DOCTORAL THESIS

A qualitative study examining Ontario science curriculum policy from 1985 to 2008: Global influences, local political arenas and curriculum reform

Bloch, Marietta

Award date:
2014

Awarding institution:
University of Roehampton

A qualitative study examining Ontario science curriculum policy

from 1985 to 2008:

Global influences, local political arenas and curriculum reform

by

Marietta Bloch BSc, BEd

A thesis submitted in partial fulfilment of the requirements for the degree of PhD

School of Education

University of Roehampton

University of Surrey

2014

Abstract

This qualitative study examines science curriculum policy making in Ontario, Canada over four different governments between 1985 and 2008. Each government released new curricula for school science. The purpose of this study was to explore influences that shaped the origins, processes and content of these government-mandated curricula. Since 1985, Ontario's education reforms encompassed neoliberal trends for standards and accountability measures thereby transforming its education system into an auditable commodity. A policy cycle approach, adapted from Bowe, Ball and Gold (1992), and Vidovich's (2003, 2001) modifications for macro, meso and micro levels of analysis, provided an analytical framework for this study. A trajectory approach was used to analyse science curriculum policy-making both within a government and to identify patterns, trends and actors across all governments. Document analysis, interviews and focus groups were chosen methods to understand the meaning of events, situations and actions of key actors and texts and to understand the contexts within which science curriculum policy was initiated and developed. Findings indicate that an interplay of global trends and local political arenas have influenced Ontario's science curricula. Governments responded to the decrease of public confidence in education and the increasing demand for standards and accountability measures by reforming education and its curricula. The science curriculum policy documents reflected these reforms as over time they became more specific and were written as standards; however, the content is reflective of Cuban's (1992, p.223) notion of the 'historical curriculum' in that each curriculum continued to exert influence on successive curricula thereby highlighting a tendency to continue with the traditional.

Contents

Abbreviations

AAAS	American Association for the Advancement of Science
ASAP	Assessment of Science and Technology Achievement Project
BERA	British Educational Research Association
BSCS	Biological Sciences Curriculum Study
CHEM study	Chemical Education Materials Study
CMEC	Council of Ministers of Education, Canada
D.C.	District of Columbia
EIC	Education Improvement Commission
ESS	Elementary Science Study
EQAO	Education Quality Accountability Office
IEA	International Association for Evaluation in Education
K-12	Kindergarten to Grade 12
MS	Microsoft$^{(R)}$
MST	Mathematics, Science and Technology
NARST	National Association of Research in Science Teaching
NDP	New Democratic Party of Ontario
NPM	New Public Management
OAC	Ontario Academic Credit
OAC-TIP	Ontario Academic Credit Teacher In-Service Program
OAIP	Ontario Assessment Instrument Pool
OECD	Organisation for Economic Co-operation and Development
OECTA	Ontario English Catholic Teachers' Association
OISE	Ontario Institute for Studies in Education
OS:IS	Ontario Schools: Intermediate and Senior Schools
PC	Progressive Conservative Party of Ontario
PCAP	Pan Canadian Assessment Program
PISA	Programme for International Student Assessment
PSSC	Physical Science Study Committee
RQ	research question
SAIP	School Achievement Indicators Programme
SCCAO	Science Coordinators' and Consultants' Association of Ontario
SHSM	Specialist High Skills Major
SiHH	Science is Happening Here
SISS	Second International Science Study
SL	Scientific literacy/Science literacy
STAO	Science Teachers' Association of Ontario
STS	Science-technology-society
STS-E	Science-technology-society-the environment
TIMSS	Trends in International Mathematics and Science Study
TOC	The Ontario Curriculum
TOC-R	The Ontario Curriculum, Revised
U.K.	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
U.S.	United States of America

List of Figures

List of Tables

Acknowledgements

The process of completing a doctoral dissertation is not an individual endeavor. I am indebted to a network of supporters for their advice, encouragement and friendship. There are many to thank who have been with me on this journey.

Heartfelt thanks to my Director of Studies, Pat Mahony. She has been an inspiring mentor. Her words of support, encouragement, insights and timely feedback has been greatly appreciated and valued. Thank you also to my Supervisor Geoff Troman. His insightful critiques challenged me to think deeper. His attention to methodology heightened my awareness and respect for the process of research. To both Pat and Geoff, although we were separated by an ocean for this study, I have always felt connected to you and to Roehampton. Thank you to Steve Alsop, my Canadian Supervisor for your support and delightful discussions about science education. To all three, your advice and suggestions, encouragement and inspiration, and patience have helped make this journey a positive experience.

Special thanks to both Graham Orpwood and Doug Roberts whose interest in my study helped boost my confidence that this was indeed an area of research important to study. Their support gave me reassurance when I kept questioning what I was missing in the literature.

Special thanks also to my colleagues at Let’s Talk Science. Since I started to work with you, my research has been the “elephant” in the room. Your accommodation to enable me to complete this journey is much appreciated. Your interest in my study also boosted my energy when juggling both work and studies became challenging.

Special thanks goes to my mother for her staunch support and understanding as to why I was not able to visit or see her as often these past years. The same can be said of my sisters who provided generous encouragement for me to complete this study.

I would also like to thank those who participated in this study and provided their insights and experiences in Ontario science curriculum and about the political arena in which these documents were developed. They not only gave of their time generously and imparted enormous detail, but several also followed up with further advice or sources of information.

My deepest thanks go to my husband Peter and our two sons David and Richard. Their steadfast support from when this journey began as an idea to its realization in this thesis has contributed to making this a personally fulfilling experience. Their sacrifices – and there were many – have enabled me to see this journey through to its completion. Peter was my anchor whether I was up or down, quietly lending support in countless ways and I will always be grateful. I pay special tribute to them and dedicate this thesis to them. You have been an integral part of this journey with me.

Chapter 1 Introduction

1.1 Overview

Ben-Peretz (2009) argued that curriculum is a major element by which education policy is expressed within the practice of education. This qualitative study considers that curriculum is policy situated within the political arena of a nation-state. I argue that this local arena and global trends of increased accountability, surveillance and regulation can influence the curriculum of a specific school subject – in this case science. Between 1985 and 2008, three different provincial political parties were elected to govern in Ontario. Each government released new curricula for school science. Although it is entirely appropriate that curriculum should undergo revisions over a 23 year period, the purpose of this study was to explore influences that shaped the origins, processes and content of these curricula.

This chapter begins with a brief overview of global trends related to standards and accountability mechanisms. These, along with an emphasis on effectiveness, efficiency and testing, can be viewed as conditions to create an audit culture in education (Apple, 2005). Following this overview, this chapter outlines the purpose of this study and the significance of the topic, and proceeds to describe the research setting. There are three aspects presented related to this. The first is an orientation to Ontario's education system. This provides context regarding the organisation of Ontario schools and its curricula when reading the findings of this study in Chapters Five to Eight. The second is an orientation to Ontario's political culture. This provides a point of reference regarding the political arena with a brief overview of how Ontarian's view their governments. This provides context as to the political changes in Ontario governments over the time period of this study. The third aspect introduces myself in the research setting. I am an Ontario science educator and have always lived in this province. As such, I have a relationship with the topic and have experienced the policies of the four governments examined in this study. I discuss this in more detail in Chapter Four. This chapter concludes with an outline of the remaining chapters for this thesis.

1.2 Global trends: Standards, accountability and an audit culture in education

Education standards embody neoliberal needs for increased accountability, surveillance and regulation (DeBoer, 2011a; Carter, 2005b; Apple, 2005, 2001, 2000, 1999). They are achieved through policies of accountability (Earl, Watson and Katz, 2003; Astiz , Wiseman and Baker, 2002). While policy-makers use arguments about accountability to prepare students for a competitive global market, it remains unclear as to how that is to be achieved; they typically call for curriculum reform and accountability measures requiring standards (Astiz, Wiseman and Baker, 2002).

In a knowledge-based economy, the production of knowledge becomes a business (Hall, 1979). Knowledge becomes a competitive asset and an advantage of nation-states competing in a global economy (O'Sullivan, 1999). Standards contribute to this commoditisation of knowledge, and testing quantifies whether it is achieved. What knowledge is worth knowing is tested although testing in itself only reflects 'bits of knowledge' (Apple, 2005; Sears, 2003, p.215). Good results are indicators of educational productivity (Carter, 2005b). Published league tables of school results in provincial tests, or published ranking of a nation-state in comparison with other nation-states provide evidence of the market value of education. These standards are part of a broader effort to measure knowledge and hold educators (usually teachers) accountable (Cuban, 2008; Apple, 2005; Carter, 2005b). At the same time standards and testing programs use knowledge as discrete fragments to compare performativity. Ball (2008, p.49) described performativity as a ‘regime of accountability’. Performances of individuals, organisations and even systems serve as measures of productivity or output (Ball, 2008). In that sense performativity can be part of an audit culture.

The word audit, used primarily in financial accounting, entered the realm of new domains in the 1980s and 1990s (Humphrey and Owen, 2000; Shore and Wright, 1999). Power (1997) suggested that with no precise agreement about what auditing is, definitions are more about what they could be. He argued that this ‘essential obscurity’ (Power, 1997, p.81) has allowed the idea of audit to spread readily to new policy areas and situations. Power (1994) suggested that to be audited, an organisation must actively transform itself into an auditable commodity. He viewed audit as a system of surveillance. Humphrey and Owen (2000, p.41) suggested that audit is part of a broader move towards a ‘performance measurement society’. In school programs, curriculum has gained prominence due to the call for educational accountability, developing standards and improving student achievement (Orpwood, 2007). A centralised curriculum can provide the nation-state with control of what is to be taught and learned, and the testing results are indicators of performativity. Although Power (1997, p.127) suggested that an audit explosion has occurred in the name of improved accountability, he wrote that more auditing measures do not necessarily mean more accountability. He cautioned on the reverse effects of auditing, namely information and inspection overload, damages to cultures of trust, an over-commitment to creating politically acceptable images of control, declining performance and increasing organisational cost-functions (Power, 1997, pp.120-121). The damages to trust reduce professional relations to quantifiable templates of ‘human accounting’ (Strathern, 1997, p.306).

New agencies have emerged to scrutinise the effectiveness of education, teacher training, curriculum and achievement (Shore and Wright, 1999). Furthermore, new market opportunities open as new categories of experts emerge such as education development consultants, staff development trainers, teaching quality assessors and quality assurance officers, policy entrepreneurs, accountability experts, and policy intellectuals (Ball, 2008; Carter, 2005b; Shore and Wright, 1999). These political actors can succeed in advancing issues for policy change beyond agenda setting and policy adoption (Kingdon, 1995; McCown, 2005) such as within policy formulation and implementation (McCown, 2005). Kingdon (1995) suggested policy entrepreneurs may choose to be involved as a promotion of their personal interests such as promoting their career, promoting their values in relevant policies and gaining satisfaction from participation in the policy process. They could emerge as advisors to Cabinet Ministers and although expected to operate at a national or state level, their entrepreneurial spirit extends their local reach globally. They can advise on the design of institutional procedures and preside over new regulatory mechanisms and systems, and judge the adherence or deviation from them (Shore and Wright, 1999).

Taking these global trends into consideration, this study examines how local political arenas assimilated these trends to suit its own particular circumstances and their subsequent influence on science curriculum policy by Ontario governments since 1985.

1.3 Purpose

Since 1985, three different political parties were elected to govern in Ontario. Each new government released new curriculum documents for school science. Although it is entirely appropriate that curriculum should undergo revisions over a 23 year period, I was interested to explore influences that shaped the ways in which these documents were developed, how they were developed, and by whom. Although nation-state curriculum is rooted in local needs, concerns, desires and imaginings (Sumara, Davis and Laidlaw, 2001, p.159), it does not emerge out of a vacuum.

The primary research question for this study is:

- What influences contributed to the origins, processes and content of Ontario science curriculum policy since 1985?

