass to construct figures from lines of symmetry, parallel lines, or perpendicular lines; the use of the compass to draw circles; classification of figures using different criteria, that is, same angles, equal sides, parallelism, and symmetry; constructing figures at scale (simple cases).

4. *For use of information.* Organizing information in tables, diagrams, bar-graphs, and pictograms; analysis of tendencies in bars, averages, mode and median; making graphs with proportional and non-proportional variation; compilation and analysis of information obtained from diverse places.
5. *For process of change.* Making tables of proportional and non-proportional variation for solving problems; relation between the variables in proportional and non-proportional tables; drawing graphs of proportional and non-proportional variation; formulation and resolution of percentage problems.
6. *For chance and prediction.* problems which imply the arrangements of permutations between two and three objects, listing the results; using the tree diagram for solving problems involving permutations listing possible outcomes; aleatory experiments and analysis of the possible outcomes and favourable cases; identification of higher or lower probability.

Intended Curriculum Content for Grade 6

This intended curriculum for Grade 6 is divided into the six axes. The following prescribed content is:

1. *For numbers, their relations and operations.* Natural numbers, their reading and writing, preceding and following number, construction of numerical series, positional value, and number line; reflecting on the rules in the decimal numeration system; multiples of a number; lowest common multiple; formulation and resolution of diverse problems which require two or more operations for their resolution; use of calculators for solving problems. Fractional numbers: Placement of fractional numbers in the number line; equivalency and ordering of fractional numbers; formulation and resolution of problems which use addition and subtraction of mixed fractions; conversion of mixed fractions into improper fractions and vice versa; simplifying fractions; formulation and resolution of addition and subtraction problems with fractions which have different denominators through the calculation of

common denominators. Decimal numbers: Reading and writing of decimal numbers; placing decimal numbers in the number line; writing fractions as decimal numbers and writing decimal numbers as fractions; formulation and resolution of addition and subtraction problems which contain decimal numbers up to thousandths; formulation and resolution of multiplication problems which contain decimal numbers up to thousandths; formulation and resolution of division problems which contain decimal numbers in the dividend and natural numbers in the divisor; expressing percentages as decimal numbers; and the use of calculators for the resolution of problems.

2. *Measurement: Length, area, and volume.* Perimeter of a circle; use of formulas for solving problems which imply the calculation of the area of different figures; use of hectare for the resolution of problems; formulation and resolution of simple problems which imply the calculation of the volume of cubes and some prisms by the counting of cubic units; formulas for the calculations of the cube and some prisms; variation of the area of figures as a function of the measurement of the sides; calculation of the total area of prisms; more in depth study of the decimal metric system in multiples and submultiples of the meter, multiples and submultiples of square meters and cubic meters; relationship between units of length in the metric system and the imperial system, that is, meter to yard, centimetre to inch, centimetre to foot, and kilometre to mile. Capacity, weight and time: Problems which imply conversion of the units of time, that is, year, month, week, day, hour, minute, and second; introduction of some of the aspects of the history of measurement; in depth study of the decimal metric system in multiples and submultiples of liters and grams; the ton as a measurement unit; relationship between capacity and weight units in the decimal metric system and imperial system, that is, liter to gallon, kilogram to pound.

3. *For geometry: Spatial placement.* Construction of sketches on scale; use of Cartesian coordinates and axes; reading of maps. Geometric objects: Construction of patterns of prisms, cylinders, and pyramids. Geometric figures: Construction of figures to scale; identification of similarities and differences of figures that are drawn to scale; constructing figures starting from their diagonals; classification of figures using diverse criteria like lengths of their sides, number of sides, measurement of angles, number of vertices, pairs of parallel sides, equal diagonals different diagonals, points of intersection between diagonals, number of symmetry lines, etc.; construction and reproduction of figures using two or more symmetry lines; construction and reproduction of figures using ruler and compass.

4. *For use of information.* Organizing data in tables, diagrams, bar-graphs, and pictograms; analysis of tendencies in bar graphs, identifying averages, mode and median; use of relative frequency in the resolution of problems; compiling and analysing diverse information; analysis of problems to establish whether there is enough

information to be able to solve them, and distinguishing between needed and irrelevant information.

5. *For process of change.* Formulation and resolution of problems which imply making tables and graphs of proportional and non-proportional variation; analysis of tendencies in proportional and non-proportional variation tables; relationship between variation and the corresponding tables and graphs; the unit value as a procedure for solving certain problems of proportionality; formulation and resolution of percentage problems.
6. *For chance and prediction.* Representing on tables and graphs the outcomes of diverse aleatory experiments; use of tree diagrams for counting the number of possible outcomes in simple experiments; comparing two events taking into account the number of favourable cases without quantifying the probability; analysing and interpreting graphs for making predictions.

Grade 4 Teacher Package

The *libro para el maestro,* (Mateo Calderon, 1994) which is the book for the teacher, for Grade 4 begins with a "presentation" (p. 7) from the Ministry of Education, which states that each teacher will receive one of these books to ensure that they are aware of the latest curriculum and didactic methods recommended for teaching. Teachers are encouraged to keep these books in their personal library, so as to have them handy for future reference.

The introduction begins with a direct challenge in which they state that traditionally mathematics has been taught around the conception that for students to resolve a problem they need to apply the model for resolving it that has been proposed by the teacher. In other words, so far, solving mathematical problems requires the application of already known solution mechanisms. But for learning to become permanent, the student has to construct a viable solution from a motivating question. Therefore, the present proposed didactic requires problems that will put in motion a chain of events in the students: they will act, reflect, find strategies, and discuss to construct new knowledge or reinforce the knowledge previously acquired. Because of this it is very important to differentiate between two kinds of problems: 1. Problems which require knowledge to be constructed which can be called problems for discovery, and 2. Problems which require a resolution model to be applied which is already known, which can be called application problems. This program hinges around the first type of problems which have two fundamental characteristics: (a) they need to be real problems for the students, which means they have to really pose a challenge to the student that will motivate him or her to search for a strategy to resolve them; (b) the problems need to be able to be solved by the resources the students possess when the problem is formulated, which means that the degree of difficulty of the problem has to be at the level of the student.

The introduction continues with the general purpose for the grade which is for Grade 4: to develop the ability to read, write, order, place in the number line, and compare numbers having up to five place settings and decimal numbers up to hundredth; to develop strategies for estimating and mentally calculating the answer of problems involving addition, subtraction and multiplication; to develop the capacity to recognize, formulate, and solve problems with the four basic algorithmic operations of addition, subtraction, multiplication, and division; to solve problems which imply the use of fractions in situations of sharing, measuring, comparing, equivalency, or ordering; acquiring, through rotations, the notion of angles and the capacity of measuring the fractions of a revolution; the ability to elaborate and interpret a drawing made in a Cartesian Plane and the representation and translation of points within the plane; to develop the ability to manipulate and use geometric instruments for drawing parallel lines, perpendicular lines, figures, lines of symmetry, and geometric figures; to develop the ability to collect, communicate, and interpret information that comes from questionnaires, tables, graphs, pictographs, etc., to develop the ability to estimate the results of different games of chance in terms of *more or less probable than*. The organization of all this content is done around six axes that are: the number and its relationship to its operations; geometry; measurement; treatment of information; process of change; and prediction and chance.

The book for the teacher continues with general didactic recommendations. This part of the book reminds the educator that if we want to make mathematics enjoyable for students, teaching must include information and applications that are interesting and useful for the children. We must work from situations that are part of the children's culture. The process of learning is inductive, in that no formal definitions are given, but these are the conclusion of lessons obtained at the end of activities undertaken in the classroom. The teacher plays several important roles which include looking for and designing problems that are adequate for the learning of the students, choosing activities which favour games and play in which students engage to use their mathematical learning, suggesting situations which contradict the students' hypotheses so as to foster reflection and steer towards the formalization of mathematical knowledge, and promoting discussions about the ideas which students have in the situations which are studied. All these things must rest upon the foundation of the children's previous knowledge upon which they can construct further understandings and knowledge. The resolution of problems will generate significant knowledge. The students should be allowed to solve the problems in their own way, followed by class discussions in which questions are posed as to which method of resolution is easier, requires less effort, is more direct, or is easier to understand. This should lead to the formal way of solving the type of problems posed, but always bearing in mind that problems that have many correct answers will enable the learner to delve into deeper understanding of the processes of resolution. The importance of class or student discussion is indispensable in the construction and learning of new mathematical knowledge. It also will enhance the abilities and skills to listen to the opinions of others, ask appropriate questions, refute arguments, etc. which will help both student and teacher in the class dynamic. Through this process students will learn the skill to explain and present ideas and concepts and evaluate the advantages and disadvantages of diverse methods of problem solving, thereby validating their learning.

This part of the book continues with an explanation of how the various parts of the package provided for the teacher complement each other but also states clearly that if the resources provided do not meet the learning needs in a specific context, the teacher ought to find alternate or supplementary resources which will enable the student to achieve the intended learning. This part of the book concludes by stressing the importance of using manipulatives in the learning of mathematics, and stressing that teachers need to be mindful to always use the manipulatives provided in the student textbook for the appropriate lesson as well as complementary material that the teacher may gather.

The third part of the book for the teacher is entitled "Didactic Recommendations by Axis" (p. 21). This part is an overview manual for the teacher, in which the six axes are touched upon, giving the teacher specific examples of how to use the student book, the teacher guide, and how certain specific lessons could look when taught in the classroom. It gives many examples of questions teachers can ask, what is important to bear in mind when teaching or doing mathematics, how to present games so as to engage students, how to model specific lessons to students, etc.

The fourth part of the teacher book is a 2-page explanation about evaluation in mathematics. This section begins by stating that evaluation is one of the most complex aspects of education, as it does not only consist of a mark, but it is an intrinsic part of the learning process. Especially in mathematics, the teacher has to be aware of the incremental learning that is taking place in the student. Evaluation in mathematics is more than assessing the right and wrong answers, as mistakes may indicate areas in which students may not be yet clear about the meaning of the material, a lack of algorithmic dexterity, or just that the student has not learned the intended material. Therefore, evaluation in mathematics is a very effective tool for assessing student learning. In this section, it is strongly suggested that the teacher should keep a student file with observations, work, anecdotes, tests, etc. so that the teacher can synthesize the learning journey of each student through the school year. Student evaluation should begin the first day of the year and continue to be done throughout each class session, so as to record the progression in the learning, comprehending, becoming skilful with the geometric tools, etc.

The final part of the teacher's book is a recommended bibliography for the teacher.

Grade 4 Student Textbook

The Grade 4 textbook (Avila, Balbuena, Bollas, 1994) is a consumable textbook which is provided to each Grade 4 student in México free of charge. At the beginning of the book this fact is reiterated in a preface in which the Ministry of Education requests the opinions of teachers, students, and parents, so as to be able to have an ongoing evaluation and improvement of the textbook. From year-to-year books are revised in those areas in which they can be improved. The textbook proceeds with an index. Then it has all the lessons. All work is recorded in the textbook that helps students have an orderly collection of all their mathematics work of the year. At the end of the book there is a section with concrete manipulatives that can be cut out by the student when they are needed. It obviously pre-empts the necessity of having to photocopy these resources by the teacher, so that all students can access these manipulatives when required.

Grade 5 Teacher Package

Like the previous package, this one has a *libro para el maestro,* (Garcia Cuevas, M., 2006) which is the book for the teacher. The Grade 5 book for the teacher is essentially the same as the one for the Grade 4 teachers. The introduction and the general didactic recommendations are the same. The didactic recommendations by Axes follow the same format as the Grade 4 books, but naturally deal with the Grade 5 curricular expectations, rather than the Grade 4 curricular expectations.

Grade 5 Student Textbook

The Grade 5 consumable textbook (Garcia Cuevas, M., 2006) is the same as the Grade 4 consumable textbook, it just covers the Grade 5 curricula.

Grade 6 Teacher Package

This package entails the same materials as the previous two school grade packages, but at a Grade 6 level according to the curricular prescriptions.

Grade 6 Student Textbook

The Grade 6 consumable textbook is the same as the Grade 4 consumable textbook; it just covers the Grade 6 curricula.

So far, I have summarized the Mexican intended curriculum. I have not commented on it, nor made comparisons with the British Columbia intended curriculum, because I first will summarize the British Columbia intended curriculum in Chapter 5, and then present the comparisons between the two intended curricula in Chapter 6.

In retrospect, considering all the information gathered about the Mexican intended curriculum, one salient paradox emerges. The Mexican educational system is a top down centralized state controlled system aided by the powerful labor union. Nevertheless, ordinary teachers espouse the Freirian liberationalist attitudes. These opposing attitudes are in a constant war for the minds of the public and the educators. At times, these tensions do erupt into violence, like the teacher uprising in Oaxaca last year. Dussel (1980) attributes this tension to the "negated popular culture..." (p. 23). This latent Mexican cultural vicissitude was also a contributing factor to the eruption of the violent Mexican Revolution in 1910.

Chapter 5.

The British Columbia Intended Mathematics Curriculum

Summary of the Main Features of the British Columbia Integrated Resource Package for Grades 4 to 6

The British Columbia IRP is an extensive, integrated document that covers all grades from Kindergarten to Grade 7. It contains 344 pages of information. It was published in April 2007. All the grades share some features like the table of contents, the acknowledgements, the preface, the introduction, and considerations for program delivery. The document then presents the prescribed learning outcomes one grade at a time. After the prescribed learning outcomes, the document provides what it calls student achievement for each grade, which explains the three kinds of assessment that students should experience. This section also provides a grade-by-grade overview. The document continues with a classroom assessment model in which an overview is given of the weight allotment for the different stipulated goals for each grade. The document then proceeds with a section on learning resources. The document ends with a glossary.

The Kindergarten to Grade 7 IRP has a simple, but appealing, cover-page with an artistic number symbol logo on the upper right hand corner, a bold easily legible title in the lower bottom part of the page, and finally the British Columbia logo with the inscription “British Columbia, the best place on earth” in the lower left hand side of the page. The second page provides the reader with the Library and Archives Canada Cataloguing in Publication Data, with the main entry title, the ISBN, and alternate names.

The alternate names are: (a) Arithmetic – Study and Teaching (Elementary) – British Columbia, (b) Mathematics – Study and Teaching (Elementary) – British Columbia, (c) Education Elementary – Curricula – British Columbia, and (d) Teaching – Aids and Devices. This section concludes with specific copyright information pertaining to this document. The third and fourth pages provide the reader with the table of contents, which the reader can quickly scan or use to locate the information provided in the document. It is well laid out, with distinct headings and partitions for every section of the document. The fifth page provides clear acknowledgment of the persons who directly contributed to the publication of the document.

The second section of the document gives a 2-page preface. The second paragraph provides the URL for the IRP. I have noticed that this site is often not available. Most often, the seeker will be referred to the British Columbia Ministry of Education website, through which the document may be found. This preface gives the reader a quick overview of the content of the document. The preface divides the document into seven sections: "Introduction, consideration for program delivery, prescribed learning outcomes, student achievement, classroom assessment model, learning resources, and glossary" (pp. 7-8) and gives a very brief description of each.

Introduction to Mathematics K to 7

The introduction commences by pointing out which principles of learning have guided the development of the document. Three principles are enumerated, "Learning requires the active participation of the student, people learn in a variety of ways and at different rates, [and] learning is both an individual and a group process" (p. 11). The second paragraph reiterates clearly the reality that "British Columbia schools include young people of varied backgrounds, interest, abilities, and needs" (p. 11). It clarifies that the intended curriculum has integrated "ways to meet these needs and to ensure equity and access for all learners" (p. 11). The document continues by acknowledging that it conforms to the Western and Northern Canadian Protocol (WNCP), which is a common curriculum framework for Canada's four western provinces and three territories. It further informs the reader that the draft of this document was available for input by educators, students, parents, and other partners of educations during the latter part of the previous year. I had the privilege to be part of the School District 57 group of educators who submitted some suggestions.

The introduction proceeds to give a rationale. There is a very deliberate transition in terminology in the rationale section. The section begins by clarifying the aim of mathematics, which is "to provide students with the opportunity to further their knowledge, skills, and attitudes related to mathematics" (p. 11). Then the next paragraph changes the terminology in a very significant way. The document states, "a key component in successfully developing *numeracy* is making connections to these backgrounds and experiences" (p. 11) [emphasis mine]. It continues by giving the British Columbia Association of Mathematics Teachers' definition of numeracy as follows: "Numeracy can be defined as the combination of mathematical knowledge, problem solving and communication skills required by all persons to function successfully within our technological world. Numeracy is more than knowing about numbers and number operations" (p. 11).

This is a very significant feature of this new curriculum. It actually enlarges the scope of mathematics learning compared to the traditional view of mathematics. Using algebraic language, it enlarges the number of skills that students ought to learn from a mathematical subset, to a numeracy set. By this I am trying to point out that numeracy encompasses many more skills and attitudes than the traditional understanding of mathematics. Traditional mathematics is only a part of the new goal of numeracy. The added sphere of learning is the mathematical communication component which, to a certain extent, involves expressing our thinking processes, that is, the learner needs to understand the principles that guide the processes employed in the resolution of problems and why certain algorithms are used. Numeracy also expands the realm of problem solving from mathematical problems to real life situational problems, so that students are able to make connections between the strategies used for mathematical problem solving and real life situation problem solving. Numeracy also endeavours to help students attach “meaning to what they do and [the] need to construct their own meaning of mathematics” (p. 11). This building of meaning is best achieved when the learners can use their experience and proceed then from simple concepts to complex ones, from concrete thinking to abstract thinking. To achieve this construction of mathematical meaning, all students are helped by the use of a spectrum of materials, tools and contexts, aided by meaningful discussions with peers. These strategies can develop important connections between concrete, pictorial, and symbolic representations of mathematics. The educators should make visible the mathematical concepts that are present in the school and home setting, affording “teachable moments” (p. 11). An atmosphere of openness, respect, and inquiry should be fostered, so that the students are comfortable and secure to take intellectual risks and can explore their natural curiosity, ask questions, and pose conjectures.

The introduction proceeds with making the reader aware that in British Columbia we do have an Aboriginal presence in the classrooms that must be carefully taken into account when instruction and learning are taking place. The Aboriginal cultures which are present in British Columbia are cultures “where learning takes place through active participation … oral communication along with practical applications and experiences are important to student learning and understanding” (p. 12). This requires that educators employ a variety of teaching and assessment strategies to give its deserved place to Aboriginal cultures, communication styles, skills, attitudes, and to the experiences of Aboriginal students. For these students, as for any other student, learning will be optimal when mathematics is contextualized and not treated as a discrete component.

The introduction continues by making the reader aware that learning encompasses three domains of educational activities: the affective, the cognitive, and the psychomotor domains. The document explains to the reader how important the affective domain is in mathematics, as it “involves the way in which we respond to things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes” (p. 12). This affective component is crucial for learning. “ Environments that create a sense of belonging, encourage risk taking, and provide opportunities for success help students develop and maintain positive attitudes and self-confidence” (p. 12). The reader is further challenged to “recognize the relationship between the affective and cognitive domains” so as to “nurture those aspects of the affective domain to contribute to a positive attitude” (p. 12). Part of this nurturing involves the opportunities for students to engage in active and cooperative learning experiences that foster conceptual understanding through sharing and discussion of strategies employed to gain answers used in mathematics.