In order to understand how policy and curriculum making interact, the following sub-questions are addressed:

- What influences initiated curriculum policy changes by each Ontario government since 1985?

- What processes were involved in making science curriculum policy since 1985? Who was or was not involved?

- What were the changes to policy text in each government's science curriculum documents since 1985?

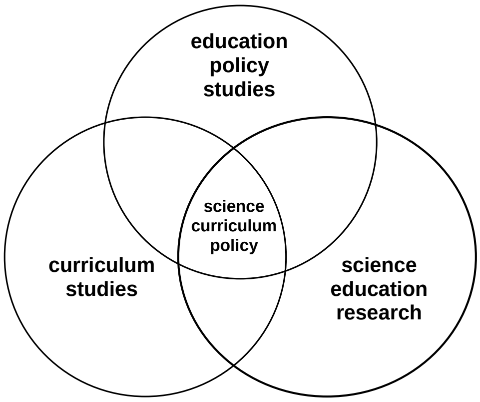
- What were the perceptions of these documents once they were publicly released?

These questions informed the design for this thesis. To answer them required an organisational and analytical framework to examine policy origins, policy development, policy text, and policy perceptions. This involved multi-dimensional methods for gathering data from political, social and economic perspectives. Sources included participants who were policy influencers in the development and writing of the science curriculum documents; participants who were users of the documents; and, a wide range of documents such as legislative debates, newspaper articles, government documents and the science curriculum policy documents. A modified policy cycle adapted from Bowe, Ball and Gold (1992) and Vidovich's (2003, 2001) modifications for macro, meso and micro levels of analysis was used to explore each government time period and to examine trends and patterns across governments. This is discussed in detail in Chapter Three.

1.4 Significance of the topic

Elmore and Sykes (1992, p.185) contended that research on curriculum policy is 'anything but a well organised distinct field of inquiry' and argued that research in this area is an 'artificially constructed field'. They commented that their review is less about curriculum policy and more about what various related bodies of research say about curriculum policy. To conduct my research, I have drawn upon selected literature from science education research, education policy studies and curriculum studies. All three contributed to my conceptualisation of this study as shown in Figure 1A and discussed in Chapters Two and Three.

Figure 1A Situating my study in the literature



Fields of study develop over time, and traditions emerge including conventional notions of what ideas are important and which problems or questions are worth looking at (Pinar *et al*., 2008). Studies related to curriculum policy are generally under-analysed and under-theorised (Looney, 2001; Elmore and Sykes, 1992; Goodson, 1988); and even more so in the case of science curriculum policy (DeBoer, 2011a; Carter and Dediwalage, 2010; Martin, 2010; Fensham, 2009; Carter, 2005a, 2005b; Lemke, 2001; Page, 1995). This study contributes to an emerging field of policy studies in science education research.

1.5 Situating Ontario

Ontario is one of Canada's ten provinces. Politically, Canada is a federation consisting of ten provinces and three territories with both English and French as official languages at the federal level. Ontario is Canada's most populous province and the second largest geographically (See Figure 1B).

Figure 1B Map of Canada (©Bruce Jones Design Inc., 2009) with location of the province of Ontario

Canada is a parliamentary democracy and a constitutional monarchy with significant institutional structures that can be traced to associations with Britain such as its parliamentary structure (Morton, 2001; Sumara, Davis and Laidlaw, 2001). At the same time, the proximity to the United States (U.S.) also has a pervasive influence on Canada and its jurisdictions such as Ontario's strong economic, political and cultural relationships with the U.S. As former Canadian Prime Minister Pierre Elliot Trudeau famously said on March 25, 1969 when addressing the Press Club in Washington D.C. on his first trip to the U.S., 'Living next to you is in some ways like sleeping with an elephant. No matter how friendly and even-tempered is the beast, if I can call it that, one is affected by every twitch and grunt.' (Andrew, 1993, p.97).

1.5.1 Ontario's education system

Canada has no national department of education; instead it has 13 education systems of which Ontario is one. Constitutionally, the federal government has virtually no control over education in Canada, with the exception of certain rights of Protestant and Roman Catholic minorities in some provinces, and with minority-language education rights supported by the federal department of Canadian Heritage. It cannot intervene against a jurisdictional government in matters of education and at times this has been a source of tension between the federal and jurisdictional governments (Gidney, 2002). In spite of limited constitutional rights for education, federal governments have occasionally tried to influence educational policy by providing funds for educational initiatives but they cannot compel a jurisdiction to participate (Gidney, 2002).

Curriculum policies that govern education from Kindergarten to Grade 12 are specific to each of Canada's 13 jurisdictions and within the responsibility of the Ministries of Education. Curriculum implementation is within a school board's area of responsibility. This can be impacted significantly by the funding provided by a government.

Ontario's education system has a similar structure to those of other Canadian provinces. The Ministry of Education is led by an elected member of the legislature who is appointed by the government leader to be in charge of education. The Ministry's bureaucracy (civil service) is led by a Deputy Minister who is responsible for the operation of the Ministry to ensure it meets the government-of-the day's agendas. Local governance of education is usually administered by publicly elected members of Ontario's school boards. Their power and responsibilities are determined by the government and generally consist of the operation and financial administration of the schools within their domain (Canadian Education Statistics Council, 2007). During the time frame of this study, the funding for Ontario's public education changed dramatically from a mix of government transfers and local taxes collected by local rural and urban governments to a centralised funding formula administered solely by the government.

This study spans science curriculum policy across all school grades from 1985 to 2008. During this time period Ontario science curriculum documents have had various grade, division and streaming combinations. The following description provides an orientation to the organisation of Ontario's education system. The divisions and grades mentioned here, recur throughout this thesis, particular in Chapters Five to Eight outlining the findings of this study.

Ontario education is organised by school divisions: elementary education consisting of Kindergarten and Grades 1 to 8; and secondary education consisting of Grades 9 to 12. The elementary division can be further sub-divided to primary (Grades 1 to 3 sometimes including Kindergarten), junior (Grades 4 to 6) and intermediate (Grades 7 and 8). The secondary division is divided into intermediate (Grades 9 and 10) and senior grades (Grades 11 and 12). During the timeframe of this study, Ontario's fifth senior grade called the Ontario Academic Credit (OAC) was last offered in the 2002-2003 school year. It existed from 1988 to 2003 and was discontinued to cut costs. Prior to 1988, it existed as Grade 13. At the secondary level, there have been a variety of streamed courses across different government curricula.

In recognition of Canada's linguistic duality, most jurisdictions have separate English-language and French-language education departments within their Ministries. In Ontario there is a high degree of alignment between the English-language and French-language science curricula but they are not mere translations of each other. Although there is collaboration between these two linguistic groups, this study only examines the processes of curriculum development and decision-making for Ontario English science curriculum documents and their content. A parallel study examining influences on Ontario French science curriculum policy is both beyond the scope of this thesis and my language expertise in reading, writing and speaking French.

1.5.2 Ontario's political culture

The mid 1980s began a period of political change in Ontario politics. This was particularly noticeable from 1987 to 1995 when each of Ontario's three major political parties formed a majority government. During the time frame of this study, Ontario governments shifted from David Peterson's Liberal Party (1985-1990), to the New Democratic Party (1990-1995), to the Progressive Conservative Party (1995-2003) and back to the Liberals under Dalton McGuinty in the fall of 2003. The ideology of each of these parties is presented within the findings chapters for each government to provide a political orientation of each party. This section provides a broad context of Ontario's political culture, in particular its electorate. I draw upon the research of John Wilson, an Ontario political scientist, as he makes a compelling argument in trying to understand what was happening politically in Ontario. But first, this section starts with a brief description of Ontario's governing process.

Ontario's Lieutenant Governor is the Queen's representative in Ontario; the Queen, being the Head of State in Canada. At the opening session of each parliament the Lieutenant Governor reads aloud in the Legislative Assembly of Ontario the government’s priorities and plans in the Speech from the Throne. I refer to this as the throne speech in my findings chapters. A throne speech provides evidence of the direction of a government’s agenda in its own words. The political party that wins the largest number of seats in the legislature forms the government and that party’s leader becomes its Premier. The government must maintain the confidence of the legislature and loses power if it loses the confidence of the majority of elected members of parliament. This occurred in 1985, when the Progressive Conservative government led by Frank Miller lost a vote of confidence and was required to step aside. This marked the end the Conservative dynasty which had governed since 1942.

Change of governments does not happen on its own; governments are elected by winning the majority of seats in the legislature. Ontario uses an electoral system called first-past-the-post. With this system, Ontarians vote for the candidate in their riding. They do not vote directly for the Party Leader. Whichever candidate wins the most seats becomes that riding’s elected representative. In his essay analysing Ontario’s political culture during the 1990s, Wilson (1997) argued that these political changes did not mean that the traditional values of Ontario voters had changed. He suggested that political culture was less about the policies of a government and more about the attitudes of its people. In the case of Ontario’s political culture, he suggested that Ontario’s electorate valued managerial efficiency (Wilson, 1997, p.56). By this he meant that voters demanded a government that administered the province’s affairs efficiently and a leadership that was cautious and had a capacity to maintain a balance among the interests of all Ontarians. He argued, after an analysis of circumstances surrounding previous elections, that the

Ontario electorate placed a high value on a leader to manage the affairs of the province competently. He noted that on one hand Ontario voters want competent leadership and efficient management, thereby reflecting conservative values; and, on the other hand they want fair play for everyone, thereby reflecting progressive values. Wilson (1997) suggested that during the rapid succession of different governments in the 1980s and 1990s, Ontario voters did what they had always done – reject what they perceived as incompetence and reward managerial skills. Nevertheless, once a political party becomes a government, its ideologies are reflected in its policies and in how it governs. Governments change but their policies continue. It is within a complex and evolving political arena that science curriculum policy is situated. During the 23 years of this study, science curriculum has undergone significant transformations as each new government undertook education reforms. This study seeks to understand what influenced these transformations and what their impact was on the science curriculum policy documents.

1.6 Situating myself in the study: The lens of the researcher

Hammersley and Atkinson (1995) stated that it is important to understand how the presence of the researcher may shape the data so that readers of the research can understand how to interpret the discussion of the findings. Furthermore, for the researchers insights can be gained to develop or test elements of the emerging analysis. For this study, science curriculum has been purposely chosen. I am an Ontario science educator and have had a range of practitioner roles including teacher, consultant, science coordinator and resource developer. I have lived experiences with the science curricula examined in this study and have seen firsthand how these documents have a direct influence on what science is taught to students. They inform teacher-developed courses of study, lesson plans, assessment and evaluation of students - and of teachers, and resources such as textbooks.

I have always been an Ontario citizen and as such have experiences with each of the governments in this study as a resident. As a result of these experiences both as a citizen and as an Ontario educator, I have conducted this research with the assumption that my relationship to this study is anything but distant. Ball (1990a, p.170) suggested that writing one's self out of a study denies the dependency of the data on a researcher's presence. My experiences could not be set aside and were my 'personal baggage' (Ozga, 2000, p.53). Qualitative research cannot be made researcher proof and one cannot escape the personal interpretation brought to qualitative data analysis (Cresswell, 2003; Ball, 1990a). Methodological and ethical considerations are addressed in Chapter Four.

1.7 Thesis organisation

This study is organised into nine chapters. The first four chapters provide contextual, theoretical and methodological underpinnings for this study. These are followed by four chapters providing descriptive and analytical accounts of the findings. Each chapter discusses one government time period. The final chapter draws together the findings of this study.

Following this introductory chapter, Chapter Two provides a brief orientation to reforms that have influenced school science since the 1950s. These are presented within three contexts: political, economic, and social. Each context was chosen to emphasise how it can influence science education reforms. I have deliberately chosen the 1950s as a beginning point for two reasons: the launch of Sputnik and its impact on school science, and the introduction of the term scientific literacy. This term has evolved into a powerful platform for promoting science education. It has been a goal of Ontario school science since the 1980s. Due to the importance of this term to school science, it warrants having its own section. This provides the reader with an orientation as to how this term is presented in the literature, and later in the findings chapters, how it is represented in the science curriculum documents examined for this study. This chapter concludes with two additional areas in science education of significance to this study. The first describes two Canadian science education initiatives which were influential to Ontario science curriculum over the time period for this study. Both are referred to in the findings chapters. The second discusses international and national programs that test student performance. Over the time period of this study, Ontario has participated in these large-scale science testing programs. This study examines what influence these tests had on the political arena and subsequently on science curriculum policy.

.

Chapter Three draws upon ideas from a range of literature to arrive at a defensible framework for analysing science curriculum policy. Definitions for curriculum, for policy and for curriculum policy are developed. This provides the reader with clarity in how these terms were defined for this study. I considered this particularly important as in science education research there is no tradition of policy analysis or policy research. I acknowledge that there are ongoing debates about these terms in the literature and my interpretation adds to these. This chapter discusses literature from curriculum studies and education policy studies that have informed the design of this study and the choice of using a modified policy cycle approach adapted from Bowe, Ball and Gold (1992) and Vidovich (2003, 2001) as a framework. Although this approach may have its limitations, it did inform the design of this research and provided a manageable analytic framework.

Chapter Four describes the research methodology, research design and methods of data analysis used in this study. Included is a section on my role as a researcher. This chapter illustrates the key role of research questions in informing the design and choice of methods. This is followed by a discussion on the methods of data analysis that turned large amounts of qualitative data into a resource that could be analysed and interpreted. Processes based on Miles and Huberman's (1994) interactive analytical model, and Mason's (2005) three levels of reading data enabled turning thousands of pages of data into a meaningful resource to address the research questions for this study.

Chapters Five to Eight present an analytical discussion of Ontario science curriculum policy since 1985. Each chapter focuses on one government time period from 1985 to 2008: Chapter Five, the Peterson Liberals from 1985 to 1990; Chapter Six, the New Democratic Party from 1990 to 1995; Chapter Seven, the Progressive Conservatives from 1995-2003; and, Chapter Eight, the McGuinty Liberals from 2003 to 2008. For each of these four chapters, there are descriptive and analytical accounts of the political arena and education reforms that surrounded the origins, processes and content of the science curriculum policy for that government. I approached this study and the analysis of the data by examining the interconnections between science curriculum policy and these broader political arenas. Each chapter provides a brief orientation of ideology of the governing party to provide some context for the reforms that they undertook. Each chapter is organised into two major sections. The first section focuses on the political arena. The second section focuses on the origins, processes and content of the science curriculum documents, and how these may or may not have been influenced by the political arena within which a government acted on its education reforms. This organisation of the findings enabled me to examine each government's science curricula and compare differences and similarities across all four governments.

Chapter Nine draws together the findings of this study with a discussion about influences contributing to the origins, processes and content of Ontario science curriculum policy from 1985 to 2008. This chapter discusses limitations about this study and offers final concluding reflections for this study. Considerations are presented for further research in science curriculum policy.

Chapter 2 Literature review: Science education reforms, curriculum and testing

2.1 Introduction

Policy studies are a growing area of research in science education (DeBoer, 2011b; Fensham, 2009, 2008b; Carter, 2005a). In his 2008 keynote address at the annual National Association of Research in Science Teaching (NARST) conference, Peter Fensham called for a larger research agenda in science education to include policy and the influence of policies on practice (Fensham, 2008b). He identified three aspects of science educator naïveté about education policy and politics: 'the processes of developing new curriculum materials; not recognising the contested nature of having science in the curriculum by stakeholders; and, exaggerating the generalisability of research findings' (Fensham, 2009, p.1078). This study contributes to research in the emerging field of science education policy studies.

This chapter begins with literature related to reforms in science education that have influenced school science curriculum since the 1950s. These are examined within political, economic and social contexts. Each context illustrates that science education reforms, and subsequently their related curricula are interconnected with global and national events. This is followed by a section specifically about scientific literacy. Using literature related to this term, I discuss its significance to this study. The remainder of the chapter is organised into two additional sections. The first one describes two Canadian science education initiatives that have been influential in Ontario science curriculum. These are: a significant report about science education in Canada (Canada. Science Council of Canada, 1984); and, a national curriculum framework for school science developed in 1997. I refer to both of these in the findings chapters as each influenced Ontario science curricula. The final section of this chapter presents literature related to testing programs in science. These programs emerged in the 1990s and are related to public demands for accountability measures (Apple, 2005). Over the time period of this study, Ontario has participated in these large-scale science testing programs. This study examines what influence these tests had in the political arena and subsequently in science curriculum policy.

2.2 Science education reforms and political, economic and social contexts

Education reforms are not isolated from larger spheres of public policy and social thought (Carter, 2005b; Young and Levin, 1999), similarly neither are science education reforms. This section organises the progression of science education reforms from political to economic and then to social contexts. For each context, I discuss the implications of these reforms on science curriculum, specifically how they contributed to the legitimately dual but often conflicting purposes in science education: specialisation for science- related careers; and, science regardless of career or workplace specialisation.

2.2.1 Political

Science education is not immune to political events. The launch of Sputnik on October 4, 1957 was a wake-up call for the U.S. with regard to their technological and military competitiveness with the (former) Soviet Union (Dow, 1999). This scientific and technological achievement by the Soviets was followed one month later by their launching of an orbiting rocket carrying a live dog. These events created momentum for science curriculum reforms in the West that were supported by large scale funding in the U.S. and other counties such as the Nuffield Project in the United Kingdom (Fensham, 2009; Laubach, 2005; Atkins and Black, 2003).

This political agenda supported science education as a response to the Soviet Union's launch of Sputnik and its perceived advancements in science and technology research and innovation. This period is referred to as the Golden Age in science education (Kyle, 1991) due to the proliferation of science-specific programs and resources that were developed and taught in schools.

During this time, curriculum programs were exported without consideration of the different socio-educational contexts of other jurisdictions. Programs developed at this time made an assumption that science curriculum could be 'packaged' (Fensham, 1988, p.4), and in this sense represent a commodity. Ready-made science programs of the Golden Age – the so-called alphabet-soup curriculum - found their way into Ontario schools. This well-known moniker among science educators arose from the acronyms that described the programs – Biological Sciences Curriculum Study (BSCS), Chemical Education Materials Study (CHEM study), Elementary Science Study (ESS), Physical Science Study Committee (PSSC). These programs were used when I was an Ontario high school student and I can still remember using ripple tanks in physics to explore wave motion as part of the PSSC program!

Curriculum developers and decision-makers assumed science education would happen if teachers had programs that represented what school science should look like and were given access to supporting resources (Fensham, 1988). It was presumed that a science program could be handed over to teachers for immediate implementation with their students. Developers of these programs were science specialists - scientists and engineers in academic fields and not educators (Laubach, 2005; Cuban, 2008).They considered science knowledge and skills as universal and could therefore be transferable across national boundaries (Fensham, 1988). Considerable funding was provided to upgrade school science facilities, particularly secondary school science laboratory classrooms. In Ontario, these facilities and equipment were improved with assistance from federal funds for capital expenditures (Connelly, Crocker and Kass, 1985). This is a noteworthy point given that education in Canada is a jurisdictional responsibility and rarely involves the federal government.

Findings from major studies examining the reforms of the 1960s and 1970s (Harms and Yager, 1980; Stake and Easley, 1978; Weiss, 1978; Helgeson, Blosser and Howe, 1977) noted that these programs fell short of expectations (Fensham, 2008a). Stake and Easley's (1978) case studies of U.S. science reform innovations showed that schools had other competing agendas (Fensham, 2008a) and indicated that 'true reform is difficult to achieve, schooling process is affected by social forces, and quick fixes to curriculum reform are 'doomed to fail'' (Shymansky and Kyle, 1992, p.754). Attention turned to how programs were implemented and teachers were seen as barriers to providing quality science education (Fensham, 1988). The contextual aspects of schools and classrooms were not seen as relevant to the implementation of these programs. The programs themselves were not seen as a barrier as they had been developed by science specialists. (Fensham, 1988).

The science education programs that resulted from the launch of Sputnik valued science expertise. Written by science experts these programs encouraged students to enter post-secondary science or science-related careers. Their orientation was science for specialisation. This supported a political agenda of having more scientists and engineers to be competitive with other nation-states. I suggest that with these programs crossing national boundaries, their emphasis on science for specialisation was also transferred.

2.2.2 Economic

Governments and markets cite economic arguments to have a workforce with the skills and competencies to be competitive in a global marketplace (DeBoer, 2011a; Williams and Cummings, 2005; Ungerleiter, 2003; Morrow and Torres, 2000). This is not new (Cameron and Stein, 2000). In 1907, the Canadian Manufacturers' Association declared world competition had become so strong that technical education was necessary as well as educating about efficiency (O'Sullivan, 1999, p.312).

Science educators in the 1980s did not share panic over the concerns by business, industry and governments about global economic competitiveness (Turner, 2008). Their discontent with the failed reforms of the 1960s and 1970s provided motivation for new ones regardless of political and societal concerns about the economy (Turner, 2008; Laubach, 2005); for governments, a globally competitive national economy was closely linked to the quality of what was being learned in schools (Laubach, 2005; Earl *et al*., 2002). This suggests the science education community was disconnected from the concerns government had about an economic purpose for education. It also reflects Fensham's (2009) comment about science educator naïveté about education policy and politics. This study is situated squarely with examining education policy and politics as it relates to science curriculum.

Following the reforms of the 1960s and 1970s, science educators were conceptualising school science with a vision oriented towards students having the knowledge, skills and attitudes for shaping and managing their futures in a world that was increasingly interconnected with science and technology (Hurd, 2000; Canada. Science Council of Canada, 1984). This new vision for school science embraced the notion of science education mainly oriented for 'all students regardless of age, gender, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science' (National Research Council, 1996, p.2; see also Canada. Science Council of Canada, 1984; Fensham, 1985). This contributed to a duality of purposes for school science: science for specialisation; and, science-for-all. The orientation of a science for all movement is situated within a social context and discussed in the following section.

2.2.3 Social

In 1984, UNESCO's Regional Office for Asia and the Pacific was asked by its member states to make science-for-all a top priority area for development over the remaining years of the decade. Many countries announced their support of this direction (Fensham, 1988, 1985). Politically and publicly, the techno-scientific optimism of the 1950s became tempered by concerns about advancements in science and technology that would result in environmental degradation, cultural change and even the prospect of global annihilation (Kyle, 1991). The notion of science-for-all became a priority for nation-states (UNESCO, 1993; Fensham, 1988, 1985). Science programs developed during the 1980s had a strong emphasis on the processes of science and reflected that an ever-changing and increasing knowledge base was of less value and importance than the processes of science (Millar and

Osborne, 1998). This is quite a departure from the previous orientation of science programs that emphasised science knowledge.

By the 1980s, the public's growing awareness and concerns about environment and resources led to science-technology-society (STS) being introduced in the science curriculum (Bybee, 1991). Aikenhead (2002) described an STS program as student-centred rather than science-centred. This differentiates it from the science programs that looked inward towards science. An STS emphasis would help students to make sense out of their everyday experiences and integrate their personal understandings of the social, technological and natural environment contexts that were part of their lives (Aikenhead, 2002). An extensive international survey by Bybee and Mau (1986) in the mid-1980s indicated that a majority of science educators thought that examining global problems was important to study in schools, and supported science and technology-related problems to be addressed in school science.