This section of the document proceeds with a description of the nature of mathematics. It defines mathematics as "one way of trying to understand, interpret, and describe our world" (p. 13). It enumerates the components that make up the nature of mathematics: change, consistency, number sense, patterns, relationships, special sense, and uncertainty. The document draws the reader's attention to the fact that these components "are woven throughout the curriculum" (p. 13).

As far as change is concerned, mathematics is characterized as dynamic and not static. There is a need to recognize that change is a pivotal component in "understanding and developing mathematics" (p. 13). It helps the learner to make predictions because students need to be able to recognize quantities that remain the same and those that change. As for consistency, this is indicated by different terms like "stability, conservation, equilibrium, steady state, and symmetry" (p. 13). Recognizing constancy will helps learners to solve problems that include constant rates of change, lines with constant slope, sum of interior angles in polygons, etc. The paradoxical nature of mathematics, which integrates all these variable and different characteristics, becomes apparent to the reader. Number sense is explained as "intuition about numbers" which is characterized as "the most important foundation of numeracy" (p. 13). Number sense is acquired when learners make connections between numbers and real life situations and will result in the use of benchmarks and referents bringing about computational fluency, flexibility with numbers, and intuition about numbers. This number sense is fostered by "rich mathematical tasks which allow students to make connections"

(p. 13). Mathematics deals with recognition, description, and how numbers are related to each other within numerical and non-numerical patterns. Learning to recognize patterns enables the learner to "make predictions, and justify their reasoning when solving routine and non-routine problems" (p. 13). Relationships among number sets, shapes, objects and concepts will require collecting and analysing data and describing relationships in visual, symbolic and written forms. Spatial sense will help students visualize, create mental imagery and foster spatial reasoning. It will also "offer a way to interpret and reflect on the physical environment..." (p. 14). Finally, we must be able to recognize uncertainty in "patterns that have a degree of uncertainty" (p. 14), so as to be able to make predictions and assess the degree of reliability of data and data interpretation. Chance will aid us in predicting the occurrence of an outcome, enhancing the understanding of probability and the degree of uncertainty more accurately.

The next aspect the introduction of this document addresses are the goals for mathematics from Kindergarten to Grade 7, which are: using mathematics to become confident problem solvers, to better understand the world around us, and to be able to communicate and reason mathematically; valuing mathematics; become committed to be a life long learner; and becoming mathematically literate. The way educators and parents can assess if students are meeting these goals is by observing "appreciation for the contribution of mathematics as a science, philosophy and art" (p. 14), seeing mathematics being employed to justify decisions about the world around us, observing positive attitudes and perseverance in mathematical endeavours as well as risk taking, curiosity and involvement in mathematical discussions.

The introduction continues with an exposition on the curriculum organizers that actually gives the reader a bird's view of all the content of the mathematics curriculum in an age-appropriate manner from K to 7. The curriculum is divided into categories that are number, patterns and relations, shape and space, and statistics and probability. The 2-page curriculum organizer gives an overview of all the intended learning outcomes for all grades and facilitates for the reader the appreciation of the scope, sequence, and content of the entire curriculum for elementary students.

The second to last part of the introduction of the document deals with the mathematical processes. These processes are:

1. Communication, which grants the learner the opportunity to "read about, represent, view, write, listen to, and discuss mathematical ideas" (p. 18), so as to be able to "create links between their own language and ideas, and the formal language and symbols of mathematics" (p. 18).
2. Connections that enable the learner to make links between mathematical ideas and real world phenomena, so that the learner understands the usefulness and relevance of mathematics, thereby validating their past experiences through contextual learning.
3. Mental mathematics and estimation which involve a "combination of cognitive strategies that enhance flexible thinking and number sense" (p. 18). This provides the foundation for estimation with alternate algorithms and unconventional techniques for finding reasonable answers. This will enable the learner to "make mathematical judgments and develop useful, efficient strategies for dealing with situations in daily life" (p. 18).
4. Problem solving which is a "powerful teaching tool that fosters multiple creative and innovative solutions...empowering the students to explore alternatives and develops confident, cognitive, mathematical risk takers" (p. 19).
5. Reasoning which aids the learner to think logically and make sense of mathematics, developing confidence and justification in mathematical thinking through the exercise of inductive and deductive reasoning.
6. Technology which augments mathematical learning by providing a wide range of mathematical outcomes which enable the learner to "explore and create patterns, examine relationships, test conjectures,

and solve problems … contributing to a learning environment in which the growing curiosity of students can lead to rich mathematical discoveries" (p. 19).

7. Visualization, which is the ability to think in pictures and images; it is being able to transform and recreate various aspects of the visual-spatial world, and the ability to create, interpret and describe visual representations.

The final part of the introduction deals with suggested timeframes. It recommends that kindergarten students enjoy 2.5 hours of mathematics instruction a week and Grade 1 to 7 students between 4.5 and 5 hours of mathematical instruction in a week. This introduction is also supplemented with an extensive list of references.

Consideration for Program Delivery

This section of the British Columbia Kindergarten to Grade 7 curriculum deals with eight topics, which are deemed important to clarify:

1. *Alternative delivery policy.* This section makes it clear that parents and students have the right to choose alternative educational settings. The schools are obliged to support these endeavours. This policy affirms that the family is the "primary educator in the development of children's attitudes, standards, and values" (p. 29). Nevertheless, it still prescribes learning outcomes to be assessed in the alternative setting.
2. *Inclusion, equity, and accessibility for all learners.* This section reiterates the fact that in British Columbia all students are integrated and included in the system, even those who experience English as a second language, or who have special needs.
3. *Working with the Aboriginal community.* This section declares that "the Ministry of Education is dedicated to ensuring that the cultures and contributions of Aboriginal peoples in BC are reflected in all provincial curricula" (p. 30). Teachers are encouraged to avail themselves of local Aboriginal communities to support and enrich the classroom experience for all students through the cultural contribution of Aboriginal expertise.
4. *Information and communications technology.* As information and communications technology is more and more important for our daily

lives, students require the skills for acquiring and analysing information, reasoning and communicating, and making informed decisions. This is facilitated through understanding and using information and communications technology for a variety of purposes.

5. *Copyright and responsibility.* This part of the document makes the reader aware of the scope of the copyright laws and their implications for users of copyrighted materials. It also specifies how to navigate through this legal maze, delineating what can and cannot be used in the classroom or private domains.

6. *Fostering and development of positive attitudes in mathematics.* This part of the IRPs stipulates that "a positive attitude towards mathematics is often a result of a learning environment in the classroom that encourages students' own mathematical thinking and contributions to classroom activities and discussions" (p. 31). These activities should include enjoying and valuing mathematics, developing mathematical habits of mind, exploring, taking risks, exhibiting curiosity, making and correcting errors, persevering, experiencing mathematics in non-threatening, engaging ways, and understanding and appreciating the role of mathematics in human affairs. Teachers in particular need to consider their role in developing a positive attitude in mathematics and role modeling this positive attitude directly and indirectly.

7. *Instructional focus.* This document has a number of organizers with mathematical processes integrated throughout. As students learn in different ways and rates, it is necessary in mathematics instruction that students be introduced to concepts in a variety of ways, be exposed to varied explanations, watch demonstrations, draw and represent thinking, engage in experiences with concrete materials, and visualize and discuss their understanding of concepts. Conceptual understanding is paramount and is emphasized throughout the curriculum as a means to develop in students the ability to become mathematical problem solvers. Therefore, "problem solving should be an integral part of all mathematics classrooms" (p. 32). Teachers are encouraged to render mathematics problematic, that is, problems should not be activities which can be solved by students by memorized methods or rules, and problems should have many correct ways to solve them. The problems must begin where the students are in their learning journey, they must deal with what students are about to learn, and the solutions require explanation for the answer provided and the method used to solve it.

In this longer section, a rationale is provided regarding the importance of teaching mathematics through problem solving. Then a general method is provided through which problems can be solved: Understand the problem, make a plan to solve the problem, carry out the plan, and then look back or verify your answer (p. 32). The strategies provided through the curriculum for problem solving are:

look for a pattern, construct a table, make an organized list, act it out, draw a picture, use objects, guess and check, work backwards, write an equation, solve a simpler or similar problem, and make a model.

Problem solving necessitates a shift in attitudes, both of students and teachers. There needs to be a desire to find solutions to problems, the confidence to try various strategies, the willingness to take risks, the ability to accept frustration when not knowing, and the understanding of the difference between not knowing the answer and not having found it yet (p. 33). Good problems will allow every student in the classroom "to demonstrate their knowledge, skill or understanding" (p. 33). Notwithstanding all this, instruction ought to emphasize mental mathematics and estimation to check the reasonableness of paper and pencil exercises.

8. *Applying mathematics.* The section stresses to the reader that in order for mathematics to be relevant and useful, the learner must understand how mathematics is applied in a variety of contexts. Therefore teachers are urged to "incorporate, and make explicit, mathematics concepts which naturally occur across the subject areas" (p. 33). Mathematical concepts are found in Fine Arts as patterns, fractions in rhythm and meter, spatial awareness in dance, geometrical shapes in visual arts, symmetry, transformations, and proportions, measuring and mixing in art materials. In Health and Career Education mathematical concepts occur in creating schedules, interpreting statistical data, charts, graphs, diagrams, and tables, and using mathematics to develop a logical argument to support a position on a topic or issue. In Language Arts mathematical concepts can be fostered through reading literature which incorporates mathematical themes. In Physical Education mathematics is relevant when estimating distances, examining patterns of movement, exploring the benefits of physical activities, that is, burning calories, etc. In Science mathematics is prominent in calculations, classifying and sorting objects, measuring quantities, using units and conversions, collecting, organizing and interpreting data, and creating a logical argument to support a hypothesis (p. 34). In Social Studies mathematics appears when discussing magnitude of numbers, pursuing concepts of area, perimeter, and distances when mapping, graphing using the Cartesian plane, employing the concepts of a circle when studying latitude, longitude time zones, etc., reading and recording dates and times, and again using mathematics to develop and support a position on a topic or issue.

Finally students should be encouraged to become aware of the mathematics around them in their daily lives when making purchases, reading schedules, reviewing sports statistics, interpreting media resources, following a recipe, estimating time to complete tasks, estimating quantities, creating patterns when doodling, etc.

Prescribed Learning Outcomes

This section of the document begins with a 1-page explanation. It makes very clear that the prescribed learning outcomes "are content standards for the provincial educations system; they are the prescribed curriculum" (p. 37). The learning outcomes are the attitudes, skills and what students are required to know or be able to do at the end of each school year, set out in observable and measurable terms. The document continues by clarifying that schools have the responsibility to make sure that the curriculum is covered, but gives the schools the flexibility to choose the best way in which to meet these outcomes in the particular context in which they are embedded. The expectation is that students' achievement will differ with respect to the learning outcomes. The manner in which student are evaluated, the way in which it is reported, and the placement of students is left to the professional judgment of the teachers, who are guided by the provincial policy.

The prescribed learning outcomes are presented grade-by-grade in a curriculum organizer and sub-organizer which are coded alphabetically but which are not intended to be prescriptive in the sequence in which the professional teacher chooses to use them. Furthermore, the document clarifies that all parts of the intended learning outcomes "must be addressed" (p. 37). The word *including* in the document points out that these are the minimum requirements linked to the general requirements, but grants the teacher the liberty to expand on or address additional items which could be part of the general outcomes.

This preamble to the learning outcomes also makes the educator aware that learning must be linked to one or more of the domains of learning identified: cognitive, psychomotor, and affective. The cognitive domain is identified as pertaining to the "recall or recognition of knowledge and the development of intellectual abilities" (p. 37). It is sub-divided into four realms: knowledge, understanding, application, and higher mental processes. It is accepted that learning develops over time. The affective domain relates to "attitudes, beliefs, and the spectrum of values and value systems" (p. 37). The psychomotor domain is explained as pertaining to those parts of learning which are associated with "movement skills and demonstration" (p. 37). These three domains are the foundations for the Assessment Overview Tables provided for each grade in the section of the Classroom Assessment Model.

Prescribed Learning Outcomes, Grade 4

The prescribed learning outcomes by grade are divided into four categories of learning: number, patterns and relations, shape and space, and statistics and probability. These learning outcomes are set out in a table format in 2.5-pages, which allows the viewer to gain a complete overview of the expected learning outcomes through a quick glance. Each of these categories has expected learning that the student will achieve. Each expected learning is identified by a capital letter and a number. For example, the number category has 11 expected learning outcomes. For each learning outcome, clearly marked cognitive processes that students have to engage in are identified: communication, connections, mental mathematics and estimation, problem solving, reasoning, technology, and visualization.

The 11 learning outcomes for students in the number category are labelled with a capital A and a number, and can be summarized as being able to describe, represent, compare, add, and subtract numbers to 10,000. It also includes knowing and being able to understand, explain, represent and apply the multiplication facts to 9 x 9 and its reverse process to divide 2-digit numbers by a 1-digit number and the properties of 0 and 1 for multiplication and of 1 for division. The number section also covers the understanding and representation of fractions less than or equal to one, and being able to equate it to its decimal counterpart. Finally, the number category expects students to be able to add and subtract decimal fractions to hundredths. Each of these expected abilities are accompanied by the cognitive processes that the students should be able to engage in as they cover the expected outcome (p. 50).

For the patterns and relations category, the document identifies four distinct learning outcomes labelled with a capital B and a number, which can be summarized as students being able to identify and describe patterns found in tables and charts, including the multiplication chart. Students should learn how to use, identify, and explain patterns, relationships, and their corresponding charts to solve problems (p. 51).

The category of shape and space is identified with the capital C and has as well five expected learning outcomes for the students divided into three subcategories. The first subcategory includes the measurement of time using digital and analog clocks including the 24-hour clock, dexterity with the use of the calendar, and the understanding of area of regular and irregular 2-dimensional shapes. The second sub-category deals with the description and construction of 3-dimensional objects and 2-dimensional shapes. The final sub-category deals with transformations of shapes including line of symmetry, identifying symmetrical 2-dimensional shapes, creating symmetrical 2-dimensional shapes, and drawing one or more lines of symmetry on 2-dimensional shapes (p. 51).

The category of statistics and probability is identified with the capital D and has two expected learning outcomes for students that are the understanding of many-to-one correspondence and constructing and interpreting pictographs and bar graphs involving many-to-one correspondences so as to be able to draw conclusions (p. 52).

Prescribed Learning Outcomes, Grade 5

The learning outcomes for Grade 5 are again divided into the four categories of number, patterns and relations, space and shape, and statistics and probability. The number category identified with the capital A has 11 outcomes as well which can be summarized as being able to describe, represent, compare add, and subtract numbers to 100 000; being able to estimate by using front end rounding, compensation, using compatible numbers all in the problem solving context. In this grade applying mental mathematics strategies like skip counting, doubling or halving, in multiplication annexing and then adding zero are required; understanding and applying two by 2-digit multiplication as well as 3-digit by 1-digit division and understanding remainders must be mastered; students must understand and represent fractions using concrete and pictorial representations, they need to be able to compare fractions with like and different denominators; they need to understand and represent decimal fractions to thousandths, being skilful in adding and subtracting them. As well the learner must be able to compare and order decimal fractions using benchmarks, place value and equivalent fractions (p. 53).

In the patterns category identified with the capital B letter there are only two learning outcomes: students must be able to determine a pattern rule and find the subsequent numbers in the pattern, and solve single-variable, one-step equations (p. 54)

In the shape and space category students need to be able to design and construct various rectangles given their perimeter or area, or both (whole numbers) and draw conclusions. Students need to be able to master the understanding of length measurement in mm, cm, or m and their relationships. In this grade students need to learn and understand the measurement of volume and its corresponding units in centimetres or meters cubed, measuring and recording volume measurements in the mentioned units. The students also have to understand the concept of capacity by describing the relationship between millilitres and litres, estimating capacity, and measuring capacity with these measurement units. As far as shapes are concerned, in this grade students ought to be able to describe and provide examples of edges and faces in 3-dimensional objects, as well as sides in 2-dimensional objects, understanding and applying the concepts of parallel, intersecting, perpendicular, vertical, and horizontal. As far as shapes are concerned, students should understand and be able to identify quadrilaterals according to their attributes, differentiating between rectangles, squares, trapezoids, parallelograms, and rhombuses. Students also need to be able to perform or identify single transformations like translations, rotations or reflections of a 2-dimensional shape with or without technology (pp. 54-55).

The category of statistics and probability, which is identified with the capital D, has four learning outcomes: the learner must be able to differentiate between first-hand and second-hand data, construct and interpret double-bar graphs to draw conclusions, describe the likelihood of a single outcome occurring using words like impossible, possible or certain, and compare the likelihood of two possible outcomes occurring using terms such as less likely, equally likely, or more likely (p. 55).

Prescribed Learning Outcomes, Grade 6

The learning outcomes for Grade 6 are divided as well into the four categories of number, patterns and relations, space and shape, and statistics and probability. The number category which is identified with the capital letter A has only nine outcomes for this grade. These learning outcomes include understanding and being skilful with numbers greater than 1 000 000 and less than 1 000; solving problems involving large numbers using technology, understanding and applying the concept of factors, identifying prime and composite numbers, solving problems involving multiples; relating mixed fractions to improper fractions; understanding and representing pictorially, concretely, and symbolically ratios and integers and percentages, division of decimals; and explaining and applying the order of operations including exponents (p. 56).

The patterns section represented with the capital B has four outcomes for this grade: students ought to understand the relationships of values within tables to problem solve, represent and describe patterns and relationships using graphs and tables, represent generalizations arising from number relationships using equations and variables, and understand and explain the meaning of equality (p. 56).

The category of shape and space represented by the capital letter C has nine learning outcomes for this grade which are: understanding angles by being capable of comparing, measuring, classifying, estimating, and drawing and identifying them;

demonstrating that the sum of the interior angles in a triangle add up to 180° and 360° in quadrilaterals; developing and applying formulas to determine the perimeter of polygons, the area of rectangles, and the volume of rectangular prisms; constructing and comparing triangles including equilateral, isosceles, scalene, right, obtuse, and acute; describing and comparing sides and angles of regular and irregular polygons; performing a combination of translations, rotations, and reflections of 2-dimensional images with and without technology; and performing and describing a single transformation in the first quadrant of the Cartesian Plane (p. 57).

Finally, the category of statistics and probability identified with the capital letter D has four learning outcomes: students must be able to create, label, interpret, and draw conclusions from graphs; select and justify the appropriate methods for collecting data; graph collected data and analyse them to solve problems; and understand the concept of probability demonstrated by identifying all possible outcomes of a probability experiment, differentiating between experimental and theoretical outcomes, determining theoretical and experimental outcomes through experimentation and comparing these results (p. 58).