This orientation in the 1980s of school science to address science-for-all is embedded within the debates related to scientific literacy. At a time when science-related issues such as genetic modification of foods, climate change and energy dependencies continually surface as political and moral dilemmas facing society, youth are becoming disengaged with science (Ipsos Reid, 2010; Fensham, 2009; OECD, 2006a; Osborne, 2000). A potential consequence is that this 'may lead to the rejection of scientific advice, place limitations on scientific research that may have potentially beneficial outcomes for humanity, and reject a body of knowledge that represents one of the great cultural achievements of societies' (Osborne, 2000, p.13). This underscores the significance of the next section about scientific literacy and the purposes of school science to this study. Of significance to this study is whether the emphasis of the science content is focused on knowledge for specialisation or science-for-all.

2.3 Scientific literacy and school science

In the post-Sputnik era, Paul Hurd (1958) used the term scientific literacy in a paper for educators that proposed goals for science education. Since science had such a prominent role in society, he argued that economic, political and personal decisions could not be made without some consideration of the science and technology involved. His paper described scientific literacy as an understanding of science and its applications to social experience (Osborne, 2007; Hurd, 1958). Despite Hurd's view of scientific literacy, science programs developed during the Golden Age had little discussion about social implications and consequences of science (Fensham, 1988; Hurd, 1969). The notion of scientific literacy may have been discussed among science educators but the school programs developed by science specialists placed a stronger emphasis on science knowledge and skills outside of social implications and consequences of science (Connelly, Crocker and Kass, 1985). This resulted in school science programs for academically-oriented students to pursue further science studies. However, as Connelly, Crocker and Kass (1985) argued, these programs were often too advanced for students who were not university-bound. Scientific literacy became a rallying cry to re-examine the purpose of science education (Bybee, McCrae and Laurie, 2009; Deng, 2007; Roberts, 2007a, 2007b, 1988, 1983; Hodson, 2005).

Since then scientific literacy has evolved into a powerful platform for promoting science education and a fashionable slogan used synonymously with science education (Hodson, 2005, 1992; McEneaney, 2003; DeBoer, 2000; Shujah, 1999; Hodson and Reid, 1998; Aikenhead, 1990; Roberts, 1988, 1983). Calls for increased levels of scientific literacy have become a commonplace goal of school science (Deng, 2007; Hodson, 2005; McEneaney, 2003; Millar and Osborne, 1998; CMEC, 1997; UNESCO, 1993; AAAS, 1993, 1990). It has become legitimised as a science education goal, as a purpose for school science, and as a curriculum orientation shaping what counts as science education (Roberts, 2007a, 2007b, 1988; Hodson, 2005; McEneaney, 2003; DeBoer, 2000; Shujah, 1999). To that end, science curriculum policy documents often state an intended goal of scientific literacy (Deng, 2007; Roberts, 2007a; CMEC, 2005,1997; McEneaney, 2003).

Ontario science curricula have stated scientific literacy as the goal for school science since the mid-1980s (Ontario. Ministry of Education, 2008a, 2008b, 2007c, 2000; Ontario. Ministry of Education and Training, 1999, 1998d, 1988i,1987b). Of interest to this study is how this term has been represented in these curriculum documents and whether there have been any changes over the past 23 years. The literature indicates that scientific literacy can range from a view of science for social growth and social political action to a view of science as needed for economic growth and marketplace competitiveness (Pedretti, 2004). It can be viewed as the capacity to read, with reasonable understanding, lay articles regarding scientific ideas and issues that are published in modern media (Fang, 2004; Hodson, 2003; Norris and Philips, 2003; Yore, Bisanz and Hand, 2003; Wellington and Osborne, 2001). It can be viewed as having a possession of the requisite knowledge, skills and attitudes deemed appropriate for a professional scientist (Osborne, 2007; Donnelly, 2005; Gilbert, 2004; Canada. Science Council of Canada, 1984). These multitude descriptions of scientific literacy enable those involved in developing and writing science curricula to orient the term to their own interpretations.

One of the more recent contributions to the discussion is Doug Roberts' (2011, 2007b) notion of two visions of scientific literacy. He identified the long-standing and continuing political and intellectual tension in science education as manifested by the term scientific literacy/science literacy or what he calls SL. He noted that the term is used in debates about science education goals, assessment programs, curriculum policies, classroom programs and teaching resources. Upon examining these debates within the political and intellectual tensions inherent in science education, Roberts (2011, 2007b) identified two competing emphases. Should science curricula emphasise the science subject matter itself; or, should science curricula emphasise science in life situations in which science plays a key role? He referred to the former as Vision I with science curricula looking within science itself, and the latter as Vision II in which science curricula uses contexts that students are likely to encounter as citizens.

Roberts' (2011, 2007b) characterisation of scientific literacy into these two visions reflects the long history of legitimately dual but often conflicting purposes for school science: science for specialisation in science- related careers; and science-for-all regardless of career or workplace specialisation. As there are ample discussions about this in the literature (see Roberts, 2007a, 2007b; Osborne, 2007; Donnelly, 2005; Roscoe and Mrazek, 2005; Gilbert, 2004; Millar and Osborne, 1998; Fensham, 1993, 1988,1985); I focus on the relevance of the discussion to this study which is connecting Roberts' (2011, 2007b) conception of Vision I and Vision II scientific literacy to these two dual purposes of school science.

Addressing two competing purposes for science raises challenges for science curriculum developers and writers in how to address this in school science. On one hand, the curriculum should enable students with interest in science to take courses that emphasise science for specialisation, thereby being more representative of Roberts' (2011, 2007b) notion of Vision I scientific literacy. On the other hand, science curriculum should enable students who are not interested in specialising in science to have courses that emphasise the relevance of science, thereby being more representative of Roberts' (2011, 2007b) notion of Vision II scientific literacy. Vision II is more consistent with the view of scientific literacy first proposed by Hurd (1958) and contemporary views by Fensham (2007), Osborne (2007), OECD (2006c), and Millar (2006) among others. It is distinct from the emphasis found in many science curriculum policy documents which are foundationalist and reflect Vision I (Bloch and Laurie, 2009). One common thread for Robert's notion of Vision II SL is that it implies a broad and functional understanding of science for general education purposes rather than preparation for specific scientific and technical careers. As Ontario science curriculum has undergone four revisions with four different governments, of particular interest is whether over these 23 years the resulting science curricula remained oriented to specialisation as it had been in the 1960s and 1970s with the alphabet soup curricula mentioned in the previous section.

2.4 Canadian science education initiatives

2.4.1 Science Council of Canada

During the Golden Age of science education, the Canadian federal government created the Science Council of Canada. This federal agency focused on Canadian research and development projects in science and technology. In 1984, they published a major study about science education in Canada called *Science for Every Student: Educating Canadians for Tomorrow's World* (Canada. Science Council of Canada, 1984). This study researched the current state of science education in Canada's jurisdictions and made recommendations for its future directions. Project Officers, Orpwood and Souque (1985, p.625) engaged multiple actors in dialogue about school science education in Canada in a series of what they called 'deliberative conferences'. As the Science Council of Canada was a federal agency and the governance and policies for school science are a jurisdictional responsibility, engaging educators, communities and different governments in meaningful discussions was a notable achievement (Ivany, Sherwood and Wideen, 1997).

This Council's report endorsed the concept of science-for-all and influenced Canada's provinces and territories as they renewed their school science curriculum (Aikenhead, 2002). One key recommendation was for jurisdictions to guarantee science education in every elementary school, science was typically not taught on its own for this division unlike in secondary schools where it was well established as a school subject. Another key recommendation was to develop resources, programs and materials that were set in a Canadian context (Canada. Science

Council of Canada, 1984). The era of importing science curricula and their related resources was over.

The Science Council report supported the goal of scientific literacy for all and stated that it could be achieved ‘through a balanced curriculum in which science is taught with four broad aims in mind’ (Canada. Science Council of Canada, 1984, p.10). These were to encourage full participation in a technological society; to enable further study in science and technology; to facilitate entry to the world of work; and to promote intellectual and moral development of individuals.

After the release of the Science Council’s report in 1984, science curriculum development in Canadian jurisdictions, including Ontario, emphasised the goal of scientific literacy as important to having an informed Canadian citizenry while continuing to encourage and support students who demonstrated a strong interest in the sciences and in pursuing science-related post-secondary studies and careers. This view of scientific literacy encompassed the duality of purposes mentioned previously in this chapter. How this view of scientific literacy was represented in Ontario’s science curriculum is part of the research for this study.

2.4.2 Pan-Canadian Protocol for Collaboration on School Curriculum

As mentioned in Chapter One, Canada has no national department of education; however, in 1967 an intergovernmental body called the Council of Ministers of Education, Canada was established as a forum for Ministers of Education to get together and discuss policy issues and to have a mechanism to work on joint projects. One such project was the *Common Framework of Science Learning*

Outcomes: Pan-Canadian Protocol for Collaboration on School Curriculum (CMEC, 1997), hereafter referred to as the *Pan Canadian* as it is commonly known amongst Canadian science educators. The intent was to harmonize learning goals and science instruction in Canadian schools. Ontario was a participating province and I was one of Ontario's three representatives. The other two were from the Ministry of Education. My participation in this initiative was during its last year. At the time I was also a research associate for a science project at York University in Toronto, Canada called the Assessment of Science and Technology Achievement Project, known as ASAP. I discuss this involvement in more detail in Chapters Six and Seven. Regarding the CMEC curriculum initiative, it was the first time that I had been involved in a national project. As this is not a study about the *Pan Canadian* project but rather about Ontario science curriculum, I limit this discussion to disclosing my involvement. Important to this study is the existence of the *Pan Canadian* and how it influenced Ontario's science curricula.

One of the intentions of the *Pan Canadian* was to provide direction for curriculum developers across Canada when renewing their science curricula. The *Pan Canadian* described scientific literacy as recognising the importance of understanding science, its role in and its relationships with technology, society and the environment, and developing skill sets related to scientific inquiry, problem solving, and decision-making (CMEC, 1997). Like the report by the Science Council mentioned in the previous section, it endorsed a science-for-all orientation for school science. The *Pan Canadian's* four foundation statements delineated critical aspects of scientific literacy: science, technology, society and the environment (STS-E); skills; knowledge; attitudes. These foundation statements were to be considered interrelated and mutually supportive although weight was given to STS-E as being ‘the driving force of the framework’ (CMEC, 1997, p.9).

STS-E is a Canadian version of an approach proposed by Soloman (2002) to remodel science curriculum towards attaining scientific literacy. She called this approach science-technology-society or STS. In Canada, environmental education was added. I use the acronym STS-E to acknowledge its origins in STS. Carter (1991) commented that STS-E is rooted in addressing engagement and relevance of science knowledge in students and is intended to develop knowledge grounded in settings of social and personal relevance. In that sense it is oriented to Roberts’ (2011, 2007b) conception of Vision II scientific literacy. However, the STS-E *Pan Canadian* foundation statement encompasses the duality of purposes of school science, similarly to the Science Council depiction of scientific literacy. Thereby both incorporate Roberts’ two visions of scientific literacy. The STS-E *Pan Canadian* statement states:

> Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology foundation (CMEC, 1997, p.6)

This suggests that these aspects of STS-E are as relevant to the student who is interested in specialising in science as well as the non-specialist. The challenge for curriculum developers comes in deciding what science content would be for both specialist and non-specialist if STS-E is considered a driver for science curriculum.