The British Columbia document proceeds by giving the reader these same outcomes in what they call "Described Learning Outcomes *by Curriculum Organizers*" (p. 61). This section is the repeat of the Learning Outcomes section, with the difference that this time each category is shown grade-by-grade, that is, first all the number learning outcomes are given grade-by-grade, then the pattern and relationships learning outcomes are given grade-by-grade, and so on. This provides a very clear scope and sequence of the learning outcomes by grade for the reader in each separate category.

Student Achievement

The student achievement section is divided into two parts. It starts with a lengthy and detailed explanation of assessment which applies to all the grades, and then it concludes with a very detailed chart for each grade presented in a visual organizer which is divided into two columns: the first column has each individual learning outcome with its cognitive process on the left, and on the right column it has a list of very detailed suggested achievement indicators.

The introduction on assessment begins with a clearly stated caveat, that the assessment model provided with its specific achievement indicators "may be used to assess student performance in relation to each prescribed learning outcome" (p. 81). It is noteworthy that the verb "may" is used. It denotes that this can be used, but it does not mean that it must be used, although it does provide "descriptions of content that help determine the intended depth and breath of the intended outcomes" (p. 81). The document defines assessment as "the systematic gathering of information about what students know, are able to do, and are working towards" (p. 81). The "evidence" which must be gathered can be collected through a variety of means which include observation, student self and peer assessment, samples of students work, quizzes and tests, projects and presentations, oral and written reports, journals and learning logs, performance reviews and portfolios.

The document introduces three distinct types of assessment that "can" be used in conjunction with each other. These three types of assessment are assessment *for* learning, assessment *as* learning, and assessment *of* learning. The document explains these different types of assessment in a variety of ways and then summarizes them in a chart. The chart defines assessment for learning as a formative, on-going assessment in the classroom which involves teacher, student self-, and peer assessment and which uses criteria based on the prescribed learning outcomes; it involves both teacher and student in the process of reflection and review about the student's progress and will prompt the teacher to adjust their plans and engage in corrective teaching in response to the formative assessment. Assessment as learning is also formative and ongoing in the classroom but is a student self-assessment that should prompt the student to consider how to improve their learning, resulting in adaptations made by the student to their learning process so as to develop new understandings. Finally, assessment of learning is a summative assessment which happens at key stages or at the end of the year and is a teacher assessment which can be criterion-referenced based on the learning outcomes, or it can be norm referenced comparing students' achievement to others; the information is shared with parents, school districts, staff and other professionals and is used to make judgments of students' performance in relation to provincial standards (p. 46). At the end of this lengthy explanation and visual chart, the document refers the reader to websites that give further information about these types of assessment, should the reader be interested in the rationales, and research that support the given material.

This student achievement introduction then proceeds to explain criterion-referenced assessment and evaluation. It defines it as an evaluation in which the student's performance is "compared to established criteria, rather than to the performance of other students" (p. 83). This type of evaluation identifies in specific terms the most important parts of what a student produces in relation to the prescribed learning outcomes, indicating how well the student is meeting those learning outcomes.

The student achievement section of the document provides, at the beginning, the key elements in a brief overview of the learning outcomes in each curriculum organizer. This facilitates the use of the suggested achievement indicators. Finally, this part of the document gives a very detailed list of achievement indicators for each category of the learning outcomes for each grade level. It is presented as a visual organizer that is divided into two columns: the first column has each individual learning outcome identified with the capital letters, and with its cognitive processes on the left; on the right column it has a list of very detailed suggested specific achievement indicators. For Grade 4, there are 10 pages (from p. 129 to p. 138) of achievement indicators. For Grade 5, there are 11 pages (from p. 141 to p. 152) of achievement indicators; and for Grade 6, there are 10 pages (from p. 155 to p. 164) of achievement indicators.

Classroom Assessment Model

The next section of the British Columbia document deals with the classroom assessment model. At the beginning of this section, there is the explanation for the section. It begins by making the reader aware that this section provides a "suggested means of organizing, ordering, and delivering the required content" (p. 179). But the organizer is not intended to be a prescriptive linear outline for delivering the course: rather "teachers are encouraged to reorder the learning outcomes and to modify, organize, and expand on units to meet the needs of the students, to respond to local requirements, and to incorporate relevant recommended learning resources…" (p. 179). This preamble continues by reminding the educator that it is highly recommended that parents and guardians be kept abreast of all aspects of mathematics in the elementary grades. Again, it is highlighted that teachers are responsible to set a positive climate in the classroom and to elicit suggestions from students for the way in which the lessons will proceed, how to interact appropriately in class discussions, how to become critical thinkers, and how to remain open minded so as not to dig in on just one point of view. Students also need to be aware that if they disclose information that indicates that they are at risk for harm; this information will not be able to be kept confidential (p. 179). Then the preamble makes the reader aware that students need to have the most current information available, so as to be able to make informed decisions. This information is usually available through the internet, and therefore, teachers need to consider how students can best gain access to the latest technologies. Finally, the preamble lays out what the reader will find in this section, for example, an assessment overview table, and overview by grade. The overview gives the reader the capacity to understand what students have learned in the previous grades, and also gives a curriculum correlation, which is a table which "shows which curriculum organizer and suborganizers are addressed by each unit in this grade of the Classroom Assessment model" (p. 180). It continues with the prescribed learning outcomes, suggested assessment activities, like planning for assessment and assessment strategies. It concludes with a brief explanation about the assessment instruments.

This section then turns to each grade level with specific information. Each grade level begins with an assessment overview table, which contains seven columns. The first column is the curriculum organizer where each line contains the intended learning outcomes categories of number, pattern and relations, shape and space, and statistics and probability. The second column gives the suggested assessment activities for each category. The third column entails the suggested weight for grading, the fourth column has the number of outcomes, the fifth, sixth, and seventh columns are under the general heading of number of outcomes by domain. In the fifth column the number of outcomes that pertain to the cognitive domain of knowledge is given for each category, in the sixth column the number of outcomes that pertain to the understanding and application of the cognitive domain are given by category, and in the seventh column the number of outcomes that encompass the higher mental processes of the cognitive domain are given by category. This is a clear table that helps educators plan the yearly delivery for learning.

This section continues with a half-page list form overview about what students learned in the previous grade. Then the reader finds a table of what is called a curriculum correlation which is a curriculum organizer that shows where in our daily lives we encounter the different categories of the mathematical content students learn. This correlation table is different and serves as a different help than the correlation given before. For example, in this correlation table, the suborganizer of "shapes around us" (p. 248) indicates that this daily experience can be used in the patterns and relations and shape and space categories. This section ends with many examples of suggested assessment activities that are put together with the prescribed learning outcomes. It is noteworthy that an assessment activity can entail more than one prescribed learning outcome. The visual organizer in this section starts with all the learning outcomes the different activities cover. Then there are two columns, one for the planning for assessment column that describes specific activities, and the second column with specific observable categories that the educator can evaluate when students are engaged in the activities proposed.

In the assessment overview tables by grade there are slight differences in the weight allotted to each category of learning. It can be summarized as shown in the comparative Table 1.

Table 1

Assessment Overview Table by Grade

Curriculum Organizer	Suggested Weight for Grading		
	Grade 4	Grade 5	Grade 6
Number	45–55%	45–55%	40–50%
Patterns and Relations	10–20%	5–15%	5–15%
Shape and Space	25–35%	25–35%	30–40%
Statistics and Probability	5–15%	5–15%	5–15%

At the end of the Grade 5 classroom assessment models there is an assessment rubric for the specific "planning a party" (p. 292) activity and a "gameboard sample" (p. 293). At the end of the Grade 6 sections, the document gives an assessment rubric example for a "geometry portfolio" (p. 313).

Learning Resources

This is a short section in the British Columbia K to 7 IRP. It briefly explains that "recommended learning resources are resources that have undergone a provincial evaluation process using teacher evaluators and have Minister's Order granting them provincial recommended status" (p. 339). These materials include all forms, like print, video, software, CD-ROMs, games, manipulative and other multimedia resources. This section includes a recommendation to teachers on how to choose these resources in the most cost effective way. It also specifies the criteria used to evaluate the resources, what funding is available to acquire the resources, and what kinds of resources are found in the grade collection. It closes this section by giving the ministry website to access the grade collection.

Glossary

The glossary is a 2-paragraph section in which the document "recognizes the limitations available in print form only" (p. 343) acknowledging that the glossary used has been developed by Alberta Education and conforms to the NWCP CCF for Grades K to 9. It concludes by giving the website address.

Now that I have given the summaries of both the Mexican and British Columbia intended curricula, I will give a brief comparison between the two curricula in the next chapter.

Chapter 6.

Comparison of the British Columbia and Mexican Mathematics Curricula

Analysis of the Cultural Histories of British Columbia and México

It is very interesting to note that both México and British Columbia began their history with a very similar cultural backdrop. The aboriginal inhabitants of both British Columbia and México were descendants of the peoples that came from Asia over the Bering land bridge. There is speculation about when this happened, although scholars seem to agree that there is enough archaeological evidence to demonstrate that these peoples were in North America about 12 000 years ago (MSN Encarta, ¶1). In fact, for a person who is not a linguist, I have noticed a similarity in the language and sounds used by some first nations groups in British Columbia and in México. For example the use of the last two consonants "t" and "l" at the end of names is very common among the Nahuatl peoples of México and some of the coastal peoples in British Columbia like the Kwakuitl. However, this could be a whole research project by itself. Suffice it to reiterate that, in my personal experience, the cultures of the First Nations in British Columbia and the Mexican indigenous peoples are very similar. This experience comes from having lived in México for my first 25 years of life, and having taught in Prince George in an inner city school with a 79% Aboriginal population. Therefore, this cultural, pre-European historical reality does need consideration as we research some aspects of the modern educational intended curricula both in México and in British Columbia, as we shall see in a later section of this research.

Once the European colonizers arrive in each locale, they take very distinct paths. In México the *conquistadores* had no qualms in killing the ruling elite of the indigenous peoples, and in using the indigenous women in whichever ways were convenient for them and the men as serfs. One result of this mindset was the creation of a mixed blood race, the *mestizo,* which had some deep identity challenges, as described by Dussel earlier in this work. In contrast, the British Hudson's Bay Company only had trading interests at the beginning, and only few British trading post guardians intermarried with the Aboriginal women of British Columbia. In México the conquest was violent and bloody; in British Columbia the colonization was gradual and by royal decree, rather than by armed conflict. This reality still has legal implications for British Columbia, which now is forced by the higher courts to negotiate comprehensive land-claims settlements, in which culture and education play a part. We shall investigate if this is indeed reflected in the British Columbia intended curriculum in the next chapter.

There is a further difference which is readily noted, namely that the educational philosophies which British Columbia and México developed are markedly distinct. The British Columbia philosophy of education was based on the British philosophical currents of their time, while the Mexican philosophy of education was heavily influenced by the French philosophical currents of their times. The British philosophical thought follows a strong individualistic pattern. We will look for evidence in the intended British Columbia curriculum of this philosophical stance. The Mexican philosophical thought follows the socialist French Revolution pattern, in which there was the motto *liberté, égalité,* *fraternité.* It will be interesting to scrutinize the Mexican intended curriculum to see if this French influence is still reflected in the Mexican intended curriculum in mathematics.

As we think of cultures, we also need to remember the religious beliefs of the peoples in both places. Both the British Columbia Aboriginal groups and the Mexican indigenous peoples have a host of animistic, nature-involved religions, according to each group's individual history. The Spanish *conquistador* brought the Catholic Religious system, which was imposed on the indigenous people. They took some of these beliefs but upheld some of their own ancestral beliefs, producing a very distinct religious identity for themselves. In British Columbia, the traders came with two Christian religions, the Catholic and Protestant religions. These again were shared with the Aboriginal peoples, but had a much shorter time of influence, as the traders came to British Columbia in the nineteenth century and the *conquistadores* came to México in the sixteenth century. With the abuse that Aboriginal children suffered in many of the Residential Schools in British Columbia, many Aboriginal people have left the Christian faith and embraced some of their ancestral beliefs. These realities may have an influence on how education is viewed and administered in both locales. We have seen that politically, both locales have sought to establish a separation between church and state at around the same time in history. Therefore, in both locales education became secular.

Reviewing both educational projects, we find some interesting characteristics that set each educational system apart. For the Mexican educational projects, we observe that México's educational philosophy was heavily influenced by the fact that México strongly resisted any influence exerted by the United States of America after the catastrophic American-Mexican war of the nineteenth century. For the Mexican mindset, the British philosophies were synonymous with the American philosophies, as they viewed Americans as the offspring of the British. Furthermore, remembering world history, the Spanish and British empires were always in rivalry in the sixteenth and seventeenth centuries. By their historical reality, anything British was disliked in México. Shortly after México shook off the Spanish yoke in the beginning of the nineteenth century, the United States took half of México's territory. From that time on, México has always looked elsewhere for direction and inspiration. The French revolutionary ideology appealed to the Mexican elite as a worthy model to emulate. And so we can identify in México a *corriente* of resistance to any British or American influence. The Mexican *corriente* sought any alternative philosophical mooring to anchor onto.

In British Columbia, the predominant mindset was one of accommodation and compromise. This way of life has become modern Canada's hallmark in international diplomacy. But this cultural heritage has been a long standing trait in the educational projects through its history. This has also propelled the British Columbian educational system to change often, as pressure from interest groups became apparent. Even these days, the British Columbia Ministry of Education has established a new separate educational system for the Aboriginal youth. This educational system has been set up and is led by Aboriginal educators who have integrated their cultural roots into the intended curriculum. Here again we can see accommodation and compromise work at its best.

Comparison of the Epistemologies Reflected in the Intended Curricula in British Columbia and México

The conceptions that one may hold of what mathematics is provide us with a framework for thinking about how mathematics should be taught. The way an intended curricular document is presented will bear imprints of what is believed to be the most essential parts of mathematics. The mathematician Hersh (1986) introduces an interesting perspective when he writes: "The issue, then, is not, What is the best way to teach? But, What is mathematics really about?" (p. 13).

These thoughts bring to light that what educators hold to as what is the way mathematics is best taught and learned rests to a great extent in the educators' "epistemologies, beliefs and conceptions about mathematics" (Pepin, 1999, p. 127). Webster (1983) defines epistemology as "the study or a theory of the nature and grounds of knowledge esp. with reference to its limits and validity" (p. 419).

Within any country and educational community, there exist many factors that exert influence on how mathematics is perceived. "Embedded in the context are the values, beliefs and traditions of a particular education system which may be manifested in adopted curricula, educational practices, in systemic features..." (Pepin, 1999, pp. 127-128). Another factor that exerts influence on the epistemology of mathematics lays in the country's philosophical school knowledge traditions. Pepin (1999) posits that the philosophy espoused in a country "permeates and underlies ... to a greater or lesser extent, teachers' thinking and decision-making and thus their pedagogies" (p. 129).

In British Columbia the main philosophy has been handed down from the English education system, namely, humanism. Pepin (1999) summarizes this philosophy as follows:

> ...education is said to be child-centered and individualistic, the interaction between teacher and pupil is greatly emphasized. With respect to morality...education should develop qualities such as fairness and integrity, and teachers have traditionally had a pastoral as well as an academic function. (pp. 129-130)

Therefore, individualism and moral purpose are the foundations upon which the English and British Columbian educational systems rest. Holmes and McLean (1989) posit that it is the interaction of the learner with different appropriate materials that foster the student's development. Thus, the content of education should be chosen taking into consideration the individual differences in the student body (Pepin, 1999, p. 130). This focus on the individual and on individual differences stands out as a significant difference to the Mexican educational philosophy, which is more universal, egalitarian, and fraternal. The British Columbia IRPs document reiterates this stance: "a positive attitude towards mathematics is often a result of a learning environment in the classroom that *encourages students' own* (italics are mine) mathematical thinking and contributions to classroom activities and discussions" (p. 31). The other aspect of pastoral care is present in the expressed obligation of a teacher to foster a welcoming environment for students: "Environments that create a sense of belonging, encourage risk taking, and provide opportunities for success help students develop and maintain positive attitudes and self-confidence" (p. 12).

In México, the prevailing philosophy of education was founded upon the French educational model. To understand the Mexican educational philosophy we need to understand the French educational philosophies. Pepin (1999) states that there are "two features in the philosophy of French education which helps in understanding the systems and practices of those who work within it" (p. 130). The first one is encylcopaedism which espouses the principles of rationality and universality associated with *égalité*. These ideas postulate transforming society in the interest of the majority of its members. Therefore, fostering the development of rational faculties is seen as important. This can be accomplished through, for example, the teaching of mathematics. The principle of universality is found in education in the form of students studying broadly the same curriculum at the same time. The associated egalitarian thought endeavours to ameliorate social inequalities through an educational system that promotes and gives equal opportunities to all learners.

The second feature is the concept of *laïcité,* which traditionally views social and moral education to be a family task, whereas the academic formation is expected to take place in school. Paraphrased, school is responsible for the academic development of a child, while the parents and church are responsible for the moral development of the child. This feature has been slowly shifting, as schools are more and more given the responsibility to develop the socializing of students (Pepin 1999, p. 130). In British Columbia, the intended curriculum document states explicitly in the introduction that "British Columbia schools include young people of varied backgrounds, interest, abilities, and needs" (p. 11). It clarifies that the intended curriculum has integrated "ways to meet these needs and to ensure equity and access for all learners" (p. 11).

The Mexican educational system emulates the features of *égalité* and *laïcité*. There is no individual considerations given to students' academic histories, all students are taught the same curriculum at the same time, and every student is furnished with the same material required for successful learning within the confines of this philosophical paradigm. This stands in clear contrast to what is expected in the British Columbia intended curriculum, namely that the educators focus on the individual differences in their students. The pastoral function of an educator is absent in the Mexican documents, as these only focus on the academic learning and civic responsibilities of the students.

Even though the Mexican and British Columbia philosophy of education moorings are quite distinct, it is interesting to note that both curricula promote the use of the constructivist approach to learning. Pepin (1999) helps us understand that there may actually be differences among constructivist approaches. In reviewing some of the interpretations of Piaget's constructivist epistemology, she writes: "From the constructivist point of view, there are no direct connections between teaching and learning, since the teacher's knowledge cannot be conveyed to the students; the teacher's mind is inaccessible to the students and vice versa" (p. 131). This is the reason why it is alleged that students actively construct their own learning through accommodation and assimilation of cognitive structures. This process is guided by the personal experiences the learner has had and depends on structures that allow the learner to acquire the needed concepts. In the realm of constructivism, there are two distinct strands: social constructivism and radical constructivism.

According to Pepin (1999), social constructivism proposes a process of enculturation that is distinct from and in addition to the learner's constructions that are influenced by the cultural and social milieu of the child. It is said that the essential part of enculturation in school mathematics is learned indirectly.

Radical constructivism proposes the idea that educators must recognize that they are not teaching the learner about mathematics, but how "to develop their own cognition" (Confrey, 1990, p. 110). This means that educators need to infer the model which students possess in their conceptual constructs. Then the teacher needs to lead the learner in altering their own constructs to that which the educator sees as helpful for advancing their learning. Thus, radical constructivism proposes that teaching is an interaction with students in a learning environment that is based partially on the student's knowledge in mathematics. This environment has three essential parts: "posing of situations; the encouragement of reflection; and interactive mathematical communication" (Pepin, 1999, p. 132). Pepin (1999) continues to say that socio-cultural theories propose the idea that individuals are embedded within cultures and social situations, so that it does not make sense to think about learning without understanding it as a process that emanates from a given context or activity. Therefore, the idea of having knowledge *a priori* fades in favour of the idea that knowledge is socially constructed and justified (Pepin, 1999, p. 132).

Looking at the intended curricula for British Columbia and México, we can identify that the British Columbia intended curriculum espouses the concept of social constructivism, in which much emphasis is given to communication and representation in mathematics. The importance given to individualism is paramount in this paradigm of learning. In comparison, the Mexican intended curriculum employs radical constructivism, as it puts greater emphasis on teachers developing models of conceptual learning for their students. This is modelled in the readings of *La enseñanza de las matemáticas en la escuela primaria: Lecturas* (Balbuena Corro et al., 1995) and *La enseñanza de las matemáticas en la escuela primaria: Taller para maestros* (Block

Sevilla et al., 1995). The readings of the first book help teachers to understand the importance of the mathematical models that are then modelled in the second book of workshops, where the conceptual models of learning are conveyed to teachers, so that they can develop them. It is interesting to note that Freire's influence upon Mexican educational philosophy rests upon the socio-cultural theories that Pepin briefly explains.

As a professional educator here in British Columbia, I was made aware of the constructivist approach to teaching and learning mathematics. Nevertheless, I did not understand that within this pedagogical interpretation of Piaget's constructivist epistemology, there exist distinct forms or interpretations. From the conversations I have had with many of my colleagues, I infer that many of them also do not understand the different ways constructivism can be interpreted, and therefore used in their daily practice. From conversations I have had with my sister in México, I conclude that, although Mexican educators are given the radical constructivism approach to use, they are likely unaware that there are different strands of constructivism.

As we think about these differences, the reader can identify a very subtle irony. In México, the pedagogy takes an individualistic constructivist approach. Nevertheless, it is implemented in a very socially controlled manner by the educational system. In contrast, in British Columbia a socially constructivist pedagogy was implemented in an individualistic manner.

Comparison of the Intended Curricula by Categories

In this section, we will explore some of the similarities and differences between the Mexican and British Columbia curricular documents. I shall look at different aspects of the intended curricula in each place and make an analysis of both similarities and differences in the aspect under scrutiny. The categories that I will use as a basis for comparison are ones that I developed after analysing the documents. These categories are: (a) availability of the documents, (b) the format of the document, (c) the content and sequence of the intended curriculum, (d) the prescribed pedagogy or philosophical current of education, (e) the use of manipulatives, (f) the amount of learning time allotted for specific parts of the curriculum, (g) the intended learning outcomes for students, and (h) the teaching resources for teachers.

Availability of the Intended Curricula

The first aspect I would like to address is the availability of the documents. The British Columbia Mathematics curriculum is readily available at the Ministry of Education website http://www.bced.gov.bc.ca/irp/mathk7/mathtoc.htm . Educators, parents, academics, students, and any other person who has access to the internet can readily access, print, read or review this document at any moment and at their convenience.

In contrast, the *Plan Educativo de Matemáticas* is next to impossible to access, unless you are a teacher at that grade level. The *Secretaría de Educación Pública* website does not have the curricular document; it only has general information about education in México. It briefly mentions de *Plan Educativo de Matemáticas*, but does not have it available for viewing. Instead, the *Secretaría de Educación Pública* publishes the curricular documents every year in the form of books, which every teacher is given at the beginning of the school year. Nevertheless, it appears that there is a chronic shortage of books, as apparently more teachers end up being employed than books printed. Therefore, to get one of these curricular documents after August is impossible. Even in August, the supply is so tight, that unless you are a teacher and have been somehow favoured, it is likely one could not get one's hands on one of the copies. One can speculate about the reason for the chronic shortage of books, but the most likely explanation is that, because there is a very tight supply of funds, the government officials do not want to print more of the books than are necessary and usually underestimate the number of books needed. I had a very hard time getting a copy of these documents, even though my sister is an educator in México, and is very well connected in the *Secretaría de Educación Pública.* Even she had to wait over half a year, from January when she began to ask for these documents, until late August when she got just a partial supply of these documents. My sister contacted several colleagues who are teachers both in México City and around the state of Guanajuato. At the end, my sister was given copies of the books by different educators as a very special favour to her.

In light of all these facts, it is readily apparent that the general public, the parents, or the students cannot access these documents to view them or to try to understand the philosophical pillars upon which the mathematics education is built in México.

Therefore, in this aspect, the only similarity that can be found is that in both places it is made available to teachers. The difference between the availability between both places is that in British Columbia it is readily available to all public through the ministry's website, and in México it is only available for the teachers who are on active duty.

Format of the Curricula Documents

The second aspect I am going to compare between these two curricula is the format in which they are presented. In British Columbia, this document is formatted in the Ministry of Education's website as a single document. This document is 433 pages long. It encompasses the grades from Kindergarten to Grade 7 in a single document. Each grade level does have a particular section and prescribed intended curriculum, nevertheless is sequenced within the whole document. This gives the whole elementary mathematics education a sense of continuity and unity. Educators, parents, students, and the public at large can readily see the scope and sequence of the mathematics instruction and learning through the format of this document.

The format of the Mexican curriculum document is a series of books for each grade level. For each teacher there are several books that describe and contain the curricular document. Each teacher gets two general books entitled *La enseñanza de las matemáticas en la escuela primaria: Lecturas* (Balbuena Corro et al., 1995) which translated is "The teaching of mathematics in the elementary school: Readings" and *La enseñanza de las matemáticas en la escuela primaria: Taller para maestros* (Block Sevilla et al., 1995) which translated is "The teaching of mathematics in the elementary school: Workshops for teachers." Then there is a teacher book that is grade specific, for example, the *Libro para el maestro: Matemáticas (grade level),* Book for the teacher: Mathematics (grade level). The fourth book provided by the Mexican Ministry of Education to each teacher is a detailed guide of specific important concepts, strategies to be used, and assessment formats for each unit of the student consumable workbook. It also provides a summative assessment test for each unit. The fifth book is the student consumable textbook. The sixth book is *Plan y programas de estudio. Educación Básica. Primaria. 1993,* which is a curricular overview book with of all the learning outcomes for each grade that helps the teacher understand what they have to teach in relation to what students have learned before and will have to learn after the school year.

The only similarity between the formats of both intended curricula is that they are in a written document or series of documents. There is an apparent difference between the way both documents are formatted, in that the British Columbia intended curriculum is in a single document, and the Mexican intended curriculum is formatted in a series of six distinct books which vary from grade level to grade level.

The difference becomes important for a number of reasons. The fact that one document is readily available through the internet and the other only in hard copy of six books, brings out the question of accessibility for the educator and the other stake holders in education. My personal experience is that I continually think and reflect upon my practice, both while I am in the physical building of the school and at home as well. If I have a doubt about one of the learning outcomes, or pedagogies, or resources, I can readily access the document though the internet both at school or at home. I can imagine that if I only had the six books, I would either store them at home in my personal library as suggested by the document, or at school with my professional library. Therefore, I would not have access to them if I am in the other location. Another issue is that the book format may be advantageous for a sequential mind in that the curriculum being divided into books may aid me in remembering where to find which aspect of the curriculum, as it becomes more departmentalized. This would save time during preparation or reflection tasks. In addition, depending on the educator's working style, some people prefer to have a hard copy in front of them that is glossy and colourful. This may inspire them and encourage them to scrutinize and study the content more than if it is in a drab, electronic format.

Type of Program Used in Mathematics Education

There is a great difference between the type of educational program used to teach mathematics in British Columbia and México. The British Columbia elementary mathematics program is a curriculum based program. There are no prescribed textbooks, although there is a list of recommended textbooks. The sequence in which the curriculum is taught is suggested, but not prescribed. Each school is free to choose their teaching resources, like textbook, manipulatives, etc. This has evolved, so that now many school districts choose one textbook for the whole district, because in this way there are some economies of scale that allow the schools to purchase the textbooks and teachers' guides at a discount. BC schools have a chronic shortage of funds to purchase resources, like textbooks, and individual schools find themselves constantly making difficult choices trying to provide for the needs of the learners with the allotted dollars. Lately there has also been a drive to harmonize the whole province with the same textbook, so that as students move around the province, they may encounter the same textbook and didactic approach across the province. Having worked on the numeracy taskforce in my school district, I observed that one of the arguments put forth for the recommendation to adopt a certain textbook was that it had been chosen and was being used in the majority of school districts around the province. The coercive and mimetic isomorphism that institutional theory explains is readily observable in these decisions. Although this drive is not mandatory, a majority of school districts are opting to purchase a particular textbook, to realize some savings from the economy of scale by purchasing from the same publishing house. Nevertheless, the school boards have been very careful to stress that the chosen textbook is not the only resource educators should use, but that they should supplement the lessons with other materials grafted in from other textbooks or learning resources which often teachers have to purchase with their own money, as the some school accounts are usually spent by mandatory changes directed from the school boards.

In contrast, the Mexican program is what is called a textbook based program. The whole country uses the same textbook which is published by the *Secretaría de Educación Pública,* and distributed free of charge to all students and teachers in México. The scope and sequence of the program are fixed by the textbook, although it is made clear that the teachers have the liberty to augment the textbook with culturally embedded and relevant lessons. For example, in the *Libro para el Mastro: Matemáticas Cuarto Grado,* it is stated that "the participation of the teacher is essential for the success … he is the organizer, the coordinator of the activities, the one who guides students when they face difficulties and the one that suggests sources of information and additional support when necessary" (p. 13). Later the book describes the most important function of the mathematics teacher: "Looks for and designs mathematical problems that are adequate to foster learning of the various learning outcomes" (p. 14). The wording becomes quite interesting, as it delegates the success of the learning of the student to the activities the teacher designs and implements that may be over and above the ones given in the textbook. Nevertheless, the reality of the magnitude of the intended curriculum seems to steer teachers to endeavour to just cover the prescribed textbooks on time. The lessons seem to be so well implemented and constructed that the teachers may feel they have little need to deviate from them.

The Sequence and Content of the Prescribed Curricula

The first aspect I want to broach is the sequence of the curricula. In the British Columbia intended curriculum, it is clearly specified that the order or sequence of teaching is not fixed, but can be chosen by the individual professional educator to meet the needs of the students in their own contexts. This means that after having done a preliminary assessment (assessment for learning) of the students' mathematical knowledge at the beginning of the school year, the teacher has the professional discretion to choose which topic to teach according to the mathematical proficiency of the students at hand. This provides a great flexibility for the British Columbia educator, in which he or she makes the professional judgments regarding which order will create the optimal learning for the students they have each year.

In contrast, the Mexican mathematics program as prescribed by the *Secretaría de Educación Pública,* has predetermined the sequence in which the prescribed curriculum will be covered. It is lock-stepped into the publicly provided textbooks and teacher manuals. There is no room for professional preference or initiative, as one lesson follows the other, one activity the other, one teaching block the other as set out in the texts. The Mexican curriculum is covered in stages throughout the year, in which each block of teaching covers some aspects of each axis of learning. It seems to be a spiral learning method, in which each concept is taught and then revisited later in the year, building upon what has been taught until the whole prescribed curriculum is covered. For example, in the textbook *Matemáticas quinto grado,* number concepts are taught in lessons 1, 4, 5, 11, 17, 21, 23, 26, 28, 33, 35, 37, 44, 47, 55, 57, 74, 78, 83, 85, throughout the whole year. Each lesson builds on preceding ones. It seems that while the Mexican intended curriculum encourages spiralling, the British Columbia one leaves that as an option. Number concepts do come up repeatedly in the different strands in the intended curriculum in British Columbia, but perhaps not in such an intentional way as in the Mexican intended curriculum.

Prescribed Pedagogy or Philosophical Current of Education in Mathematics

It becomes very clear that both the British Columbia and Mexican mathematical pedagogies are built upon the constructivist approach. For this approach, learning mathematics occurs by doing it, by solving problems, by starting from a situation in which the learner needs to investigate, use their current knowledge, and build upon it as they construct their new knowledge. Therefore, for students, mathematics ought to be a tool that they recreate and which evolves as students confront problems to be solved. In the British Columbia intended curriculum, we find that conceptual understanding is paramount and is emphasized throughout the curriculum as a means to develop in students the ability to become mathematical problem solvers. Therefore, "problem solving should be an integral part of all mathematics classrooms" (p. 32). To construct their knowledge, the learner needs to understand the problem, make a plan to solve the problem, carry out the plan, and then look back or verify their answer (p. 32). The strategies provided through the curriculum for problem solving are: look for a pattern, construct a table, make an organized list, act it out, draw a picture, use objects, guess and check, work backwards, write an equation, solve a simpler or similar problem, and make a model.

In the words of the Mexican documents, the learning of mathematics entails that the learner needs "to do mathematics" (Block Sevilla et al., p. 9), generating their own resources as they have the challenge of new problems. At first, the students' resources are informal, but gradually change through his experience, interaction with classmates and the teacher to a form of formal knowledge. In the view of the Mexican and British Columbia documents, students' mathematical knowledge and problem solving are inseparable. Students do not learn mathematics and then apply them to solve problems, but they learn mathematics by solving problems. As the Mexican document very eloquently states, this didactic conceptualization implies that students must appropriate the significance of their knowledge, contextualize it again, that is, embed it in situations in which the knowledge acquires sense for the learner, as he or she is able to resolve a given problem (Garcia Cuevas, 2006, p. 9). It also needs to be borne in mind that the problems require the fulfillment of two characteristics: a) they need to be real problems for the students, which means they have to really pose a challenge to the student that will motivate him or her to search for a strategy to resolve it; b) the problems need to be able to be solved by the resources the students possess when the problem is formulated, which means that the degree of difficulty of the problem has to be at the level of the student (Garcia Cuevas, M., 2006). This pedagogy follows the pedagogical recommendations given by Paulo Freire, in that the construction of mathematical knowledge emanates from the embedded contextualized problems students face in their daily lives. As Freire demonstrated in Brazil in the 1960s, it is a very powerful pedagogical tool. At the same time, we can observe that Paulo Freire, who was exiled to

México in the 60s, had a profound influence on the Mexican educational institution, as he was a passionate and vocal educator who promulgated his educational convictions loudly and clearly.

The British Columbia IRP expands the concept of mathematics into the concept of numeracy. Numeracy also expands the realm of problem solving from mathematical problems to real life situational problems, so that students are able to make connections between the strategies used for mathematical problem solving and real life situation problem solving. Numeracy also endeavours to help students attach "meaning to what they do and [the] need to construct their own meaning of mathematics" (British Columbia IRP, p. 11). This building of meaning is best achieved when the learners can use their experience and proceed then from simple concepts to complex ones, from concrete thinking to abstract thinking. To achieve this construction of mathematical meaning, all students are helped by the use of a spectrum of materials, tools and contexts, aided by meaningful discussions with peers. The educators should make visible the mathematical concepts that are present in the school and home setting, affording "teachable moments" (p. 11).

The similarities of the pedagogical approach to learning mathematics are interesting. It is noteworthy that the Mexican Curriculum integrated their philosophical and pedagogical approach since 1993. British Columbia's curriculum officially integrated their approach since 2007, although many school districts had begun implementing it since 2003. It seems to point to the fact that what the Institutional theorist posit, is actually happening through what they call institutional normative isomorphism. Meyer et al. (1977, as cited by Wiseman & Baker, 2006) postulate that there are parts of the "institutionalized culture that creates and spreads commonly held models of the individual and the social organization (formal and informal)" (p. 4). Though practice may not reflect the intended curricula, we observe that the intended curricula have merged into a common understanding in the minds of the writers of the documents. With the modern communication systems, it is amazing how quickly news travels and is absorbed around the globe. When a pedagogical approach renders more positive results somewhere, this information is disseminated around the globe very quickly and educators elsewhere are prone to try it out and implement it when it has positive results. Most school districts in British Columbia have educators who are constantly reviewing the Curriculum and Instruction strategies and are proactively disseminating new and researched pedagogical innovations in their districts. In this way institutional isomorphism takes place here in British Columbia.

The Use of Manipulatives

In both British Columbia and México the use of manipulatives is mandated. The research has proven that many learners profit greatly in gaining mathematical understanding by the use of manipulatives of various kinds (Borko & Elliot, 1999; Burns, 2004; Heuser, 2000). For most lessons and concepts, various distinct manipulatives are recommended or mandated in both curricula. It becomes readily apparent that the Mexican Ministry of Education has recognized the reality of the scarcity of resources for procuring these manipulatives and has included a section of 2-dimensional manipulatives in the student consumable textbook. In contrast, the British Columbia curricular document recommends and to a degree, demands the use of 3-dimensional manipulatives that are very costly to purchase. The British Columbia Ministry of

Education has downloaded the responsibility of the purchases of these manipulatives to the local school level. This creates a continual internal tug-of-war in the schools, as different interests compete for the scarce resource dollars. My experience has been that some schools have made the investment for these manipulatives, while other schools have not been able to afford this “luxury” because of their particular funding and student population needs situation. Therefore, in reality, educators may or may not have access to these teaching tools that are indispensable for teaching through the constructivist approach.

In summary, both intended curricula are similar in that they prescribe the use of manipulatives. The difference, though, in their individual approaches is that in México the Ministry has taken a realistic approach to providing these manipulatives, while in British Columbia, the Ministry has downloaded the responsibility, thereby making it very difficult for many teachers to have their students benefit from the learning opportunities that these manipulatives provide, because they do not have them available.

The Teaching Resources for Teachers

The teaching resources for teachers can be divided into different categories: (a) Professional development resources for understanding and being able to implement curricular, pedagogical, or philosophical changes brought in by the Ministry of Education through the mathematics' curricula; (b) Teaching guides for the mathematics' lessons at hand; and (c) Physical teaching resources for classroom instruction in mathematics, that is, manipulatives, geometric set, textbooks for students, etc.

As educators, we continually face change, as research provides the understanding that there may be better and more efficient ways for students to learn. We also live in a rapidly changing world, in which many paradigms of thinking become obsolete or, simply not that efficient or politically acceptable. Therefore, change in education is inevitable. These changes do put an extra burden on teachers and educators, because teachers' beliefs about teaching and learning have usually been developed "during teachers' schooling years and are shaped by their own experiences as pupils" (Pepin, 1999, p. 136). To change these beliefs requires the willingness of the teacher to re-examine and reflect seriously about their practice, its results, and compare it honestly with the new research. This process of personal change can be very painful, if, for instance, an educator realizes that the way they are teaching is not the optimal way for students to learn. It also involves great personal honesty and labour, to read and dialogue with new research, take the time to study and reflect on changes needed in the personal instruction given in the classroom, and the energy and willingness to put changes into action during their daily professional practice. It also may imply the willingness to participate in a community of professional learners, an activity which requires time, energy, and effort—three things which are at a premium for educators these days.