2.5 International and national science testing programs

During the time frame of this study, Ontario students participated in large-scale science testing programs. Two were international tests: Programme for International

Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS); and, two were national tests: School Achievement Indicators Programme (SAIP) and the Pan Canadian Assessment Program (PCAP). All four programs claim to assess scientific literacy. Carter (2005b) cautioned that testing programs that are about measuring scientific literacy have implications to the ongoing debates about this term; for in order to develop assessment instruments, scientific literacy had to be defined in a way that allowed it to be tested internationally through a series of questions (Carter, 2005b). As testing programs gain prominence their results influence how nation-states view their science education programs as compared to other countries, and knowledge becomes a competitive asset (O'Sullivan, 1999). Participation is an indicator of accepting that tests of student performance are a means of providing information for the purposes of auditing, surveillance and accountability (DeBoer, 2011a; Apple, 2005, 2001, 2000, 1999; Carter, 2005a). These programs can be considered as mechanisms for providing change (Earl, Watson and Katz, 2003; Astiz, Wiseman and Baker, 2002). This study examines what influences these tests may have had on science curriculum policy in Ontario as the results from these testing programs, reported in the media, contribute to public perceptions of the success or failure of the education system (Ungerleider, 2003).A discussion of the findings is presented in each of Chapters Five to Eight as each government participated in having Ontario students tested in science. These discussions are in the section about accountability measures in the political arena for each government. A brief descriptive summary of the four tests is given below to provide the reader with some familiarity beyond the name of the program.

International: Programme for International Student Assessment (PISA)

In 1998, the Programme for International Student Assessment (PISA) was set up by the Organisation for Economic Co-operation and Development (OECD) to provide information to its member organisations on how well their 15-year-olds were prepared to meet the challenges of life in the twenty-first century. Science is one of three domains tested. The testing cycle occurs every three years with one domain being tested more thoroughly (called the major) than the other two (called the minor) for every cycle. A major domain is thus tested every nine years. This also means that science assessment items are always part of the test. In 2006, science was a major for the first time since the inception of PISA. The McGuinty Liberals were governing at the time.

In PISA, scientific literacy is based on three competencies that are demonstrated by students answering questions related to real-world personal, social, and cultural contexts. These competencies are: identifying scientific issues; explaining phenomena scientifically; and using scientific evidence (OECD, 2006c, p.20). PISA science represents a view of scientific literacy that is more like Roberts' (2011, 2007b) Vision II scientific literacy, which focuses on situations or contexts and looks outward from science. The focus of PISA is on relevance and science-related issues.

International: Trends in International Mathematics and Science Study (TIMSS)

The Trends in International Mathematics and Science Study (TIMSS) is an assessment of intended science curriculum content for Grade 4 and Grade 8 students. It is coordinated by the International Association for the Evaluation of

Educational Achievement (IEA), an international cooperative of national research institutions and governmental research agencies. Its framework, and ultimately its items are developed through an analysis of curriculum policies, textbooks and other curriculum materials that are used by participating countries (Fensham, 2008a). The critique of TIMSS items by White (1988) and Sjøberg (2007) convey them as traditionalist. Sjøberg (2007, p.7) commented that many of the TIMSS test items could have been used ‘60-70 years ago’. White (1988) criticised TIMSS as multiple-choice conceptual items that appeared as fragments of knowledge and not anchored to relevant aspects in students’ lives. This raises a question as to whether the analysis of the curriculum revealed that scientific literacy was more knowledge based looking inward to science; or, did the TIMSS analysers focus on the knowledge component for their test items, thus revealing their own bias. Answering this question is beyond the scope of this study. Nevertheless, the science framework (see Robitaille, 1994) that informed the development of TIMSS items has an emphasis on science conceptual knowledge. Ontario students participated in TIMSS during the NDP government, but its results were released after the election had been called and a new PC government was elected. This is discussed in Chapters Six and Seven.

Prior to TIMSS was the Second International Science Study (SISS) by IEA. It tested 10-year-olds, 14-year-olds and students in their final year of secondary school. It is mentioned here because Ontario students took part in this test during the Peterson Liberal time period. Results were released while they were still the government and are discussed further in Chapter Five.

National: School Achievement Indicators Programme (SAIP)

In 1993, CMEC developed a program called School Achievement Indicators Programme (SAIP). This program was a response to growing public concerns about accountability in education (Orpwood, 1995b). It tested Canada's 13- and 16-year-olds, initially in mathematics and language. Starting in 1996, science was tested (CMEC, 1996). Before the program was discontinued in 2004, student performance in science was tested three times. Similar to TIMSS, the SAIP framework for science was based on a review of Canadian jurisdictional science curricula which all had a goal of scientific literacy. This raises the same question that was posed in the section on TIMSS. Did the SAIP items embody scientific literacy as it was represented in the curriculum or did these items reveal a bias of the SAIP developers? Sample items incorporated into the reports of the SAIP results represent a view of scientific literacy looking inwards towards science, with a focus on the subject itself. This is more like Roberts' (2011, 2007b) notion of Vision I scientific literacy.

National: Pan Canadian Assessment Program (PCAP)

In 2007, CMEC revised SAIP with a new testing program for Grade 8 students called the Pan Canadian Assessment Program (PCAP). Science continues to be tested through this new program. PCAP items are based on the *Pan Canadian* (CMEC, 2007). Following the release of the *Pan Canadian*, Canadian jurisdictions adopted its vision of scientific literacy and its four foundation statements as a framework for their jurisdictional science curricula (CMEC, 2005). To date, there have only been two PCAPs administered; the first being in 2007 during the

McGuinty Liberal government. As science was a minor domain for this test, it is not discussed in further detail here. In 2013, science will be the major domain tested.

2.6 Chapter summary

This chapter has provided a brief orientation to reforms that have influenced school science and its curricula since the1950s. Science education reforms during 1950s to 1970s were influenced as a political response by Western countries, notably the U.S., to the launch of Sputnik by the Soviets. Programs emphasised the purpose of school science as being for specialisation and further studies in science. During the 1980s as a response to the failed attempts of these earlier reforms, and a world increasingly dependent on science and technology, science education reforms emphasised the notion of science-for- all rather than for specialisation. Both of these emphases reflect the duality of legitimate purposes for school science.

Considerable attention was given in this chapter to the term scientific literacy. Since its introduction in the 1950s, it has evolved into a powerful platform for promoting science education. Testing programs like PCAP and PISA have defined scientific literacy and developed assessment items to measure students' performance in being scientifically literate. Other testing programs like TIMSS and SAIP based their items on curricula that purport to have a goal of scientific literacy. As such they can be considered to also be measuring students' performance in being scientifically literate. As more nation-states participate in international tests, testing programs can have a powerful voice in shaping the debate; for example, in 2000 there were 32 countries participating in PISA; in PISA 2012, there were 68 countries or economies participating. An example of a participating economy is Shanghai.

Scientific literacy has been a goal of Ontario school science since the 1980s; accordingly, this study examines the representation of this term in the science curriculum documents. The following chapter continues with a review of the literature that draws upon theoretical concepts of curriculum, and policy and builds a framework for analysis for this study.

Chapter 3 Literature review: Establishing a conceptual framework for analysis of science curriculum policy

3.1 Introduction

The primary aim of this chapter is to present the theoretical underpinnings that have informed a conceptual framework for this study. Policy studies are an emerging field in science education research (DeBoer, 2011b; Fensham, 2009, 2008b; Carter, 2005a), and as such has no established tradition of policy analysis or policy research. DeBoer (2011b) commented that policy as an area to investigate within science education has limited resources to draw upon and that the authors in a recent book that he edited, *The Role of Public Policy in K-12 Science Education*, were challenged to forge new ground and provide their own interpretation of what policy and science education involves. White and Tishler (1986, cited in Page, 1995, p.22) commented that 'science educators [and Page would add policy scholars] have not found curriculum research an attractive activity…because it is complex'. Although the amount of science education research is increasing, it is mainly directed to understanding the different aspects of teaching and learning processes in science (Fensham, 2009; Carter, 2005a, 2005b; Millar, Leach and Osborne, 2000). Accordingly, I approached this study with a review of literature in curriculum studies and education policy studies in order to define and analyse curriculum policy and ultimately shape an analytical framework for this study. Literature in science education research further assisted in framing these areas to science curriculum policy. All three research fields have vast studies and literature to draw upon. This study respects the breadth and depth of these fields and I have selected from this literature to inform the research design, conceptualisation and analysis of my findings. This has kept the research and its analysis within manageable parameters and time constraints for this novice researcher.

This chapter presents my interpretation of relevant theoretical aspects in three sections to illustrate how the literature that was reviewed informed my study about science curriculum policy. The first section focuses on the task of defining curriculum policy. While there is no single or fixed definition for curriculum policy (Elmore and Sykes, 1992), literature is presented to build a definition of curriculum policy as used in this study. First, attention is given to defining the term curriculum. Since this term is widely used to mean almost anything that happens in the classroom (Bates, 2005; Egan, 2003; Goodson, 1998), this section provides clarity on how I have used the term. The second section presents theoretical considerations related to the characteristics of policy and who may or may not be involved. This section addresses how these apply to a study on curriculum policy and how they relate to my research questions. The third section discusses approaches to policy analysis. I present my argument that a modified policy trajectory using a policy cycle approach developed by Bowe, Ball and Gold (1992) is a suitable framework to analyse government science curriculum policy; in this case, both within a government and across four Ontario governments. Interrelated aspects of macro, meso and micro levels of analyses are an integral part of this study to examine the global, national and local influences on the origins, processes and content of Ontario's science curriculum policy documents. These levels of analysis relate to the research questions as follows: macro (origins); meso (processes and content of documents); and, micro (stakeholder perceptions). Although this approach may have limitations to account for all aspects of science curriculum policy, it provides an organisational and analytical framework to examine the complexity of interconnections and interrelationships among policy origins, policy development, actors who may or may not be involved, and how decisions are made and by whom.

3.2 Section One: Defining curriculum policy

The epitaph 'Curriculum Development: Born 1918. Died 1969.' (Pinar *et al*., 2008, p.6) signalled a shift in the field of curriculum studies from its traditional roots of understanding and developing curriculum frameworks, to understanding curriculum as it happens in the classroom with teachers and between teachers and students (Pinar *et al*., 2008; Pinar, 2003, 1992; Wraga and Hlebowitsh, 2003; Hlebowitsh, 1999; Reid, 1999; Goodson, 1988). This reconceptualisation distanced curriculum studies from understanding political and bureaucratic curriculum policy, and has resulted in fewer studies since then about curriculum policy-making (Pinar, 2003). Pinar (2003) argued this shift was a way of preserving intellectual independence in a field that could be taken over by political rhetoric on education and school reform. As such, the term curriculum has come to be used as anything considered for learning (Bates, 2005; Egan, 2003, Goodson, 1998). Similarly, definitions of policy are contested (Rizvi and Lingard, 2010; Naidu, 2003; Ozga, 2000; Ball, 1994) and largely depend on the meanings given to the term by the researcher. Ozga (2000, p.2) stated that 'there is no fixed single definition of policy' and this is evident in the literature (Rizvi and Lingard, 2010; Weaver-Hightower, 2008; Hill, 1997; Taylor *et al.*, 1997; Ball, 1994; Raab, 1994; McPherson and Raab, 1988).

This section discusses literature related to the terms curriculum and policy resulting in a definition for curriculum policy as used in this study. Definitions depend on the perspective of the researcher (Naidu, 2003; Ozga, 2000) and can serve as both beginning and end points based on their intended functions and discourse (Pinar *et al*., 2008, p.28). In this case, a definition of curriculum policy serves as a beginning to shape this study and define issues encompassed within its meaning and interpretation. The multiple meanings and interpretations given to curriculum and what counts as policy are important to delineate in order to understand how I have used the term curriculum policy.

3.2.1 Defining curriculum

It has been argued that part of the challenge with defining the term curriculum, lies in its basic etymology (Goodson, 2006; van den Akker, 2003). Curriculum is derived from the Latin word *currere*. This is often referred to as a course, thereby implying that curriculum can be defined as a course to be followed (Goodson, 2006; van den Akker, 2003; Ross, 2000). C*urrere* can also imply continuity (Doll, 2002). From this, curriculum could be considered as the running of the course and not the course itself. Pinar and Grumet (1981) introduced the notion of curriculum as the personal experiences of both teachers and students being integral to running the course; however, a course does not appear on its own. Whether one considers curriculum as running the course or as a course to be followed, there is a course and it can either be constructed for some purpose and have some expected use, or it can unfold simultaneously as it is constructed. As such, curriculum can encompass both running the course (process) and a course to be followed (product).