The Mexican *Plan Educativo de Matemáticas* includes in one of the reading books for teachers the notion that all educators in México have to be part of the "National Program of Permanent Actualization" (Balbuena Corro et al., 1995, p. 3). This program is an ongoing series of workshops teachers have to participate in as a part of a community of learners. It is well structured and it has the resources needed for the teachers to participate without having to incur personal cost. They only need to become participants in the ongoing community of learners as professionals in their schools or localities. In contrast, the British Columbia educational system delegates the responsibility of personal professional development to the individual professional. The British Columbia Teachers' Federation actively promotes and negotiates for professional development days to be given to educators. Contractual language grants teachers in British Columbia six professional development days that usually are used for day or part day workshops for teachers, or for dialogue in schools to implement the School Plans for Student Success. There is little continuity between the six professional development days, and no ongoing focus on helping educators understand and implement the intended curricular changes proposed by the Ministry of Education.

As far as teaching guides are concerned, the Mexican intended curriculum provides them within the six books given to the educators at the beginning of the school year. In contrast, British Columbia educators rely on the availability of funds to purchase these very expensive guides from the textbook publishers. My personal experience has been that in some schools these guides are not available; administrators and teachers may or not put importance on acquiring them through the school budget, and therefore, as with the manipulatives we find have and have not schools. This can be frustrating and energy consuming for teachers who happen to teach at the *have not* schools.

The third aspect of these resources has been covered in the preceding section of this chapter.

Amount of Learning Time Allotted for Specific Parts of the Intended Curriculum

When we consider the amount of time allotted for teaching the specific parts of the intended curriculum, we need to first distinguish between the time allotted to mathematics compared to all the other subjects, and then the specific amount of time allotted for the different curricular organizers or axes of learning specifically within mathematics.

As far as the time allotted for mathematics or numeracy, in British Columbia the intended curriculum suggests to invest 185 hours annually into the learning of mathematics. This translates to 4.5 to 5 hours of mathematics in a school week (IRP K to 7, p. 20). This time may be augmented by professional discretion if the teacher integrates mathematics into another subject, for instance, science. What is interesting to note is that there is a peculiarity if one adds up the total amounts suggested for each subject in the different IRPs K to 7: the amount of instructional time suggested exceeds the total amount of instructional time in a week, or for that, in a year. Therefore, we see that in the British Columbian school system, the educator has quite a responsibility and privilege to be the final arbiter, within reason, of how much time is invested in the learning of each subject area. Many educators have solved this apparent discrepancy by covering various subject areas simultaneously in their integrated units of study.

In the Mexican curricular document, it is clearly stipulated that for Grades 4 to 6, students should enjoy 200 hours of mathematics learning a year, with specifically mandated 5 hours of mathematics learning in a school week. Although there is a brief reference to integrating mathematics into other subjects, having the publicly provided consumable textbooks in each subject furnishes the educators with only a very limited possibility of integrating several subject areas in one unit of learning. I can only imagine how constrained Mexican teachers are, using the provided and mandated textbooks. I do remember distinctly the time I was an elementary school student, and working through the government provided consumable textbooks. It is fair to add that the consumable textbooks were very well constructed for learning, as much of what I learned in those early years using those consumable books is still clearly etched with fond memories into my mind almost half a century later.

We may then safely conclude that the similarity in this aspect between the two intended curricula is an approximate equal amount of learning time for the subject of mathematics in both locales. Although it may appear that the Mexican intended curriculum grants mathematics almost 10% more time, if one really understands the British Columbia intended curriculum, and the flexibility granted to the educator to integrate various subject areas, we could well conclude that students in both places enjoy similar amount of learning time in mathematics. Moreover, the difference between the intended curricula is that the Mexican educator has less flexibility to integrate mathematics into other subject areas, and therefore, for novice educators in both locales, the Mexican intended curriculum may grant more learning time to mathematics.

As far as the time allotted for each curriculum organizer for mathematical learning, in the British Columbia document we have clear tables which are summarized in Table 2.

It is interesting to note that British Columbian educators get a suggested time allotment given that is flexible, so they can adjust the time invested in each area according to the needs that they may find within the student body, which is determined continually by the assessment for learning which educators are called upon to engage in on a daily basis.

Table 2.

British Columbia Time Allotment by Grade

Curriculum Organizer	Suggested Time Allotment		
	Grade 4	Grade 5	Grade 6
Number	45–55%	45–55%	40–50%
Patterns and Relations	10–20%	5–15%	5–15%
Shape and Space	25–35%	25–35%	30–40%
Statistics and Probability	5–15%	5–15%	5–15%

The Mexican curricular document does not spell out the amount of time to be allotted to each axes of mathematical learning, as the consumable textbook has pre-described lessons. Each lesson ought to take a class-period to complete, so there is less flexibility in the time allotment. Analysing the three consumable textbooks I found the following time allotments for the six axes as summarized in Table 3.

Table 3.

Mexican Time Allotment by Grade

Axis	Mandated Time Allotment		
	Grade 4	Grade5	Grade 6
Numbers, their relations and operations	37%	23%	12%
Measurement	10%	20%	15%
Geometry	32%	25%	30%
Use of information	7%	20%	30%
Process of change	7%	5%	4%
Chance and prediction	7%	7%	9%

There are some very interesting comparisons to be made between the time allotments in each place. First, if we compare the British Columbia curriculum organizers and the Mexican axes of learning, we can observe that some of the axes are put together in some of the curriculum organizers. For example, we can see that the Mexican geometry and measurement axes are put together in the British Columbia shape and space curriculum organizer. The axes in the Mexican document for using information and chance and prediction are consolidated in the British Columbia curriculum organizer as statistics and probability. The process of change in the Mexican document has its counterpart in patterns and relations in the British Columbia document. Therefore, even though the groupings and semantics appear as different, really the curricula are quite similar.

For Grade 4, we can easily observe that the British Columbia intended curriculum allots more time for numbers than the corresponding Mexican axis. Instead, the British Columbia intended curriculum allots less time for the study of space and shape than the Mexican combined axes. The British Columbia intended curriculum allots more time for the learning of patterns and relations than the corresponding Mexican axis of the process of change. In the learning of statistics and probability, the Mexican counterpart has approximately the same time allotment.

For Grade 5, we see that the Mexican intended curriculum allots much more time to geometry and measurement as well as to use of information than the British Columbia intended curriculum. The Mexican intended curriculum devotes less time to the axes of numbers and their relationships, as they integrate the study of this part into the study of geometry, measurement, and use of information. For the area of the process of change, the Mexican document stipulates possibly less learning time than the British Columbia curriculum organizer of patterns and relationships.

For Grade 6, we can observe that the trend of increases or decreases in the perspective axes or curriculum organizers accentuates. In the Mexican intended curriculum in this grade, geometry and measurement encompass 45% of the learning time and the use of information a 30%, compared to shape and space having only 30–40% of the learning time in British Columbia. In the British Columbia, intended curriculum numbers still appears prominently with 40–50% of the learning time, compared to a mere 12% in the Mexican intended curriculum. Again, if one studies the composition of the lessons in the Mexican consumable textbook for the students, it is easily noticeable that many of the number concepts are embedded right into the learning of the geometry and measurement axes as well as in the use of information axis. Again, the British Columbia intended curriculum does allot more time for patterns and relationships than the Mexican intended curriculum axis of process of change. It is interesting to note that even in the earlier 1995 British Columbia document, numbers were given a greater time allotment than measurement and geometry.

The Intended Learning Outcomes for Students in Grade 4

To compare the similarities and differences for the intended outcomes in each grade I am going to first categorize the diverse curriculum organizers and axes of learning into a comparative table. This will allow us to compare the intended learning outcomes in a more organized fashion.

The reader might question why some of the topics are included in the Mexican axes in places where they do not seem to fit. For example in Table 4, measurement is placed in the same category as Patterns and Relationships. This is done deliberately as the unit on measurement in the Mexican intended curriculum really covers the concepts of patterns and relations, but accessed through the topic of measurement. I also want to make the reader aware that the choices of words for the Mexican axes are carefully translated directly from the Mexican documents without alterations.

Table 4.

Combination of Topics for Comparative Purpose for Grade 4

British Columbia Curriculum Organizer	Mexican Axes of Learning	Combined Comparative Table
• Numbers	• Numbers, their relations and operations	• Numbers/Numbers, their relations and operations
• Patterns and Relations	• Measurement	• Patterns and Relations/Use of Information/ Process of Change
• Shape and Space	• Geometry	• Shape and Space/ Measurement/Geometry
• Statistics and Probability	• Use of Information	• Statistics and Probability/ Chance and Prediction
	• Process of Change	
	• Chance and Prediction	

For numbers/numbers their relations and operations, the reader can readily compare the intended learning outcomes as shown in Table 5. There are some very apparent differences between the two intended curricula. In México, the intended curriculum stipulates that students should be skilful with 5-digit numbers, while in British Columbia they are only expected to use 4-digit numbers. In this aspect, the intended curriculum in México is a year ahead of the British Columbia curriculum. In multiplications, the British Columbia intended curriculum only stipulates that students should learn the time tables and know how to use them, while in México students have to already master 3-digit by 2-digit multiplications. Here again, the intended curriculum in México expects students to master this a year earlier than in British Columbia. In division, the Mexican student is mandated by the intended curriculum to master four digits by 2-digit division, while in British Columbia the intended curriculum only mandates two digits by 1-digit division. In this aspect, the Mexican intended curriculum expects students to master this algorithm two years earlier than in British Columbia.

Table 5.

Intended Learning Outcomes Comparison for Numbers/Numbers Their Relations and Operations in Grade 4

British Columbia Intended Curriculum	Mexican Intended Curriculum
• numbers in depth to 10,000 (read, write, represent, describe meaning of each digit, expanded notation, compare numbers, order numbers) • addition to 10,000 and corresponding subtraction • multiplication by 0 and 1, mental mathematics facts to 9 x 9 and corresponding division facts • division of 2-digit number by 1-digit number • fractions less than or equal to one • decimal representation to hundredths and relation to fractions, addition and subtraction of decimal numbers	• 5-digit numbers (read, write, preceding and following numbers, positional value, numbers in the number line) • formulation and resolution of problems involving addition and subtraction with 5-digit numbers • formulation and resolution of problems involving multiplication • formulation and resolution of problems involving division by different means • division of length to introduce new fractions, diverse resources to find the equivalency of fractions, fractions with denominators to thousandths, placement of fractions in number line, conventional algorithm for addition and subtraction of fractions with same denominator • reading and writing of decimal numbers to hundredths, formulation and resolution of problems involving decimal numbers in the context of money and length

There exists a curious but important discursive difference between the Mexican and British Columbian documents. In the British Columbia document, the expected magnitude of the numbers students have to become familiar with is given with the number symbol 10 000 and the expectations are more about dexterity in the manipulation of the numbers. In comparison, the Mexican document gives the place value magnitude in words, rather than the number, and their focus is more about formulation and resolution of problems involving the numbers.

In fractions, the Mexican intended curriculum is two years ahead of the British Columbia curriculum. In México, students in the fourth grade must master addition and subtraction of like denominator fractions, while in British Columbia students just have to understand what a fraction is and what it represents. As far as decimal fractions go, both intended curricula stipulate the same level of learning, although the Mexican intended curricula embeds it in the use of money and lengths, while the British Columbia intended curricula has a more general abstract approach to the learning of the decimal addition and subtraction.

For patterns and relations/ use of information/ process of change the reader can readily compare the intended learning outcomes as shown in Table 6.

Table 6.

Intended Learning Outcomes Comparison for Patterns and Relations/Use of Information/ Process of Change in Grade 4

British Columbia Intended Curriculum	Mexican Intended Curriculum
• patterns: pattern relationship in tables and charts • symbols to represent unknowns	• collecting and making tables with the data observed, represent information in frequency tables and bar graphs, use of absolute frequency and manipulating information, analysis and interpretation of information obtained in a small survey • simple problems that introduce the student in making tables of proportional change

In this part of the intended curriculum, we can notice a difference in the approach of learning the intended curricula. In México, it is again completely embedded in every day problems students may encounter, while in British Columbia it is more an abstract exercise in finding patterns in tables or information that is given. This could be explained by the fact that the BC curriculum is explicitly preparing students for algebra. The Mexican intended curriculum again seems to go farther into the learning of this part of numeracy by introducing the concept of frequency and proportional change. Instead, the British Columbia intended curriculum remains in the abstract realm by introducing the concept of a variable and of co-variation.

For shape and space/measurement/geometry we can readily compare the intended learning outcomes in Table 7. For this part of the intended curricula, we can readily see a large difference. The Mexican intended curriculum is much more extensive than the British Columbia intended curriculum. In the British Columbia curriculum, the emphasis appears to be placed on understanding the concepts well and mastering them, while the Mexican intended curriculum seems to try to encompass a greater variety of topics, but at a lesser degree of mastery. The topic of another research project could be to determine if in fact the Mexican students do master these concepts at a lesser proficiency, or if, because they are embedded in everyday life situations it allows the student to still master them well.

Table 7

Intended Learning Outcomes Comparison for Shape and Space/Measurement/Geometry in Grade 4

British Columbia Intended Curriculum	Mexican Intended Curriculum
• digital, analog, and 24 hour clocks and calendar dates • area of regular and irregular 2-D shapes • 3-D objects and 2-D shapes: rectangular and triangular prisms • line symmetry	• use of the clock and calendar, the decade, century and millennium • measurement of straight edged polygons using a grid, resolution of problems which imply measurement of areas in square centimetres and square meters, introduction of the formulas for the area of squares, rectangles, and triangles • introduction of the notion of volume through the construction of solids with different materials, geometric solids: classification of geometric solids under the criterion of face shape, number of faces, number of vertexes, and number of edges • resolution of problems which imply the measurement of lengths using meter, decimetre, centimetre, millimetre, and kilometre • formulation and resolution of problems which imply the calculation of perimeter • resolution of problems which imply the use of measurement instruments like the ruler, tape measure, weigh scale, and graduated cylinder • representation of points and their displacement in the plane • design and interpretation of sketches and blueprints, reading and interpretation of maps

For statistics and probability/chance and prediction comparison can be made as in Table 8.

Table 8.

Intended Learning Outcomes Comparison for Statistics and Probability/Chance and Prediction in Grade 4

British Columbia Intended Curriculum	Mexican Intended Curriculum
• data analysis: many to one correspondence including bar graphs and pictographs • answer questions given a graph in which data is displayed using many to one correspondence	• represent the results of aleatory experiments, represent the results of aleatory experiments on tables and graphs • use the expressions more probable and less probable in the prediction of results • engage in games and experiments in which the results depend on chance

For this section of the intended curricula, we can see that both curricula cover about the same amount of information, although again the British Columbia intended curriculum focuses more on having students learn the basic concepts of probability and how to use them and what they mean, while the Mexican intended curriculum focuses more on the daily life application of the concepts of probability.

The Intended Learning Outcomes for Students in Grade 5

For the comparison of the Grade 5 curricula, I am going to again take the approach of combining some of the Mexican axes with some of the British Columbia curriculum organizers as shown in Table 9. The reader will observe that I have changed the configuration of the table compared to the one for Grade 4. In this table I have slotted the use of information of the Mexican intended curriculum with statistics and probability, as what is covered in Grade 5 aligns better with this category.

Table 9.

Combination of Topics for Comparative Purpose for Grade 5

British Columbia Curriculum Organizer	Mexican Axes of Learning	Combined Comparative Table
Numbers	Numbers, their relations and operations	Numbers/Numbers their relations and operations
Patterns and Relations	Measurement	Patterns and Relations/ Process of Change
Shape and Space	Geometry	Shape and Space/ Measurement/Geometry
Statistics and Probability	Use of Information	Statistics and Probability/ Chance and Prediction/ Use of Information
	Process of Change	
	Chance and Prediction	

Table 10 illustrates numbers/numbers their relations and operations.

Table 10.

Intended Learning Outcomes Comparison for Numbers/Numbers Their Relations and Operations in Grade 5

British Columbia Intended Curriculum	Mexican Intended Curriculum
• numbers in depth to 1 000 000 (read, write, represent, describe meaning of each digit, expanded notation, compare numbers, order numbers) • estimation strategies for problem solving • mental mathematics strategies for multiplication facts to 81 and its corresponding division facts, mental mathematics for multiplication, multiplication of 2-digit by 2-digit numbers • division of 3-digit number by 1-digit number • comparison of decimal and fractions • decimal representation to hundredths and relation to fractions, addition and subtraction of decimal numbers up to thousandths	• 6-digit numbers (read, write, preceding and following numbers, positional value, numbers in the number line) • formulation and resolution of problems involving addition and subtraction with 5-digit numbers • Roman numerals • formulation and resolution of problems involving the decomposition of numbers in addends and factors • formulation and resolution of problems involving two or more steps • use of calculators to solve problems • formulation and resolution of problems involving quotients up to hundredths • formulation and resolution of problems with decimal numbers divided by natural numbers • division of length to introduce new fractions, diverse resources to find the equivalency of fractions, formulation and resolution of problems with fractions with denominators to thousandths, placement of fractions in number line, algorithm for addition and subtraction of fractions using equivalencies, use of fractions as simple division or proportion • calculation of percentages through different methods • reading and writing of decimal numbers in different contexts, comparing and ordering decimal numbers, equivalencies between tenths, hundredths and thousandths, formulation and resolution of problems involving decimal numbers to hundredths • use of calculators to resolve problems

In looking at Table 10's two intended curricula it is interesting to note that at this grade level both locales expect students to learn how to be skilful with 6-digit numbers. In the area of decimal numbers, students in both locales are expected to learn similar concepts and depth of manipulation. As for differences between the intended curricula, we see that British Columbia students should be developing mental math skills to use the multiplication facts and apply them to 2-digit by 2-digit multiplication, a process that students in México should have mastered in Grade 4. As far as division is concerned, again the Mexican intended curriculum is a year ahead of the British Columbia one. It also includes quotients with decimals and problems that include decimals. In fractions, the Mexican intended curriculum expects students to master concepts and algorithms that students in British Columbia are not expected to do till Grade 7. In British Columbia, the intended curriculum for fractions endeavours to set a firm understanding of what fractions are and how they can be expressed in both fractional and decimal form. The new British Columbia intended curriculum has dropped Roman Numerals completely, while the Mexican intended curriculum still teaches them. The Mexican intended curriculum prescribes the use of calculators for the solution of problems, while the British Columbia curriculum emphasizes mental estimation and number dexterity.

For patterns and relations/process of change, see Table 11.

Table 11.