Goodlad (1979) proposed five layers of curriculum which provide insight into different interpretations of the term. Each of these could be central to a series of research questions related to a study about curriculum: the ideal curriculum (defined by its developer); the formal curriculum (that which gains official approval by the government and is to be implemented in boards and to be adopted by teachers); the perceived curriculum (what parents and teachers believe to be the curriculum reflecting their subjective views on what should be taught); the operational curriculum (what is presented to students in the classroom); and the experiential curriculum (what is actually experienced by students).

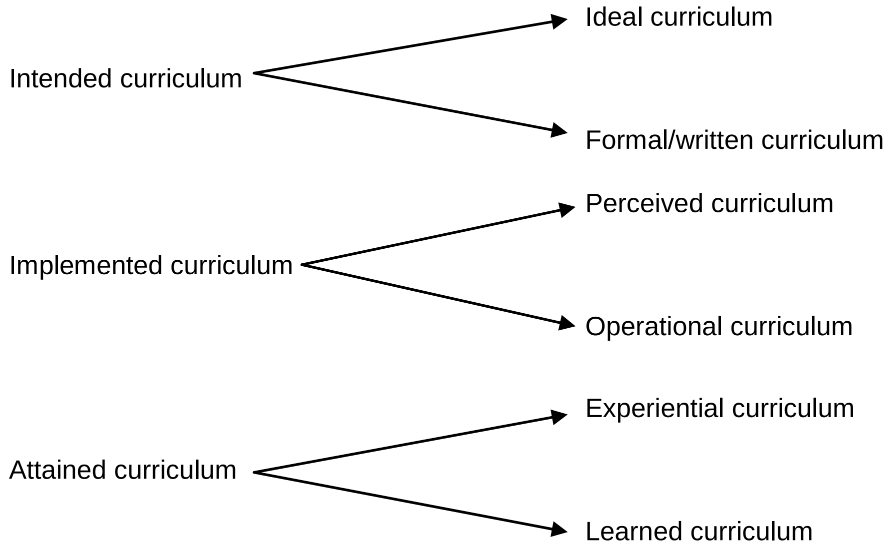
Goodlad's (1979) formal curriculum layer referred to curriculum that had been officially approved by the government; however, if government regulations stipulate which resources are to be used in schools then textbooks could be interpreted to be formal curriculum in that they specify intentions of what is to be taught. For example, the *Ontario Education Act*, describes one of the duties of a principal as follows: 'to ensure that all textbooks used by pupils are those approved by the boards and, in the case of subject areas for which the Minister approves textbooks, those approved by the Minister' (Ontario. Ministry of Education, 1990b, c. E.2, s. 265 (1), par. h.). These textbooks could be considered formal curriculum as they have been officially approved by government. This reference in the *Ontario Education Act* reflects the history of Ontario curriculum where what was expected to be taught was the content of approved textbooks (Tomkins, 2008; Gidney, 2002; Berg and MacKeracher, 1985). This study does not confine the interpretation of curriculum to these government-approved resources, and further delineation is required.

Eisner (2002) identified curriculum as being explicit, implicit and null. The explicit curriculum being defined as what is publicly expected to be taught and could take the form of policy documents or course outlines. The implicit curriculum is what is taught along with the explicit curriculum, such as social values and expected behaviours. The null curriculum is that which is not taught. Eisner's notion of explicit curriculum as public expectations may not necessarily be reflected in curriculum documents. Instead, these policy documents could reflect what its developers expect to be taught and this could differ from public expectations. For example, as public interests in standards and accountability gained prominence, curriculum documents may or may not reflect knowledge that could be commoditised or quantified. This is discussed in Chapters Five to Eight as part of the findings related to standards and science curriculum policy.

Martin and Kelly (1996), Bybee (1991), and Murnane and Raizen (1988) differentiated curriculum as intended, implemented and attained. This differentiation can also be seen in Bernstein's (1975) three message systems: curriculum (intended); pedagogy (implemented); and, evaluation (learned). The intended curriculum identifies what counts as knowledge. This is subtly different from Eisner's notion of the explicit curriculum in which, as mentioned, what is publicly expected may not necessarily be the same as what curriculum developers think should be taught. The implemented curriculum refers to the strategies of teaching and learning in terms of what is intended to be learned, and the attained curriculum refers to what students have actually learned.

Van den Akker (2003, p.3) combined the intended, implemented and attained curricula and Goodlad's (1979) five curriculum layers as shown in Figure 3A.

Figure 3A van den Akker's (2003, p.3) curriculum typology



He added the learned curriculum as an additional classification for the attained curriculum. This typology does not clarify whether a study is about government-mandated curriculum or a reconstructionist view of curriculum. On one hand, the curriculum could be considered as government-mandated curriculum policy that is implemented and enacted between teacher and student. On the other hand, a reconstructionist notion of curriculum could view the curriculum as a teacher deciding what to teach. This may or may not include government-mandated curriculum.

In considering these distinctions of the term curriculum, this study refers to curriculum as government-developed documents that mandate what is intended to be taught and learned in schools in the form of a particular subject area, typically conventional academic subjects, and for this study, science. These official curriculum documents are products of political intent and are often referred to in the literature as the official, core, state or national curriculum (Walker and Soltis, 2004; Apple, 1993; Codd, 1988).

Government-mandated curriculum documents have a wide-ranging influence on what students learn. They inform teacher-developed courses of study, lesson plans, assessment and evaluation both of students and of teachers, and resources such as textbooks to support curriculum implementation. In that sense, I argue that the influence of curriculum, as defined in this study, is connected to and not isolated from Bernstein's (1975) education message systems of curriculum, pedagogy and evaluation. He considered curriculum to be what counts as knowledge, pedagogy as the transmission of knowledge, and evaluation as the realization of knowledge. Ball (1994, p.1) proposed that 'organisation' as related to management implications could be considered a fourth message system. This is also connected to the definition of curriculum used in this study. Governments and school boards use managerial strategies to monitor and measure performativity of the implementation and attainment of the intended government-mandated curriculum documents.

3.2.2 Defining policy

A wide range of interpretations have been presented over time as to what counts as policy (Rizvi and Lingard, 2010; Taylor *et al.*, 1997; Parsons, 1995). Dye (1992, p.2) argued policy is 'whatever governments choose to do or not to do'. Rizvi and Lingard (2010, p.4) made two points about this; first, that Dye was referring to public policy developed by governments; and second that other institutions also make policy. Dye's definition may not account for all types of policy (Rizvi and

Lingard, 2010; Taylor *et al.*, 1997), but for this study, policy refers to the course of action governments have chosen regarding whether or not to develop curriculum.

Policies are concerned with how issues and problems come to be identified and defined, and how solutions are constructed and enacted (Kogan, 1999; Parsons, 1995). They are commonly considered to be end products usually in the form of some type of written document (Rizvi and Lingard, 2010), and curriculum documents are no exception. The Ontario Ministry of Education refers to its curriculum documents as policy and describes these as setting government standards for what the public can expect children to learn. In my practitioner experiences, working with Ontario teachers and other colleagues, when we speak of curriculum it is considered to be synonymous with government curriculum documents. While this can narrowly define curriculum policy as product, there is an underlying importance in recognising that policy is both process and product (Rizvi and Lingard, 2010; Trowler, 2003; Ozga, 2000; Taylor *et al.*, 1997; Blackmore, 1995; Ball, 1994), as this helps to understand how and why government curriculum documents are formulated and generated.

It is therefore worth noting that Wedel *et al.* (2005) argued that policy refers to a field of activity, a specific proposal, government legislation, a general programme, and what governments achieve (Wedel *et al.*, 2005 cited in Rizvi and Lingard, 2010, p. 4). Inherent in this is both process and product. Borrowing from the basic entymology of curriculum, policy could be considered as running a course of action (or inaction) implying process, and a course of action (or inaction) to be followed implying product.

3.2.3 Formulating a definition of curriculum policy

Based on a review of the literature describing views of curriculum and of policy, this study defines curriculum policy as an expression of political intention involving a course of action shaped by political acts, events and interactions among actors resulting in a product in the form of government curriculum documents. This requires that a study on curriculum policy take into consideration more than just understanding the ‘mechanisms’ (Hart, 1989, p.607) of constructing curriculum, but that it also examines the influences contributing to the origins, processes and content of these documents. This provides insight into how resulting policy documents are products of compromises, influences and agendas among a variety of actors in a variety of arenas. This interpretation of curriculum policy is congruent with the research questions that were presented in Chapter One.

3.3 Section Two: Policy characteristics and the actors involved

In further examining theoretical considerations, the first part of this section identifies policy characteristics and how they relate to curriculum policy as has now been defined for this study. The second part discusses actors who may be involved in curriculum policy.

3.3.1 Curriculum policy characteristics

Policy creation is complex and inherently political (Weaver-Hightower, 2008; Taylor *et al.*, 1997; Ball, 1994; Firestone, 1989) regardless of whether it is policy creation about curriculum (Cuban, 2008; Tomkins, 2008; Goodson, 2005, 1993, 1988; Apple, 2004; Looney, 2001); governance in education (Sears, 2003; Levin, 2001; Raab, 1994); or areas such as teacher professionalism and performance management (Troman, 2007; Maguire, 2004, 2002; Whitty, 2002; Mahony and Hextall, 2000).

Naidu (2003, pp.168-169) summarized eight characteristics of policy as outlined by Taylor *et al.* (1997, pp.15-17), and they are examined in this section to see the extent to which they apply to curriculum policy. The eight characteristics are: policy is more than the text; policy is multi-dimensional; policy is value-laden; policies exist in context; policy making is a state activity; education policies interact with policies in other fields; policy implementation is never straightforward; and, policies result in unintended as well as intended consequences. These characteristics led to conclusions by Taylor *et al.* (1997, p.23) that policy is 'both a product and a process' and that policy processes are 'ongoing and dynamic'. This study illustrates how these characteristics similarly apply to curriculum policy in that it is also complex, interactive and multilayered. These curriculum policy characteristics are discussed again in Chapter Nine as to how they related to my study upon its completion. The research sub-questions for this study that were presented in Chapter One, take into consideration these characteristics. They are restated here as a reminder for the reader:

- What influences initiated curriculum policy changes by each Ontario government since 1985?
- What processes were involved in making science curriculum policy since 1985? Who was or was not involved?
- What were the changes to policy text in each government's science curriculum documents since 1985?
- What were the perceptions of these documents once they were publicly released?

Curriculum policy is more than the text

Taylor *et al.* (1997, p.15) referred to policy as more than a document and not merely a set of instructions or intentions. To analyse policy only by the written text overlooks the contexts that give the text meaning and significance (Taylor *et al.*, 1997, p.15). Similarly, an analysis solely of government curriculum documents, while they represent curriculum policy, has limitations as it does not illuminate the context, struggles, conflict and competing interests related to their development. In summary, curriculum policy involves more facets than the text of the resulting documents (Ben-Peretz, 2009). Hence, all four research questions required gathering data beyond analysis of the text of the science curriculum policy documents. For example, legislative debates in Ontario's *Hansard* provided a record of what politicians of all political parties were saying about a government's education and curriculum reforms; government media releases provided insights into the messaging of their reforms; and newspaper articles provided a record of these reforms as presented to and read by the public and by politicians.

Curriculum policy is multi-dimensional

Policy represents political compromises and this becomes dynamic and interactive (Taylor *et al.*, 1997). Policy also has an interpretational and representative history (Ball, 1994, p.17; also see Kogan, 1978). This is similarly intrinsic to curriculum policy which involves multiple actors and their agendas. At the same time, each group of actors has its own perception of curriculum policy as it is developed and enacted. Actors involved in or influencing curriculum policy thereby bring their own contributions towards policy outcomes. Further to this, the resulting policy can be perceived and represented differently by different actors and interests. A study on curriculum policy therefore needs to gather data on how curriculum policy documents are perceived and received once they are publicly released. This data is central to answering the research question about stakeholder perceptions of the science curriculum documents.