Intended Learning Outcomes Comparison for Patterns and Relations/Use of Information/Process of Change in Grade 5

British Columbia Intended Curriculum	Mexican Intended Curriculum
• patterns: prediction using a pattern rule • single variable, one step equations with whole number coefficients and solutions	• making tables of proportional and non-proportional variation for solving problems, finding relations between the variables in proportional and non-proportional variation • formulation and resolution of percentage problems

In this area of the intended curricula, we notice that the British Columbia intended curriculum focuses on prediction in the pattern rules, which would be proportional change, while the Mexican intended curriculum continues with non-proportional change between variables. In the British Columbia intended curriculum, students are guided into the abstract thinking of using variables to represent unknown quantities. Instead, the Mexican intended curriculum proceeds with expecting students to be skilful in the concept of percentages and their applications in problems.

Table 12 highlights shape and space/measurement/geometry.

Table 12.

Intended Learning Outcomes Comparison for Shape and Space/Measurement/Geometry in Grade 5

British Columbia Intended Curriculum	Mexican Intended Curriculum
• design and construct different rectangles given either perimeter or area or both • demonstrate an understanding of measuring length by selecting, justifying and modeling the relationship between mm, cm, dm, and m • demonstrate an understanding of volume by selecting, justifying and modeling the referents of cubic cm and m • demonstrate an understanding of capacity by describing the relationship between ml and l, by selecting and justifying referents for ml and l, by estimating capacity in ml and l and by measuring capacity in ml and l • describe and provide examples of faces and edges in 3-D objects and sides of 2-D shapes that are parallel, intersecting, perpendicular, vertical, and horizontal • identify and sort quadrilaterals including rectangles, squares, trapezoids, parallelograms, and rhombus • 2-D shape single transformation and identification of different transformations	• formulation and resolution of problems which imply the calculation of perimeter of polygons and curvilinear shapes by different means • resolution of problems which imply the calculation of the area of polygons like trapezoids, rhomboids by decomposition into squares, rectangles, and triangles • formulation and resolution of problems which imply the use of square cm, dm, m, and km • measurement of volume of the cube and some prisms by counting cubic units and then using cubic cm as the basic measurement for volume • relationship between capacity and volume and the relationship between cubic dm and l • introduction and systematic study of the metric decimal system in multiples and submultiples of m, l, and g • introduction of the Cartesian axes for placing points and objects on a map or sketch, coordinates of a point • construction of figures using ruler and triangular ruler, compass for circles, parallel and vertical lines, lines of symmetry • construction of figures at scale

Here (Table 12) we observe that the Mexican intended curriculum is much more ambitious in scope. It includes many topics that the British Columbia intended curriculum relegates to later years of study. Instead the British Columbia intended curriculum really focuses on an in depth study of all the concepts which it embarks upon. The Mexican intended curriculum has a more systematic and rational approach to studying the decimal metric system by looking at the multiples and submultiples of 10 in the metric decimal chart. It is easy to understand the conversions in this light. Again, in the British Columbia intended curriculum the emphasis seems to lie in depth of understanding and the learner constructing their understanding in contrast to the Mexican intended curriculum's approach of imbedding the problems and learning in the every day life challenges.

In Table 13's statistics and probability/chance and prediction/use of information, we notice that the Mexican intended curriculum covers topics years ahead of the British Columbia intended curriculum. For example, tree diagrams and permutations are covered in British Columbia in Grade 7, and analysing tendencies in Grade 6.

Table 13.

Intended Learning Outcomes Comparison for Statistics and Probability/Chance and Prediction in Grade 5

British Columbia Intended Curriculum	Mexican Intended Curriculum
• data analysis: first hand and second hand data • construct and interpret double bar graphs to draw conclusions • describe the likelihood of single outcome using impossible, possible, or certain • compare the likelihood of double outcomes occurring as less likely, equally likely, or more likely	• organize information in tables, diagrams bar graphs and pictograms • analyse tendencies in bar graphs, identify average, mode, and median • recompilation of information from diverse sources • identification of more or less likely • outcomes • problems which imply arrangements or permutations of 2 or 3 objects listing possible results • use of the tree diagram for solving problems listing possible results • aleatory experiments and analysis of possible outcomes and favourable outcomes

The British Columbia intended curriculum still takes more time to construct and understand in depth the meaning of the various concepts covered during the school year. The Mexican intended curriculum also encompasses more topics in this area than the British Columbia intended curriculum.

The Intended Learning Outcomes for Students in Grade 6

For Grade 6, I will also use the rubric of comparison outlined in Table 14.

Table 14.

Combination of Topics for Comparative Purpose for Grade 6

British Columbia Curriculum Organizer	Mexican Axes of Learning	Combined Comparative Table
• Numbers	• Numbers, their relations and operations	• Numbers/Numbers their relations and operations
• Patterns and Relations	• Measurement	• Patterns and Relations/ Process of Change
• Shape and Space	• Geometry	• Shape and Space/ Measurement/Geometry
• Statistics and Probability	• Use of Information	• Statistics and Probability/ Chance and Prediction/ Use of Information
	• Process of Change	
	• Chance and Prediction	

Table 15 illustrates numbers/numbers their relations and operations. There are many similarities between the Grade 6 intended curricula. They both expect students to master natural numbers, multiples, use of technology for solving problems, mixed fractions, and division of decimal numbers. The Mexican intended curriculum continues to have a much wider scope encompassing many more topics than the British Columbia intended curriculum. The central importance of the number line in the Mexican curriculum seems interesting as well. The other noticeable difference is that the British Columbia intended curriculum continues to stress mental mathematics in the form of estimation to verify the reasonableness of an answer.

Table 15.

Intended Learning Outcomes Comparison for Numbers/Numbers Their Relations and Operations in Grade 6

British Columbia Intended Curriculum	Mexican Intended Curriculum
• numbers over 1 000 000 and smaller than one thousandths (read, write, represent, describe meaning of each digit, expanded notation, compare numbers, order numbers, place value) • estimation strategies for problem solving • factors and multiples • solve problems involving large numbers using technology, determining the reasonableness through and estimated answer • ration and whole number percent • integers • multiplication and division of decimals • order of operations excluding exponents • relate proper fractions to mixed numbers • demonstrate understanding of decimal multiplication and division	• natural numbers (read, write, preceding and following numbers, positional value, numbers in the number line, construction of numeric series, place value) • reflection on the rules of decimal numeration • multiples and smallest common multiple • formulation and resolution of problems involving two or more steps • use of calculators to solve problems • placement of fractions on the number line, equivalency and order of fractions • formulation and resolution of problem simply addition and subtraction of mixed numbers • conversion of mixed fractions to improper fractions and vice versa, simplification of fractions • formulation and resolution of problems involving fractions with different denominator • formulation and resolution of problems with decimal numbers divided by natural numbers • reading and writing of decimal numbers in different contexts, comparing and ordering decimal numbers, equivalencies between tenths, hundredths and thousandths, formulation and resolution of problems involving decimal numbers to thousandths • expressing percentages as decimal numbers • use of calculators to resolve problems

Table 16 denotes patterns and relations/process of change. Comparing this part of the curricula, we note that the British Columbia intended curriculum concentrates on understanding the basic concepts of patterns that then are carried over to the concepts of equations, what they represent, and what their innate characteristics are, like the characteristic of preservation. Therefore, we can see that the British Columbia intended curriculum stresses theoretical thinking, although constructed from exemplars students should be able to relate to. In contrast the Mexican intended curriculum emphasizes more the pragmatic side, focusing on problem solving and advancing at a much faster pace through the concepts, as seen by the sheer number of learning outcomes. These tendencies have been apparent through the three grades we have been comparing thus far.

Table 16

Intended Learning Outcomes Comparison for Patterns and Relations/Use of Information/ Process of Change in Grade 6

British Columbia Intended Curriculum	Mexican Intended Curriculum
• patterns and relationships in graphs and tables including tables of values • represent generalizations arising from number relationships using equations with letter variables • demonstrate and explain the meaning of preservation of equality concretely, pictorially and symbolically	• formulation and resolution of problems which imply the elaboration of graphs and tables of proportional and non-proportional variation • analysis of the tendencies in tables of proportional and non-proportional change • relationship between situations of variation and the corresponding tables and graphs • formulation and resolution of percentage problems • the unitary value as a procedure to solve certain problems of proportionality • the cross method to verify if there is proportionality • formulation and resolution of problems with percentages

Shape and space/measurement/ geometry is illustrated in Table 17. In looking at Table 17, we can conclude that the pattern observed so far continues. The Mexican intended curriculum encompasses a much wider gamut of topics embedded in every day problems, while the British Columbia intended curriculum goes more into the theoretic understanding of fewer concepts which the student has to construct very often through inductive reasoning, as they part from particular examples to come up with general theorems or rules. Many of the concepts that British Columbia students learn in sixth grade, have been covered by the Mexican students in earlier years.

Table 17

Intended Learning Outcomes Comparison for Shape and Space/Measurement/ Geometry in Grade 6

British Columbia Intended Curriculum	Mexican Intended Curriculum
• angle measure and construction • sum of the interior angles of a triangle and quadrilateral • formulas for the perimeter of polygons, area of rectangles and volume of right rectangular prisms • construct and compare different triangles by sides and angles • describe and compare the sides and angles of regular and irregular polygons • perform a combination of translations, rotations, and/or reflections on a 2-D shape with and without technology and describe the image and the transformations • identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs, perform and describe single transformation in this quadrant of the plane	• formulation and resolution of problems which imply the use of hectare • variation of area as a function of the sides • in depth study of the decimal metric system, multiples and submultiples of m, m squared, and m cubed • relationship between the metric and imperial systems of measurement • perimeter of the circle • use of formulas to solve problems which imply the calculation of area of different polygons, and the volume of simple prisms • calculation of the total area of prisms • problems which imply the conversion of the units of time • introduction of some aspects of the history of measurement • ton as a unit of measurement • construction and assembling of layouts of prisms, cylinders, and pyramids • use of the Cartesian axes • construction of sketches at scale • reading of maps • recognizing similarities and differences of figures at scale • construction of figures from their diagonals and axes of symmetry using ruler and compass • classification of figures using diverse criteria like size, number of sides or vertices, measurement of angles, parallel sides, axes of symmetry, intersection of diagonals, etc.

Statistics and probability/chance and prediction/use of information is displayed in Table 18.

Table 18

Intended Learning Outcomes Comparison for Statistics and Probability/Chance and Prediction in Grade 6

British Columbia Intended Curriculum	Mexican Intended Curriculum
• data analysis: line graphs • methods of data collection • graph data • experimental and theoretical probability	• formulation and resolution of problems that imply the elaboration of tables and proportional and non-proportional variation graphs • analyse tendencies in proportional and non-proportional variation graphs • relationship between situations of variation and the corresponding graphs • use of the unit as a way to resolve certain proportionality problems • the cross multiplication method to verify if there is proportionality • formulation and resolution of percentage problems • the use of tables and graphs for diverse aleatory experiments • use of the tree diagram counting possible outcomes in simple experiments

Reflecting upon the similarities and differences of these curricula, we note that the British Columbian document has fewer learning outcomes than the Mexican one. It appears that British Columbia's document heeds the recommendation Porter (1989) gave, quoting Whitehead: "Let the main ideas which are introduced into a child's education be few and important and let them be thrown into every combination possible. The child should make them his own and should understand their application" (p. 9).

The British Columbia document tends to put more emphasis on the exploration of mathematical concepts through an inductive rational approach, which enables the learner to systematically construct their numeracy understandings. *Learning by doing*, which is the foundation of the constructivist approach, is a legacy which became institutionalized during the industrialization education project in British Columbia in the earlier part of the twentieth century.

The Mexican curricular document could be said to have the influence of Paulo Freirian lens, which through its pragmatic every day life focus, embraces the discourse of training, self-training, and inter-training and bears a distinct liberation theory flavour, which is a fledgling of the modernist theories. At the same time, there seem to be some vestiges from the development project era, in so far as education and preparation of the students is seen as promoting the values and habits which would be congruent with modern society so as to have a skilled workforce, which is a strong mandate of human capital formation. In both locales, we can readily find the vestiges of the historical and cultural imprints that colour the intended learning outcomes.

Consistent with the observed cultural imperatives, we note that the Mexican allotment of time for specific parts of the intended curriculum is exactly regimented through the consumable textbook. In British Columbia, as well, consistent to its cultural imperative of individualism, the educator has professional discretion to adapt the time allotments according to the particular circumstance or preference.

Analysing the time allotments, we see that the Mexican allotments appear to grant more time to the combined axes of measurement and geometry and less to number relations than the British Columbia organizer of shape and space and number. Nevertheless, looking closely at the individual lessons in the Mexican consumable textbook, we find that some of the number relations concepts are embedded in the geometry or measurement lessons. This could point to the way in which the Mexican curriculum is set up following closely the Paulo Freire pedagogy, as it has the number relation concepts embedded in the practical everyday problems of geometry or measurement.

The fact that mathematical concepts are mandated to be learned earlier in the Mexican curriculum reflects the older institutional view that was influenced by European educational philosophy, which pushes the students to learn higher thinking pattern curriculum at an earlier age. It is interesting that, until the 2007 IRP came out, British Columbia also espoused this view. Mathematical concepts were mandated to be learned earlier in the 1995 IRP, which compelled students to learn the higher thinking pattern material earlier. I am very curious to see if isomorphism will be operant and México will follow Canada's lead to have students learn some of the curriculum at a more advanced age. My sister told me that México is in the process of reviewing their current *plan educativo de matemáticas*, and is hoping to have the new intended curriculum out for September 2009. Nevertheless, some of México's leading educators have a very pessimistic assessment regarding the possibility of change in the Mexican educational system, concluding that an important factor which "blocks the transformation of the educational system is historical inertia within the bureaucratic entities" (Rangel & Thorpe, 2004, p. 572).

Just looking at the amount of curriculum that has to be covered in British Columbia and in México, we can readily appreciate that the Mexican curriculum is far more extensive than the British Columbian curriculum. It is interesting to note that the previous curriculum in British Columbia was at least as extensive as the Mexican one.

The 2007 IRP encompasses only two thirds of the amount of curriculum than did its predecessor. I wonder if this change has been made in response and in accommodation to what educators expressed as worrisome: “teaching more mathematics has led to extensive content-based curricula where the amount of mathematics covered in schools forces a pace of teaching and learning which goes beyond the possibility of all learners” (Valero, 1999, p. 21).

Chapter 7.

Conclusions

Summary of Key Findings

The key findings I will be addressing fall into several categories. I shall begin by revisiting the educational epochs in México and British Columbia, described earlier, in order to lay out some significant themes that have become apparent in this research. I shall next focus on some conclusions I have drawn from the research regarding whether and how culture is reflected in the curricular documents under study. I will conclude with some personal recommendations and with a discussion of the importance of this type of research.

The Mexican Educational Epochs: Further Reflections

Taking a quick overview of the Mexican history of education, we find that in the pre-colonial times the educational projects varied from culture to culture, but in general education was a privilege for the elite. The only exception was the Maya civilization in which every young person received a similar education in values of behaviour within that society. Even after the *conquistadores* left their indelible imprints on the different cultures, the Maya culture remained the *kindest* and *gentlest* of all the indigenous groups in México. During the colonial period, true to the mindset of the Spanish society, only the male elite youth had the privilege of obtaining a formal education. This tradition continued until the presidency of Benito Juarez, who sought to provide educational opportunities for all Mexican children. We can readily detect the French philosophical influence in this very distinct shift in educational privilege. Although the Mexican government at the time did not have the resources to implement these changes, it did set the stage for educational reform in the next century. The strong influence of the French ideals of *egalité, liberté,* and *fraternité* became the hallmark of the Mexican educational institution. The Mexican social imaginary includes the vision of helping the underprivileged and low socio-economic children better their lot in life through education or vocational preparation. In the Study plan and program, Elementary basic education 1993, we find these ideals represented in the mandate that all Mexicans be given access to an elementary education of high quality, which through Mexican history has been recognized as a fundamental right. The intention of the Mexican society is to battle ignorance, and therefore, it becomes a public responsibility to ensure the establishment of liberty, justice, and democracy. These ideals have been entrenched in the Mexican Constitution in its third article since 1917. Throughout the last century, this constitutional right has evolved from a formal ideal to an every day reality for a large segment of the Mexican population. The ideals of *egalité, liberté* and *fraternité* are evident in what this book teaches the Mexican educators. It exhorts them to ensure that the younger generation of their compatriots acquires greater skills in literacy and numeracy, the scientific knowledge of basic natural phenomena, and how our actions in nature can help preserve a healthy environment, balanced with a responsible use of natural resources. This will lead to the formation of ethical individuals who know their rights and recognize their obligations in their personal and social lives possible.

It is noteworthy to observe that, though the United States of America thought to conquer and influence the world around them, until the 21st Century, México very strongly resisted this influence in the political and philosophical realms. México always looked elsewhere for models and ideals as the relationship with the Americans had been soured by the Mexican-US wars and the subsequent political pressures the neighbour from the North exerted on México. In the educational sphere, México decisively took the ideas from the French world. The French ideals continued to guide much of the Mexican educational projects through the dictatorship of Porfirio Diaz. The Mexican Revolution, which was a cruel and bloody episode in Mexican history, culminated with the Constitution of 1917, which in theory espoused and put into law the tenants of *egalité, liberté,* and *fraternité.* Although México has always lacked the financial resources to fund all the programs it proposed, by the 1950s it made the distribution of free textbooks for all the Mexican children from Grade 1 to Grade 6 a reality. I still remember in the late 50s and early 60s when these textbooks were made available to all students in México. It was interesting to observe that even students like me, who attended a very exclusive private school, were given these textbooks and the school was mandated to have all students use them on a daily basis. The school was allowed to augment these books with other textbooks, as the argument was given that we were a German immersion school. Nevertheless, we did have to work through the official consumable textbooks, to make sure we did not feel left out, or superior. Even then, I felt that this approach was correct, as I was well taught that we all were equal before the law, and I did feel a sense of fraternity with all the other students in this country.

In the 1960s, Paulo Freire was exiled by the Brazilian government. This passionate educator brought his strong felt ideals to México where they began influencing the educational philosophy in the country. Freire's argument that education needed to be embedded into the lived reality of the learner changed the focus in education. All the problems posed in the consumable textbooks, through which the student will construct their learning, are taken from a real life situation of most of the Mexican students. For example, in the Grade 5 textbook on page 20 the lesson on using tables for resolving problems on proportional variation begins with a story of a booth in the *feria* (fair). Any child in México can relate to the *feria*, as there are countless fairs that roam throughout the whole country and provide affordable recreation for children around the country. This topic will bring to mind pleasant experiences any child in México has had and will allow them to explore the problem they have to solve with great enthusiasm, as it is embedded in the experience and reality of the children in México. Therefore, the publicly provided textbooks sought to embed the narratives of all subjects into the lived reality of what the educators in the capital city believed to be the Mexican reality for the children.

The modernizing project brought a further transformation into the Mexican educational system, that of the global rationalization of resources, which has created a fierce competition for the now reduced resources for education. At the same time UNESCO fostered the vision of making education, or learning, a life-long endeavour. The concept of training, self-training, and inter training also has become the focus of much of the educational project of this epoch, mirroring what is actually happening in most educational jurisdictions around the world. In the introduction of the books *La enseñanza de las matemáticas en la escuela primaria: Talleres y Lecturas* important recommendations to the reader are given, namely that to be able to get the most out of the workshops, these should be done with at least one colleague, but it would be better to do it with a group of colleagues who teach the same grade. This means that the *Secretaría de Educación Pública* mandates educators to model what it is to become and be a life long learner. This phenomenon of coercive isomorphism is what the advocates of the institutional theory postulate and is evidence for their theory.

The British Columbia Educational Epochs: Further Reflections

British Columbia has had a unique history. The Pre-European experience of the Aboriginal peoples of British Columbia was as varied as the Aboriginal cultures it was made up of. Some of these cultures were peace-loving traders; at the other extreme of the spectrum, some cultures were composed of warriors who sought to expand their territories. There seemed to be a power balance by the time the first Spanish explorers arrived and established their bastion in Nootka Sound. When the British traders arrived, they sought to have a peaceful, non-confrontational approach to dealing with the Aboriginal peoples. The first Governor made an effort to make mutually agreeable negotiations with the Aboriginal groups, but this was soon discontinued because of the high cost. Nevertheless, there appears to be an approach of accommodation and negotiation with the Aboriginal cultures. This social imaginary of the time is present throughout most of British Columbia's history, both in politics, and in the educational projects. Because of the diversity of backgrounds in the immigrating population, education was separated from the religious groups once British Columbia joined Confederation in 1871.

A noteworthy fact to bear in mind is the relatively short history of the colonized British Columbia. Because of this fact, we can observe rapid evolutions in the political and educational spheres in this province. This may explain why in the 1990s the educational arena was subjected to what Fleming called a "tug-a-war" between competing interests, which in a certain way continued to change under the umbrella of negotiations and accommodations for many groups, interests, and philosophies. It may also explain the many changes British Columbia has experienced in its intended curriculum and educational philosophies in the near past.

In the past half a decade the educational sphere in British Columbia has seen a sharp rationalization of resources and the introduction of pedagogical and educational theories found around the globe, as, for example, in Great Britain, Australia, New Zealand, Holland, and the United States. This may point to what the institutional theory posits is a more fitting explanation for the changes that are happening around the globe. For instance, the fact that the governments of British Columbia, México, Great Britain, among others are mandating changes through the intended curricula without providing proper funding for it and downloading the responsibility for implementation of the changes to local public bodies or boards, is evidence of the rationalization that the governments are instituting. It is curious to note that despite the varied cultural backgrounds, these changes are being implemented around the world without much consultation or fanfare with the justification that local authorities have a better handle on what the particular needs for the local region or schools are. The argument is the same, the method is the same, and the results unfortunately are also the same. This is what institutional theory argues.

Does Culture Have an Influence on How Mathematics Is Taught in a Certain Country?

Through this research, we have closely analysed how the Mexican and British Columbian cultures are reflected clearly in the intended curricular documents. This conclusion corroborates what Bishop (1991) has argued. It is interesting to observe that the field of mathematics is seen by some sociologists as pivotal in cultural identity. Leslie White (1959) posits that "the functions of culture are to relate man to his environment on the one hand and to relate man to man, on the other" (p. 8). White continues to explicate that culture entails four categories: the ideological that encompasses philosophies, beliefs and uses symbols; the sociological that is comprised of interpersonal behaviours, institutions, customs, etc.; the sentimental that includes feelings towards people, behaviours, and attitudes; and finally the technological that deals with the use and production of tools and implements.

White (1959) states that of these four factors, "the technological factor is the basic one; all others are dependent on it. Furthermore, the technological factor determines ...the form and content of our social, philosophical, and sentimental sectors" (p. 19). White sums up by arguing that "culture, then, must be adapted to the demands of the material environment and kept in contact with ideas preserved from the past" (p. 18). Bishop (1991) continues the argument by saying that the creation of symbols and symbol systems is a unique characteristic of human beings. Of these systems, one of the "more significant to us here is written language, and of course, mathematical symbolization" (p. 18). The creation and use of symbolizations is a cultural phenomenon which has a salient technological dimension, and so, "mathematics is essentially a 'symbolic technology'" (p. 18). Therefore, mathematics is a cultural phenomenon. Bishop

(1991) cautions us however that he is "not implying that the whole of culture is mathematical nor that it should be" (p. 18). Instead he views mathematics as a component of culture. He advances his argument by demonstrating that all cultures, including primitive cultures, have developed their own symbolization of mathematics "in response to the 'demands' of the environment" (p. 59), and that these symbolizations are by no means universal. He states that "the growth of Mathematics (as the internationalized discipline we know) is the result of developments both within cultures and between cultures...and has truly a multi-cultural past..." (p. 57).

De Corte and Verschaffel (2007) also found that in a comparative study in mathematics "notwithstanding some similarities such as the emphasis on conceptual and procedural knowledge—significant differences between countries were observed, thus supporting the claim for national scripts" (pp.249-250).

This study has found come corroboration for this perspective, finding both similarities and differences between the two mathematics curricula.

Comparison of Conceptions of Curriculum

Borrowing Eisner's (1974) conception of curriculum, we can observe a distinct curriculum "orientation" (p. 5) for the intended curricula in México and in British Columbia. According to Eisner's categories (1974) the Mexican intended curriculum would fall under the curricular orientation of "self-actualization, or curriculum as consummatory experience" (p. 9). It is "strongly and deliberately value saturated" (p. 9). This approach focuses on content and conceptualizes education as a liberating force. Here again we see the legacy of Freire. This orientation is also concerned with the process, as it emphasizes personal growth of the learner and sees the curriculum as an individual experience for the learner in itself (p. 9). In contrast the British Columbia intended curriculum bears the "academic rationalism" (p. 12) orientation. This approach is "primarily concerned with enabling the young to acquire the tools to participate in the Western cultural tradition and with providing access to the greatest ideas and objects that man has created" (p. 12). The major focus of academic rationalism is that "ideas within the various disciplines have a distinctive structure and a distinctive set of contributions to make to the education of man" (p. 161).

Similarities between the Intended Curricula in México and British Columbia

The first striking similarity between these two intended curricula is the content of each curriculum. The intended curriculum covers the same spectrum of concepts in both locales. This strongly point to the institutional theory model as has been carefully explicated through the research project. The one curious difference is that many concepts are taught in México in earlier grades than in British Columbia. As expounded before, the 1993 *Plan Educativo de Matemáticas* in México and the IRP 1995 in British Columbia covered most concepts in the same grade. This bears strong witness to what the institutional theory posits. Only the 2007 IRP has changed the timeline in the learning of the same concepts. This change may have come as a response to the concerns of many British Columbia educators who felt the scope of the intended curriculum was too extensive to be able to be mastered by the learners in the short time allotted.

The second striking similarity between the two intended curricula is the use of the constructivist approach to learning mathematics. The institutional theory may help us understand this reality, though we need to understand why México and British Columbia use a different interpretation of the constructivist approach. The cultural influence in each place may be the reason why there is a different interpretation of the constructivist approach used in México and in British Columbia. As concluded before, the reason why different interpretations of the constructivist approach are used is because in British Columbia the philosophy of humanism and individualism permeates the mindset of the educators, while the French Revolution philosophy and the Freirian educational pedagogy permeates the Mexican educational mindset.

Differences between the Intended Curricula in México and British Columbia

The differences in the intended curriculum can be categorized into four distinct groups:

Mode of delivery. The British Columbia elementary mathematics program is a curriculum based program. It is guideline based, flexible, and allows lots of room for teacher decision-making. This bears witness to the long tradition of individualism that came with the British colonizer. It is in essence the same mindset that we find in the colonial education project, in which the Hudson Bay Company was given the mandate to trade with the Aboriginals, but how directives were implemented was left up to the particular factor of the fort, as they adapted to the reality in which they were embedded. This is what happens with the implementation of the 2007 intended curriculum in British Columbia. The directives are given, but there is great professional discretion on how and in which order to implement the intended curriculum, which is used to adapt to the particular circumstances of the classroom and students the teacher has from year-to-year.

The Mexican program is what is called a textbook based program, which is a top-down approach that is very prescriptive. The whole program follows the government provided consumable textbook. Although there is mention in some of the books provided for teachers that they ought to supplement the textbook with embedded lessons which will fit the reality in which students live, it is much more restrictive and much more structured. We have seen that this way of ruling and providing leadership is engrained in the Mexican culture from pre-colonial times and has been part of the Mexican reality throughout its history.

Even the format of the intended curriculum bears imprints of these two distinct styles of delivery and their cultural roots. The British Columbia document is very well organized, easily accessible, rationally presented, so that any professional in the field of education can understand it and follow it. The Ministry of Education puts it out and expects the professional to apply it. This is a clear example of the second malaise that Taylor (1991) wrote about: the primacy of instrumental reason" which he defines as "the kind of rationality we draw on when we calculate the most economical application of means to a given end" (pp. 4-5). He sums this up as "the eclipse of ends, in face of rampant instrumental reason" (p. 10). The changes that are brought in their documents are clear and rational and therefore do not necessitate any further infusion of monetary resources, as it is taken for granted that professionals will implement them, because they are rational and clearly presented.

In contrast, the Mexican culture has experienced through its violent and torturous history, that any change is contingent on hard work, and many resources. Therefore, when the *Secretaría de Educación Pública* institutes changes, they provide an extensive support package, which is well funded by the government. All the *talleres* which are given in the two books of readings and workshops are provided to each teacher without cost. The program is also very directive in mandating the teachers to form the community of learners, so they can experience the new didactics and methodology in teaching the constructivist approach to mathematics. This bears the stamp of the historical cultural reality in México, where the ruling elite does not like to be questioned on what they do and how they do it, but they are also very conscious of the fact that they bear the responsibility to see their plans properly executed, implemented, and funded, as the average citizen does not possess the means to provide for resources in their continual professional actualization. The whole format of the six books they provide each teacher is the result of the historical cultural reality they live in.

Universality vs. individualization. As expounded before, the British Columbia curriculum strongly encourages particular curriculum choices tailored to individual students and classes. This rests upon the philosophy of humanism and individualism which characterize the Canadian, and in particular, the British Columbia philosophy of education.

The Mexican intended curriculum mandates a universal curriculum for all students in all classes. This means that all students study the same curriculum at the same time and in the same way throughout the country. This is in contrast to the British Columbian educational philosophy. The roots of this juxtaposition are found in the French Revolution philosophy of *egalité, liberté,* and *fraternité*. To have different curricula for different individual students would fly in the face of the egalitarian principle so entrenched in the Mexican society, where class privileges enjoyed in the past are considered counter-revolutionary. Every individual is entitled theoretically in México to exactly the same treatment. Indeed, culture exerts a strong influence in how mathematics is taught in each place.

Accessibility. The British Columbia curriculum is widely available and easily accessible to teachers, students and public. That the document is so readily available in British Columbia is a demonstration of the cultural and historical imperatives of this place. For democracy to work there needs to be a well informed public, so it can hold authorities, leaders, and educators as well, accountable of their public life. Furthermore, to satisfy the individualism in the culture we live in, that Charles Taylor (1991) describes as one of the malaises of modernity, individuals demand access to governmental documents to scrutinize them. It also allows the parents who choose to home school their children access to know what learning outcomes they have to meet. For the document to be so readily available is part of this culture.

The Mexican curriculum is very difficult to access for the public and at times for educators who are not directly involved in teaching in the primary schools. The Mexican culture as we have already seen has had since the pre-colonial times a long history of elitism, in which the governing and ruling individuals are not used to have to render accounts to its subjects. They rule according to what they deem right and are not questioned. It is fair to say that through the isomorphism and globalization imperatives, this aspect of Mexican culture is slowly changing in a radical way, as under Vicente Fox a new set of laws were enacted which are called the *transparency laws.* These laws allow any citizen or group of citizens to request any information about a public figure or institution. It has been so effective that now some very powerful former rulers, like former presidents' brothers, are spending time in jail being found guilty of corruption or mismanagement. Nevertheless, this transparency has not yet reached the bureaucratic institutions like the Ministry of Education. I am very curious to see if, after the next revision of the *Plan Educativo de Matemáticas* which is due to be undertaken in the next school year, the ministry will make their new curriculum available through the internet.

Resources. In British Columbia finding and funding teaching and professional development resources are left largely to individual teachers, schools, and school districts. In British Columbia, the ministry of education gives a list of approved resources to be used, but downloads the responsibility of choosing and purchasing those resources to the local school level. This is a reflection of both the Colonial Education Project and the Modernizing Education Project. It reflects the Colonial Education Project in that the decisions are left to the local level, as long as the expectations set by the ministry are met. It reflects the neo-conservative perspective found in the Modernizing Education Project in that the government does not provide extra funding for these items, but expects the local schools to operate with a balanced budget meeting all the mandates the ministry has set out. My experience has been that not all schools are equal in

British Columbia. Local schools are given money according to the Full Time Equivalency of students who attend that school. Schools with small student populations do not have the same amount of dollars allotted to them as schools that have a bigger student population, and therefore smaller schools have to continually fundraise through the Parent Advisory Council to be able to get some of the needed materials. But the impetus of rationalization of monetary resources as dictated by the neo-conservative philosophy seems to justify these inequalities in our educational system.

In México the curriculum is well supported through free textbooks, teaching resources and support for professional development. It is remarkable that a *developing country* like México provides free consumable textbooks in all subjects to all students. This ensures that all students possess the textbooks which they require regardless of where they live, which cultural background they have, or to which socio-economic group they belong. This provides equal access to this resource throughout the whole country. We find that this is a strong reflection of the well engrained ideal of equality from the French Revolution that was instituted during the Development Project.

The resources for teachers can be divided into different categories: (a) Professional development resources for understanding and being able to implement curricular, pedagogical, or philosophical changes brought in by the Ministry of Education through the mathematics' curricula; (b) Teaching guides for the mathematics' lessons at hand; (c) Physical teaching resources for classroom instruction in mathematics, that is, manipulatives, geometric set, textbooks for students, etc.

Looking at the professional development programs, we see that the British Columbia ministry of Education does not provide any professional development to teachers to implement any of the proposed changes. The professionals are expected to implement the changes by themselves. This approach is again rooted in the second malaise that Taylor (1991) describes, as instrumental rationalism promotes the calculation of "....the most economical application of means to a given end" (pp. 4-5). And this philosophical reasoning is the underpinning of the neo-conservative philosophy which is operant in our leadership these days. In México, on the other side, we have already discussed how the leadership provides the needed instruments to implement change. It appears to be that the Mexican educational leadership is more acquainted with the reality that teachers' beliefs about teaching and learning have usually been developed "during teachers' schooling years and are shaped by their own experiences as pupils" (Pepin, 1999, p. 136). To change these beliefs require the willingness of the teacher to re-examine and reflect seriously about their practice, and to be taught under the new paradigm of pedagogy. The Mexican intended curricular documents provide this opportunity to experience and learn the new pedagogy through the community of professional learners it proposes, and through the well structured workshops it provides for the educators to engage in, in the book of *talleres.* As we have explicated before, this is part of the Mexican culture and expectations. It is interesting to note that México's political structure is such that the country is divided into states. Each state shares the educational responsibility with the Federal Government. Therefore, the implementation of the directives from the Ministry of Education is not uniform as expressed by Sylvia van Dijk-Hoogesteger (2008) in a personal conversation. From further research, I observed that results in implementing the constructivist approach in México are mixed. In the state of Guanajuato, where the state government has prepared the educators to use the constructivist approach to teaching, the subject chosen by 29% of students as their favourite was mathematics, closely followed by Spanish with 26% of respondents choosing it (van Dijk Kocherthaler, Hernández Barrón, & Hernández Barrón, 2008, p. 126). In comparison in the *Distrito Federal* and the *Estado de México,* where implementation of the preparation for educators was not rigurous, (van Dijk-Hoogesteger, 2008) only 15% of students chose mathematics as their favourite subject (van Dijk, Sánchez, & Esparza, 2008, p. 49).

In México, the teaching guides needed for instruction are part of the packet that each teacher receives each year. This follows the Mexican cultural expectations that if a leadership expects you to do something, it is responsible to provide the means to accomplish it. In British Columbia the procurement of the teaching guides is delegated to the school level administration. As with the other resources, these guides need to be purchased from the given school budget and depending on the individual school, the guides may or may not be available for teachers to use, as the guides are very expensive. In some schools, teachers have to share the guides, which represents extra work and time spent for the teacher. In my personal experience, this is very frustrating and wearing in the long term. This approach to providing the needed professional resources reflects the present neo-conservative culture in British Columbia. Taylor

(1991) would categorize it under the second malaise of modernity our country is experiencing in its culture.

Implications for Curriculum and Practice

In general, I have been very pleased with the 2007 IRPs for mathematics developed by the Ministry of Education of British Columbia. The social constructivist approach combined with problem solving helps the learner to understand and internalize the mathematical processes in their mind. This improves on the old paradigm of learning mathematics by rote without understanding, which resulted in a rapid loss of what was learned if it was not applied on a continual basis.