Curriculum policy is value-laden

Weaver-Hightower (2008, p.129-134) stated that Easton (1965) considered policy as ‘the authoritative allocation of values’ whether or not those who created it wished to call it policy. Taylor *et al.* (1997, p.15) argued that ‘values permeate policy processes’. Values of actors participating in making curriculum policy are indeed integral to curriculum decisions (Klein, 1991). For example, there are differing values about what content should be taught in schools (Cuban, 2008; Ungerleider, 2003). Curriculum related to school science has a long history of legitimately dual but often conflicting purposes, as was addressed in the previous chapter: science for specialization in science-related careers; and, science for all regardless of career or workplace specialisation (Osborne, 2007; Roberts, 2007a, 2007b; Donnelly, 2005; Roscoe and Mrazek, 2005; Gilbert, 2004; Millar and Osborne, 1998; Fensham, 1993, 1988, 1985). Multiple actors within and outside of government involved in curriculum policy may have conflicting or competing values about the purposes of science education and seek to influence or collectively share the agenda to make science curriculum policy.

Value differences between progressives and traditionalists, public shifts in values, and differing views about the purposes of education involve political negotiation among those involved in curriculum policy (Cuban, 2008; Ungerleider, 2003). To gain an appreciation of this aspect, the research questions for this study included examining who is and is not being heard, and their interests in curriculum origins and processes. A more detailed discussion of actors and their influence on curriculum policy is presented later in this section.

Curriculum policies exist in context

Taylor *et al.* (1997, p.16) argued that policies are shaped by 'the interactions between the state, the economy and society'. This also bears on curriculum policy, which is a nation-state activity that does not exist in isolation from social, cultural and political events at both local and international levels (Ben-Peretz, 2009; Carter, 2007). As discussed in Chapter Two, the 1950s to 1970s were distinguished by political concerns related to the launch of Sputnik and fears that science education was falling behind the Soviet Union (Fensham, 2008a ; Laubach, 2005; Dow, 1999). These events created momentum for science curriculum reforms in the West that were supported by large scale funding in the U.S. and other countries such as the United Kingdom (U.K.) through the Nuffield Project (Fensham, 2009; Laubach, 2005; Atkins and Black, 2003). It can be seen that curriculum policy documents are constructed out of cultural, political and economic conflicts, tensions and compromises and are an acknowledgement of what groups of actors involved in their development consider legitimate knowledge (Apple, 1996). This leads to understanding how subject paradigms and subject subcultures also play a role in determining how curriculum can be constructed (Ball and Bowe, 1992). Consequently macro, meso and micro levels of analysis of curriculum policy provide insights into a government's decision to reform curriculum within broader global and national trends in education. These levels of analysis are examined in this study through data related to the question as to why each Ontario government since 1985 undertook a series of education reforms involving changes to curriculum policy.

Curriculum policy making is a state activity

The definition of curriculum policy for this study explicitly identifies resulting curriculum documents as those mandated and released by the state. As mentioned, these documents are also referred to as the official, core, state or national curriculum (Walker and Soltis, 2004; Apple, 1993; Codd, 1988).

As indicated earlier in this chapter, unlike the public debate and scrutiny that other education policies receive, Ontario curriculum documents are not debated and voted upon in the Legislative Assembly of Ontario. Their development is within the authority and purview of the government-of-the-day. Although they involve a nation-state activity, the processes for their development could be a closed process involving a select few with the resulting product seen as curriculum *done* to teachers who are mandated to use it, or it could involve a process of public engagement with diverse actors, including teachers, who have interests in what students are learning. To provide a fuller understanding of curriculum policy, this study includes exploring the processes in the construction of the final curriculum documents to determine the influences on their development including who was or was not being heard. This is directly related to the research question about identifying processes involved in making science curriculum policy in Ontario since 1985.

Curriculum policy interacts with policies in other fields

Curriculum is a major element by which education policy is expressed within the practice of education (Ben-Peretz, 2009, p.48). It could be said that curriculum policy research that fails to account for overarching policy decisions is ‘naive in the extreme’ (Hart, 1989, p.607). Education policies related to school improvement, testing, accountability measures, standards, equity and inclusiveness, and governance and funding, are inevitably also interconnected with curriculum policy; for example, the design of schools and classrooms can shape practices to implement curriculum policy (Cuban, 2008). In this sense, curriculum is connected to the message systems of pedagogy, evaluation and organisation.

Taking this further, curriculum documents can be viewed as political texts that serve the goals of policy makers (Apple, Kenway and Singh, 2005). On the economic front, they can be seen as a nation-state’s response to globalisation and the state adjusting to be economically competitive (Ben-Peretz, 2009). Carter (2005b, p.573) noted that current discourses about science education improvement epitomise government responses to global economic restructuring rather than science teaching and learning.

The analysis of data related to macro, meso and micro levels inherent in the research questions provide insights into the discourse congruence among these three levels. By analysing science curriculum policy at multiple levels, influences on origins, development, perception and reception of policy become evident (Caldwell and Mays, 2012).

Curriculum policy implementation is never straightforward

Policy implementation is often viewed as the link between policy production and policy practice (Taylor *et al.*, 1997, p.16); however, as Taylor *et al.* argued, the processes of policy implementation are not linear. Similarly, the release of government curriculum documents alone does not bring enactment of these documents as they were intended. These policy documents do not enter into a vacuum, void of social or institutional influences. Policy writers cannot control the meanings of the documents when they are used in arenas with differing histories, values, experiences, purposes and interests (Bowe, Ball and Gold, 1992, p.22). A government decree that these are policy and therefore need to be implemented as intended ignores the multi-dimensional and value-laden characteristics of policy which involves interactions with diverse groups of actors. As Mahony and Hextall (2000, p.53) stated:

> Although a straightforward, technically rational relationship between policy text and 'implementation' is often presumed by policy-makers, in reality, interpretation and realisation create different local contexts of use, impact and meaning.

Implementing curriculum policy in the form of student learning still depends on what teachers do in their classrooms (Cuban, 2008). Although this study does not examine implementation of the curriculum in depth, one of the research questions explored the perception and reception by various stakeholders to the curriculum documents within the context of the political landscape within which they were publicly released.

Curriculum policy results in unintended as well as intended consequences

Authors of policy texts may make a concerted effort for a 'correct reading' of their texts (Ball, 1994, p.16); however, they cannot control the meaning once policy texts are disseminated into a wider arena for policy reaction and action (Jann and Wegrich, 2007; Hogwood and Gunn, 1984). This observation relates to the research question regarding stakeholder perceptions of the publicly released curriculum documents. It is important to consider that the 'contextual factors, different and sometimes opposing interests, linguistic ambiguities and variety of' actors involved in policy processes lead to unpredictable consequences'(Taylor *et al.*, 1997, p.17). For example, in curriculum policy, teachers' personal beliefs and knowledge of the subject matter can lead to altering what students are to learn if they believe the content will be in the students' best interests (Cuban, 2008). For this study the perceptions and reception of the curriculum documents by stakeholders were examined within the context of other government policies related to curriculum and education reforms such as surveillance and accountability policies. Bernstein's (1975) message systems of curriculum, pedagogy and evaluation and Ball's (1994) addition of managerial implications related to organisation as a message system are not in isolation from each other and should not be treated as such when analysing the consequences of curriculum policy.

3.3.2 Actors and curriculum policy

What actors do and say can convey meanings of struggle and conflict in policy formulation (Jann and Wegrich, 2007; Gale, 1999; Ball, 1994). Different groups of actors can exert power and influence regarding who gets to participate and make decisions in curriculum policy including determining what final decisions are to be made. The interplay of global and local actors translates local forces into local realities (Pan, 2010).

Fensham (2002) argued that academic scientists and elite science teachers remain the principal drivers of school science curriculum. Following World War II, curriculum was developed by experts *for* teachers. Science was no exception. This was a time when a proliferation of science-specific programs and resources were developed. Experts were mainly academics and/or subject specialists (Bellack, 1969; Kliebard, 1968), and curriculum-making was predominantly an administrative process (Reid, 1997). There was less government presence (Elmore and Sykes, 1992).

By the end of the 1960s, Schwab (1970) argued for a conception of constructing curriculum that valued and included teachers and students and not only curriculum specialists. He argued that the field of curriculum studies would be better served through an approach that he referred to as 'the practical' (Schwab, 1970, p.1). This notion used deliberation as a way to involve actors to discuss curriculum issues, decisions and actions (Waks, 2000; Harris, 1999; Reid, 1999; Westbury and Wilkof, 1978; Schwab, 1970). Curriculum deliberation was a method by which those involved in curriculum decisions could bring their values and relevant knowledge and experience to identified issues, and could come together in a systematic way to arrive at agreed upon resolutions (Harris, 1999; Orpwood, 1981; Schwab, 1970). Schwab viewed curriculum-specialists as group leaders who could facilitate these discussions (Waks, 2000; Reid, 1999; Schwab, 1970). My own practitioner experiences in Ontario curriculum since the 1980s supports the observation that teachers have been involved in making curriculum policy. This is not a statement about my singular experiences but rather anecdotal data gathered through years of meetings and working with colleagues who were involved with processes that resulted in curriculum policy documents. To what extent practitioners were involved and what power and authority they had is one important aspect examined in this current study. Another is the exploration of who were the policy elites who influenced various aspects of curriculum policy and who is not being heard. Selected literature related to curriculum decision-making raised my awareness of diverse groups of actors to consider in designing this research study. This is discussed further as follows.

Goodlad (1979) had identified societal, institutional and instructional levels of actors involved in curriculum decision-making. These can be viewed as being macro, meso and micro decision-making levels. At a societal level, decisions are made by those removed from the learner such as school boards or governments. At an institutional level, they are made by principals, teachers and parents, and at an instructional level, teachers decide what and how they teach. Government curriculum documents can set limitations on this; however, as mentioned earlier, curriculum policy can have unintended consequences and teachers' personal beliefs and knowledge of the subject matter can result in teachers making their own decisions on what students are to learn if they believe the content will be in the students' best interests (Cuban, 2008).

Klein (1991) expanded on Goodlad's work and identified seven levels of decision-making, each involving different actors. Her criterion for differentiating among these levels was ‘only in the degree of remoteness or closeness to the student’ (Klein, 1991, p.25). She considered this criterion to be the major focus of curriculum decisions. Upon examining Klein’s (1991) seven levels, as they relate to this study, they encompassed the intended, implemented and attained curriculum; however, the relationship of actors to the students is not one-dimensional. For instance, Klein’s (1991) operational level involves teachers and students as curriculum is implemented in the classroom. Classroom teachers involved in contributing to curriculum policy may have experiences of interacting with previous curricula as practitioners and this could influence their views if they are involved in constructing new curricula.

Klein’s (1991) work also identified that some actors may influence curriculum policy decisions but not necessarily be in the position to act on them whereas others have the authority to make decisions and ensure that they are enacted. To illustrate this point, take for example the experiential level which identified students as the main actors. Students are recipients of curriculum policy in that they are expected to achieve what is being taught and as such have a unique experience as curriculum is *done* to them but have little to no direct political power in curriculum policy; however, they may have influence indirectly through their parents as parents are exposed to curriculum enacted through their children’s classroom experiences. Kogan (1978) commented that groups with a vested interest in education such as parents could influence policy-making. He argued that parents concerned about what their children learn can make their dissatisfaction or satisfaction with curriculum known to teachers, school board administrators, their local politicians and the media. My research questions require analysing data to identify key actors and how they influenced science curriculum policy either directly or indirectly.