The one area where I see room for improving the new document is in the area of implementation. One important conclusion about change that has become clear to me through this research is that changing a curricular document, even though it may be an excellent piece of pedagogical work, like the 2007 IRP in British Columbia or the *plan educativo de matemáticas* in México is no guarantee that the mandated changes will be implemented. The extent to which the new educational philosophy is being integrated into the classrooms across British Columbia, or how many of the mandated pedagogies have been implemented in the classrooms across México, are interesting topics for further research. For changes, like the one proposed in the IRP of 2007, to be implemented requires a well thought out and empowered structure to help educators embark on the changes. As we have discussed, the new intended curriculum in British Columbia requires a change of pedagogy and mind set to be implemented. For teachers to be able to adopt new beliefs about teaching and learning, they must first experience the new pedagogy and methodology as pupils and learners. Therefore, when changes in the philosophy of learning and teaching are proposed, there needs to be a mechanism available for teachers to experience this new pedagogy as learners themselves. Otherwise, their own old experiences will eclipse the new pedagogy, even if the new pedagogy makes rational sense. In this aspect the Mexican curricular document attempts to address this need with the book of *talleres* and by setting up the community of professional learners. Even though these mechanisms have been put in place in México, my sister Sylvia van Dijk-Hoogesteger (2008) tells me that “between the saying and the deeds exist a big gap—more like a chasm” in the implementation of the *Plan Educativo de Matemáticas.* Here in British Columbia I have been part of the round table discussions of the numeracy taskforce of my school district, in which the taskforce is seeking to facilitate the implementation of the new intended curriculum. It has been a long and labourious enterprise that to date has yielded only very limited results. My personal observation is that many educators have not even taken the time to read and reflect upon the new document, much less contemplated how to implement it. In all fairness to my colleagues, many of them have been teaching for decades and have experienced many changes, some of which have come around full circle, and they hold the position that their didactics and pedagogy have promoted learning for decades, so why change what has proven success to something new that may not have the same results. Furthermore, there has been very little or no support to implement the changes. Teachers and administrators have had their workload expanded in recent years due to the *rationalization* of resources and the expectation of higher efficiency. So it becomes unreasonable to expect them, on top of all the demands placed on them, to take the time and monetary resources that may be needed to first study and then implement the new expectation of the intended curriculum. Porter (1989) already identified this challenge then, stating that "policies may provide direction and materials may provide assistance in pursuing the direction, but without additional support and encouragement, many teachers will remain unpersuaded" (p. 14). My suggestion would be for the ministry to organize and fund a week or two of classes for teachers to experience what the constructivist approach to learning mathematics is all about. For that they would have to be given their corresponding salary for the extra week or two of their time and effort. In our district, the curriculum and instruction department has made available for teachers in the district the opportunity to participate in a math school project. They provide the paid release time for 3 teachers of each school to come together for 4 half days to research and experimentally implement any new aspect or pedagogy of the new intended curriculum. Three other colleagues and I took advantage of this offer, and we have been studying how to successfully implement assessment as learning in our classrooms. As this is a learner's self-assessment, we found that there were no child friendly performance standards rubrics. So, the first task we have embarked upon is to make a child friendly rubric, that is, to make a rubric using language that students can understand and use. For this we have enlisted the help of our students and together with them we have made a rubric on the performance standard of communication and representation in numeracy. Now they are using it for themselves. The next step was to have the Grade 4/5 students teach this rubric to Grade 2/3 students, so that these students could learn to self-assess their math work. We hope that having students construct their own knowledge on what the performance standards are, and then internalize them through teaching it to their buddies, will help them acquire the skill of self assessment, and with it to take ownership for their learning. Through this math project and support of the school district, we four teachers are able to spend time and energy *experimenting* with the new pedagogy set forth in the intended curriculum. I must admit that without the support of the professional community of learners, and the financial and resource support from the curriculum and instruction department in our school district, the attempt to implement this new facet of the curriculum would probably have been impossible for me to engage in. It has taken quite a bit of time and effort, to take the opportunity to discuss and reflect upon the current literature and combine it with the combined experience of over 20 years of teaching of each one of my colleagues and myself, to be able to embark on such an undertaking. I wonder how many educators across British Columbia have had this kind of support given to them? This is the kind of support and funding that needs to come forth from the ministry of education and be implemented across the whole province, if they really want to see the changes implemented across the province. Otherwise, the new document becomes one more document that gathers dust in a series of documents and pedagogical changes that really are implemented only in small pockets here and there. Stigler and Hiebert (1999) argue that in North America there is "a gap that exists between educational policymakers and classroom practice" (p. 155).

A further recommendation for the Ministry of Education in British Columbia comes from another conclusion reached through this research project. This conclusion follows as a logical extension of the last conclusion. We have confirmed the view of the research that sees education as a cultural activity. To effectively implement changes in an educational system we need to remember that education itself is a cultural activity. "Cultural activities are highly stable over time, and they are not easily changed" (Stigler et al., 1999, p. 97) because they are complex systems and "cultural activities are embedded in a larger culture" (Stigler et al., 1999, p. 97). The educational system is a very complex one and some of the elements in the system interact and reinforce themselves. Therefore change is very slow and has great inertia that resists change. To effectively implement changes, the whole wider culture needs to be understood, supported and empowered to begin the important professional discussion on how and why change should take place. Educational practice has "evolved over long periods of time in ways that are consistent with the stable web of beliefs and assumptions that are part of the culture" (Stigler et al., 1999, p. 87). Therefore, for change to be embraced, it has to come from within the culture, not from the top down as mandated by ministerial documents and directives.

This research has impacted my daily practice in various ways and at various levels. The first level of impact has been the conclusion that I have reached at a personal cognitive level, which interestingly enough, I never had thought about. For me an important conclusion to this research is that the historical and cultural identities of different places leave readily recognizable imprints of their essence in education. One of the highlights of this research project for me was to discover that I teach according to all the guidelines that Freire (1997) stipulates for *progresivist* educators (pp. 23–87). Though I never had read Freire's work until the latter part of my research, I was astonished to discover that my daily practice mirrors Freire's pedagogy almost completely. One possible explanation to this phenomenon is that as a student I was subjected to this methodology as a learner and incorporated it unconsciously into my daily praxis. In the conversation with Sylvia van Dijk (2008) she mentioned an interesting fact, that both of us having been schooled in a German School with post World War II teachers, we were both influenced deeply by the School of Frankfurt pedagogy. The School of Frankfurt philosophy employs the Socratic paradigm of learning, which is the same paradigm that Freire uses. The only difference between the Frankfurt School philosophy and the Freiran philosophy is that the former uses dialogical inquiry to form a worldview, while the latter starts from a Judeo-Christian worldview to propel his pedagogy. Therefore, in Taylor's (2004) words, the social imaginaries in each place have a profound influence on the philosophy of education used in a particular place. As we have concluded so far, these cultural and historical imprints, or social imaginaries, are even recognizable in the intended curricular documents in mathematics. Although there is the perception that mathematics transcends culture, as it is just a numerical subject that deals with logic and algorithms, as discussed in this research, this is not necessarily so. Rather, the way mathematics is viewed, and therefore taught, is always embedded into a culture, and the culture has a strong influence on how, what, and when different aspects of this very broad field in education are conveyed to the next generation of their citizens.

A further impact this research has had on me is a very practical one. Having been educated in México under the French Revolution ideals of *egalité,* which translated into the classroom in the form of all students covering the same curriculum at the same time, I have had a difficult time adapting to the individualistic philosophy espoused here in British Columbia. This latter philosophy translates into the classroom in the form of individualized education plans for students who have fallen behind in their academic journey in mathematics. At times classrooms have several students with individualized education plans in mathematics, which means they learn a different curriculum than the rest of the class. In theory this practice sounds great; unfortunately it may place the student at a great disadvantage. This disadvantage is due to the reality that the British Columbia Kindergarten to Grade 12 education is partitioned into two distinct components, the elementary and the secondary components. The challenge results from the philosophies these two components espouse. The elementary component is child centered, the secondary component is curriculum centered. In the real world, this means that a student may have had an individualized education program until Grade 7, and then suddenly in Grade 8 he or she is expected to be at the same level that the curriculum mandates. Therefore, the student who has had the individualized education program finds out in Grade 8 that he or she is behind and there is little or no help available for them at this point. In my personal practice I have endeavoured very hard to use the egalitarian approach that is implemented any way in Grade 8. This has resulted in some friction with my administrators and colleagues, who have strong attachments to the individualistic philosophy. This research has given me more resources to build a strong argument for the egalitarian approach in mathematics at the elementary level as I have again reaffirmed the fact that the egalitarian philosophy is used well in mathematics in other parts of the world. I have observed that students who have individualized education plans in mathematics have the perception that they will never learn this subject because *they are dumb* in mathematics. Therefore, with little support from the teacher, the student advances even more slowly than he ought to. I am not trying to downgrade the teacher who does not give the students with individualized education plans the needed support. I just know from experience that when you have a classroom of 26 to 30 students, 25 of whom are with the grade curriculum, there is little possibility of investing the needed time and energy to the other five students who may be in different levels and stages of learning. It is just humanly impossible to furnish these students with the level of help that they require to build up their confidence, understanding, and to scaffold their learning in the Vygotskyan sense. And yet in my mind, these last three aspects are crucial if we want to help the student become successful.

In my mind, to implement an intervention to help a student *catch up* to the rest of the class is more productive than to give the student an individualized education plan. This approach is now successfully used in the primary grades in literacy. I believe we ought to implement this approach in mathematics as well. One of the ways I accomplish these interventions at the Grades 4 to 6 level is through peer tutoring in my classroom. First I create an atmosphere of complete safety for students to ask questions. Then I always gauge if a question is a question that other students also have in their minds but have not had the courage to express. If this is the case, I teach specifically to address the lack of understanding or concepts that have prompted the question. On the other hand, if the question is only held by a minority of the classroom students, I allow the students who have a good grasp on the answer to teach the peers that need the help. This creates a win-win situation, as it helps the students who know the concepts to cement and widen their understanding by teaching it, and at the same time it gives the student that has this lack of knowledge the opportunity to gain it in an unthreatening setting. Case in point, one of my students who was on an individualized education plan last year, and who was very weak in mathematical understanding and did not feel good about her ability in mathematics, has completely caught up to grade level through targeted interventions in the classroom. It is very rewarding to see her confidence and joy for mathematics blossom in front of our eyes. I must admit, that in severe cases, I do put in place adaptations for various students, but they still have to cover the grade level curriculum with the rest of the class.

Now that I am cognizant that the Mexican and British Columbian curricula use the different strands of constructivism, I have tried to facilitate both approaches in the learning of my students. I believe that both strands actually complement each other as they address different aspects in constructing knowledge; and thus will benefit the learning of the students put into my care.

A further implication for my daily practice that has resulted from this research is the confidence to look elsewhere if or when I may encounter a challenge on how to teach a specific student who has not benefited from my normal approach to learning. It is very comforting to know that all over the world there are great educators who in their practice encounter situations that challenge their methodology and approaches, and who by experimentation and perseverance have had great successes in teaching their students. Through this research, I have become very skilful in finding the resources I may need at any time in my practice.

The first practical suggestion I propose is that the Ministry of Education institute a mandated course of comparative education for student teachers. This course could include the work of Paulo Freire, which could afford the students the amplified perspective on what is actually taking place in other parts of the world and with different paradigms of teaching. As explicated before, one of the benefits of comparative studies is the need to reflect on our current practice and compare it with other practices. Through this reflection, we can glean the benefits from other educational philosophies, and also reiterate the value of the positive aspects of the educational philosophy we espouse. As education is a practice embedded in the interpersonal interactions of students and teachers, students and students, and teachers with teachers, there is no one correct way of fulfilling the mandate of educating the students placed under our care. As humans are very different one from another in many aspects, we need to realize that teaching them a certain way may be great for a certain group of students, but it may be counterproductive for another group of students. Naturally, these differences will be embedded in the personal characteristics of each individual, but will be also influenced by the cultural backgrounds they come from. As Canada is composed of a varied cultural mosaic, it behooves us to give the future teachers as many ways to understand these differences as possible. Comparative studies in education would be one way of accomplishing this.

In the realm of academia, I propose a further addition to theory. So far, some of the researchers and authors in comparative education, like Kubow and Fossum and Gutek, have not included the institutional theory as part of their framework for analysis. Through this research, we can conclude that the tenets of the institutional theory are consistent with the reality of many of the changes that are occurring in education in many locales around the world. De Corte et al. (2007) found that using "cluster analysis" the result on their comparative study was to find "not one, but four more global scripts to which teachers of different countries adhered ..." (p. 250). Institutional theory is a useful tool to understand many of the changes that are taking place in education in the world. Especially here in North America, institutional theory fits well with the changes that we observe within the countries that are signatories to the North American Free Trade Agreement (NAFTA). From changes in the intended curriculum content, to the decentralization of the administration and decision making for allotting funding and implementing the mandated changes, to the rationalization of resources and emphasis on accountability, we have observed that the similarities between British Columbia and

México are striking. The isomorphic convergence of policy in the educational institutions is readily apparent. For us educators in the field, we have experienced the subtle and relentless modes of isomorphism: the coercive, the mimetic, and the normative. Institutional theory helps educators understand why and how many changes in education are taking place. Institutional theory can also assist educators in evaluating changes that take place by finding where the new norms of educational institutionalism are coming from, so as to research if the premises upon which the changes are taking place will be advantageous or not in the particular culture in which they are being implemented. At the same time, institutional theory provides educators with the tools to understand how to implement changes in the most effective and least disruptive way, as they endeavour to improve their practice and the learning of their students.

As the need for trade and worker mobility increases, Canada will have to negotiate with the NAFTA partners on what the equivalent credentials for people will be. Canada and México are both signatories to the North American Free Trade Agreement (NAFTA) (NAFTA Agreement, ch.16). In the last few years, a growing pressure has arisen to allow free flow of professional workers. Even within Canada, a harmonization emphasis is gathering momentum. As of March 2007, The Trade, Investment and Labour Mobility Agreement (TILMA) has come into effect between British Columbia and Alberta (Governments of BC and Alberta, p. 4). In the mathematics educational sphere, the Western Northern Canadian Protocol (WNCP) has created a uniform mathematics curriculum from Kindergarten to Grade 12 in the four western Canadian provinces and three territories. These agreements reflect the modern reality of population mobility. Canada keeps getting more and more immigrants from Latin America whose qualifications need to be compared with the standards required for employment in British

Columbia. Now over 2% of the Canadian population is comprised of Latin American immigrants (Schugurensky & Ginieniewicz, 2007, ¶3); 40% of these immigrants came to Canada between 1991 and 2001 and the trend had continued since then (Schugurensky & Ginieniewicz, 2007, ¶5). Therefore, the push for harmonization is a reality and as we continue down the path of globalization there is a growing urgency to create blocks of free trade and professional mobility. This emerging professional mobility creates the need to understand qualification equivalencies between the NAFTA professionals. Different jurisdictions in North America have varying regulatory bodies and laws, which have their own standards. These standards are closely related to the educational systems, which have adapted to the requirements established by these constraints. Therefore, to accommodate this harmonization need, we should first understand what impacts learning in the different educational jurisdictions in the various places that NAFTA encompasses. But to do this we need to take heed of what Ratna Ghosh (2004) posits and this research confirms, namely, that there is a cultural diversity between the two locales that have been studied, which needs to be understood and accommodated. When we consider harmonization of education within the North American trading block, we need to understand and take into account these cultural and historical realities of the different places so that requirements, credentials, and educational equivalencies can be established in an equitable and fair manner. To overlook the cultural and historical backdrops of a place will result in ill will and lost opportunities for the partners in any alliance.

Possible Future Areas for Research

One very interesting area of further research would be to investigate the authors of the intended curricular documents in both locales and compare what kinds of stakeholders were involved in each document. This study would shed further light on the philosophies of education represented in each document and could further aid the research on understanding how to produce a more balanced or helpful curricular document.

Another interesting and useful study would be to research to what extent the intended curricula is implemented in each locale. From my observations in British Columbia and from my sister's observations in México, implementation is not uniform from classroom to classroom. The reasons for this disparity could provide valuable information on how to better implement new curricula.

A further topic of research in this area would be to try to come up with a framework for comparison of professional qualifications in the three countries which are signatories of the NAFTA document. The comparison of qualifications, in my mind, should include comparison between the elementary and high school diplomas as well, as they form the benchmark of where undergraduate studies begin in the academic fields.

The Importance of Comparative Research

International researchers have chosen and defended comparative research, especially in education with many researched arguments and through many lenses.

Presently I find myself in the flux of change through the newly enacted IRP 2007 introduced by the Ministry of Education. Through this research, I have found that this vortex of change is not unique, but that our world is experiencing a profound series of changes which are taking place at an ever-accelerating pace. Inciarte et al. (2004) state that these changes are taking place in various spheres such as in the use and proliferation of technology, political transformations which emanate from new social demands, new internal and external market forces between nations, and production of new areas of consumption which create an ever increasing interdependence between countries around the world. For many of my colleagues and for me, these changes have challenged our professional lives as we try to come to grips with the new expectations we are supposed to meet. Through this research, I have been able to learn how other educators around the world have coped with the changes. As our world moves towards an interconnected globalized community, the emergent new operant imperatives compel education to search for new processes of change. These processes would allow it to adapt to the new rhythm of change, so as to serve individuals through the improvement and modernization of educational paradigms. This research had indeed widened my horizons on how to adapt to the new rhythm of change we are facing in education in British Columbia.

The research I have been engaged in has provided me with knowledge of how to adapt to the evolving changes in my professional life. This has already resulted in placing me in a leadership role in helping the community of learners I am involved in to implement this new round of changes. I have come to realize that the globalization phenomenon has made knowledge one of the more important contemporary values. According to Garcia (1993), knowledge will depend more and more on the immaterial, on human intelligence; on know how, on adaptability, and creativity. This creates new dynamics in the global economy and therefore, to be able to teach these aspects of knowledge and transmit them, has great importance. The global economy has impacted the fundamental pillars of production through the need for constant innovation, creativity, and integration. In my circle of professional learners, we have endeavoured to become creative and innovative as we implement the changes that are mandated. Inciarte et al. (2004) declare that it becomes paramount to visualize alternate possibilities for the future that should promote new interrelations between education, science, technology, and society as a tool for the development of nations, and education will enable nations to adapt to these new realities of the global world. Through this research project, it has become possible for me to engage in this new reality.

The European Union, as explained by Ertl and Phillips (2006), has been exploring and investigating how to best deal with the area of education, as those countries become closely tied politically and economically. Education has always been a contentious area, as members of the different countries view education as one of their foundations for culture, autonomy, and distinctiveness. One challenge they have to overcome is how to standardize professional qualifications between member states, so as to allow the mobility that the union promises. To be able to harmonize professional qualifications, educational systems need to become more closely aligned with each other, or at least be understood in their equivalencies. The European Union has been working in this area since the late 1980s and has sponsored many comparative studies in education. Though this reality exists in Europe, we find a lack of this kind of research between the partners of the North American block. It becomes important to begin this analysis, and this research is a step into this direction. Therefore, this research can be a model of how professional educators can change into more reflective practitioners.

Before I engaged in this research project, I constantly felt very insecure in my practice because my pedagogy and epistemology was so different from the one my colleagues and administrators use or wanted me to use. In spite of my personal successes as an educator, I felt a strong peer pressure to modify my practice. Nevertheless, my heart and inner self balked at this prospect. I have come to understand through this educational project what Brookfield (1995) asserts: "we are all theorists and all practitioners" and "our theories are grounded in epistemological and practical tangles and contradictions we seek to explain and resolve" (p. 185). These "epistemological and practical tangles" are constructs of the culture we have been raised in, or the culture we happen to be working in. The way in which I have taken a critical, reflective inventory of our educational culture is to examine a different culture and how it impacts the theory and praxis of the educational professionals elsewhere. Around the world this methodology is gaining more acceptance and use, as researches like Birgit Pepin (1999), Christine Knipping (2003), Josef Fragner (2005), Inciarte et al. (2004), Hantrais (1995), Ertl (2006) and others have actively pursued it. I believe I have made a contribution to the knowledge and theory of how culture embeds teaching and learning.

A Cautionary Note

Education is a field where "fads have ruled" (Stigler et al., 1999, p. 1). Teachers and educators have experienced "waves of ineffective reforms" and changes which have a negative result: "teachers can grow weary" (Stigler et al., 1999, p. 100). Engaging in comparative research may lead some educators and policymakers to jump onto a *bandwagon* of change too often. Any proposed reform or change in an educational system needs to be thoroughly and cautiously studied. A careful analysis of the cultural and historical components of any successful educational innovation needs to be undertaken, to understand if those cultural and historical realities make the pedagogy or idea successful. If the cultural and historical realities of a certain place are part of the success, it needs to be considered how those successes will *transplant* into a different place with different cultures and histories. Even within a province like British Columbia, we may find that an initiative is highly successful in the Lower Mainland, but the question needs to be asked if that same initiative will enjoy the same degree of success in a community like Fort Ware where an entirely different culture and history exists before it is embedded into the new culture.

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