Klein (1991, p.31) argued that the ‘amount of political power the participants have will help determine whose ideas about curriculum will become the most influential and dominant’. She raised an important point but the political power of actors is not so directly identified by her seven levels. There can be a complexity of interactions among various roles that an actor can have across these levels. Actors may be involved in curriculum policy and yet be unaware of the impact and influence that they could wield or do wield; for example, in the various facets of curriculum policy, a teacher might try to influence decisions as a parent at the societal level, participate in provincial writing teams at the formal level, be involved in reviewing draft curriculum documents at the school (institutional) level, and be the primary decision maker in the classroom at the instructional level.

Goodlad (1991) argued that the question as to who makes curriculum decisions cannot be answered simplistically in terms of who has the power to make them and must be answered within a political context. He pointed out that legislators become interested and their attention is heightened when they consider schools as instrumental in addressing global economic competition. This underscores the importance of having data to examine the cultural, political and economic contexts in order to identify their influences on science curriculum policy. Goodlad (1991, p.9) stated that ‘education for economic well-being’ has become a powerful rallying call in developing school curricula and ‘many politicians perceive themselves to have a public mandate to intervene in the goals and content of the K-12 curriculum’ (also see Kogan, 1978). This study's research questions sought to examine these influences on Ontario's science curriculum.

Another group of actors to consider as to whether they have influence on curriculum policy are referred to by Kogan (1978) as interest groups and are similar to Klein's (1991) formal level which is composed of individuals and groups who have some direct responsibility or influence on curricula but are not specifically located in a school. These include school board administrators, textbook publishers and teacher unions. The media are a group of actors not explicitly mentioned by Klein or Kogan. Their growing significance, capacity and influence in communicating political messages (Gewirtz, Dickson and Power, 2004) is reflected in Premier Bob Rae's comments about the media during his term in office. Rae was leader of the New Democratic Party which formed the Ontario government from 1990 to 1995.

> Political coverage in the age of television is a branch of entertainment. The forum is the scrum, question period, and the live event. Politicians play the game, along with their advisers, of trying to create the events and impressions that will make them look good on television. They use the medium, as best they can, to convey information, but more important, to convey feelings and attitudes which will prove ultimately persuasive (Rae, 1996, pp.287-288).

The media are a central source of information for both the public and for policymakers, and can create a sense of panic about public education (Ungerleider, 2003). Strategic use of media coverage can be tactical to define issues (Kingdon, 1995) by actors, including the media itself.

As mentioned, a review of this literature related to actors helped to clarify the data required for my research questions. There was a need to reveal multiple actors influencing science curriculum policy and their agendas.

3.4 Section Three: Formulating an analytical framework

Analysing curriculum policy that spans 23 years involves examining complex elements contributing to changing political arenas, diverse actors with different interests and perceptions, and reading multiple texts. A framework for this analysis needs to simplify the problem in order to have any chance of understanding it, to be representative of the problem and to create order for data analysis (Sabatier, 2007; Parsons, 1995). This framework has to be broad enough to encompass the curriculum policy characteristics mentioned earlier and to address the research questions.

Literature in education policy studies, political and policy studies and curriculum studies provided insights into choosing a framework. Various policy analysis approaches were examined such as policy archaeology (Walton, 2010; Scheurich, 1994); policy historiography (Lustick, 1996; Bann, 1981); policy genealogy (Macdonald, 2002; Hogwood and Peters, 1982); curriculum construction models (McGee, 1997; Klein, 1991; Walker, 1971; Tyler, 1949); and, a policy ecology approach (Weaver-Hightower, 2008).

Historical policy analyses can examine how science curriculum policy-making has changed over time. There were historical aspects to this study in the very nature of examining 23 years of science curriculum policy. However, central to this study and its research questions are the actions of Ontario's governments within evolving political, economic and social landscapes and how these influenced science curriculum. Curriculum construction models such as Tyler's Rationale (1949), Walker's (1971) naturalistic model, Klein's (1991) decision-making matrix (1991), and McGee's (1997) dynamic model of decision clusters provided insights into processes to consider when constructing curriculum. Although they involved policy text and policy discourse, they did not explicitly account for curriculum policy that is shaped by political acts, events and interactions among diverse actors and their interests. While each of these four curriculum models has merit on its own, each also has limitations when it comes to addressing the complex interrelationships of key actors, curriculum decisions, and the impact of socio-political and economic trends that were at the heart of the research questions for this study as discussed below.

Tyler (1949, p.1) posited four questions he considered as fundamental to curriculum: What educational purposes should the school seek to attain?; What educational experiences can be provided that are likely to attain these purposes?; How can these educational experiences be effectively organised?; and, How can we determine whether these purposes are being attained? Implicitly his four questions related to the intended, implemented and attained curriculum. Although he proposed these questions over half-a-century ago, his questions have had a long lasting influence on developing school curricula. However, the four questions in Tyler's Rationale (1949) do not illuminate who is involved, their values, beliefs and motivations nor the processes of how the final content is determined. Walker's (1971) model is descriptive, treating both means and ends of making curriculum as mutually determining one another. This contrasts with Tyler's model which is more prescriptive focusing on the end or curriculum-as-product. Walker's model does not explicitly account for external influences that can impact curriculum making and is peripheral to the actors involved in the process. The strength of his model is that it acknowledges personal beliefs that all actors bring to curriculum policy. Klein's (1991) decision-making matrix is useful for analysing components of curriculum text but has limitations in accounting for the complexity of interactions and influencing factors that can impact curriculum policy. McGee's (1997) dynamic model emphasizes decision clusters. Although he considered these clusters to be interconnected and not to be viewed in isolation of each other, his model does not appear to account for the role of different actors within the decision clusters and how their beliefs, values and motivations can shape what decisions are made, and how they are made and acted upon.

Curriculum policy-making, as has been underscored, is neither straightforward nor linear. Therefore, an analytical framework is needed for this study to account for, and illustrate, the complexity of interconnections and interrelationships among policy origins, policy development, actors who may or may not have been involved, and how decisions were made and by whom. As Leonie Daws said:

> At each point policy is a response to complex and diverse elements, including a range of constraints imposed by other levels of public and educational policy, different administrative contexts, varying ideologies and the personal idiosyncrasies of the people involved (Daws, 1995, p.129).

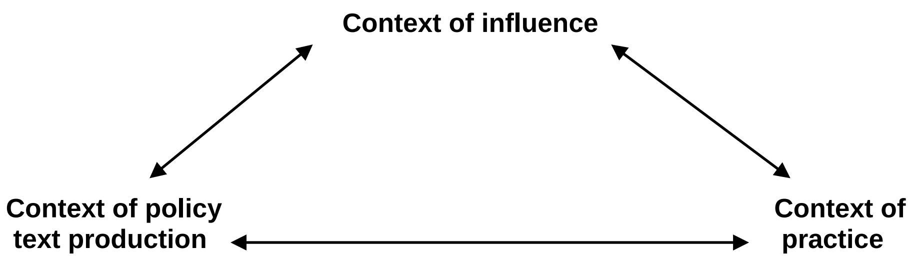
An emerging theory about curriculum policy presents a view of it as a fluid, dynamic, interactive and adaptable process (Doll, 2008; Barab and Roth, 2006). Weaver-Hightower (2008, p.154) proposed an ecology metaphor as 'a call to complexity for policy research' building upon the work of Firestone (1989), Goodlad (1987), and Baker and Richards (2004) who used the concepts of ecology as metaphors for analysis. A policy ecology approach locates policy text and processes in a much broader context (Rizvi and Lingard, 2010). Although this may illustrate the fluidity of curriculum policy and its interactions with environments, actors and events, one still needs to identify the constituent environments, the influencing actors and events in order to understand their intricacies and complex interactions. With few studies on science curriculum policy, the findings for this study may help to identify these components. However, mapping the resulting policy ecology is beyond the scope of this research.

In their study on the U.K. National Curriculum, Ball and Bowe (1992, p.100) proposed that an analysis of policy required distinctions among: the intended policy which reflects competing ideologies and continual struggle for power; the actual policy in the form of policy texts which is one form of intended policy and a resource for practitioners; and, policy-in-use which involves the institutional practices and discourses emerging from the responses of practitioners to both intended and actual policies within their arenas.

I consider these differing facets of policy as being applicable to this study, as they also relate to the nature and extent of the different facets of curriculum policy. Intended curriculum policy reflects competing ideologies and struggles of who determines what should be taught; the actual curriculum policy, in the form of government-mandated curriculum documents, is the intended policy used by practitioners and other users like resource developers; and, curriculum policy-in-use is the institutional practices and discourses that emerge from users of the intended and actual curriculum policies within and among different arenas.

Ball and Bowe (1992) argued that the policy process is more complex than an explicit government position that filters down into schools. They conceptualized the policy process as moving beyond the traditional linear view of formulation and implementation stages (also see Fitz, 1994), and saw it as a dialectical process in which legislation, documentation and implementation may be more or less loosely interconnected (Ball and Bowe, 1992, p.98). Bowe, Ball and Gold (1992) presented a policy cycle approach consisting of three interrelated policy arenas that coexist as illustrated in Figure 3B.

Figure 3B Policy cycle contexts (Bowe, Ball and Gold, 1992, p.20)



The context of influence is concerned with pressures and trends that impact on policy. This context examines where policy is initiated and involves both public and private arenas of influence where key policy concepts are constructed. For this study, the context of influence involves analysing the social, political and economic trends that impacted on reforms resulting in curriculum policy-making as well as their related discourses. This includes providing a historical background of previous curriculum policies, and identifying actors and their roles in policy formation and enactment.

The context of policy text production involves texts that represent policies being developed. It is concerned with the processes resulting in generating policy texts. Curriculum policy texts can be wide-ranging, from the actual curriculum documents to policy documents that influence their development. Ozga (2000, p.33) commented on policy written text as ‘any vehicle or medium for carrying and transmitting a policy message’. This is relevant to curriculum policy as government press releases, reform bills, discussion papers, and debates by politicians as recorded in a legislative assembly, express political intent. Textual analysis identifies sources and audiences, assumptions underlying the texts and the dominant ideology underpinning them. This is particularly important for this study as it examines science curriculum policy across governments that have different ideologies. Furthermore, ideologies have ranged along a continuum of the New Democratic Party’s left-of-centre ideology with its emphasis on social democracy, to the Progressive Conservative’s ideological shift as a centrist party in the 1980s to the New Right ideology in the 1990s in the style of Margaret Thatcher and Ronald Reagan (Sears, 2003; Woolstencroft, 1997).

The context of practice is concerned with the perception, reception and implementation of policy, the consequences of policy and policy recontextualization. Government curriculum policy may attempt to control teachers by telling them what to teach, to whom it is to be taught and what to assess, or it may exert indirect control by devolving responsibility to school boards or schools to develop their own policies. Curriculum documents without the means for implementation may have authority but have little or no power (Schwille *et al.*, 1988). Analysis within the context of practice encompasses the influence of the relationship and perception of teachers with each government; for example, Schwille *et al.* (1988, p.30) suggested analysing the perception and reception of curriculum documents on prescriptiveness - how specific and extensive the policy is in telling school boards and teachers what to teach; consistency – whether policies reinforce each other or are in isolation or even in conflict with one another such as policies related to resources, evaluation and reporting; and, authority and power – whether policies are in agreement with expert opinion or in support of individuals.

Ball (1994) later revised the original three-context analytic framework to include two additional contexts. One, the context of outcomes, analyses issues related to justice, equality and individual freedom. The other, the context of political strategy, involves the identification of a set of political and social activities to analyse implications for change. These warrant further research to examine social justice issues related to science curriculum policy but are beyond the scope of this study. Wallace (1993) advocated that the media should become a fourth context as information is conveyed through the media to actors in the first three contexts and to the larger public. As presented earlier in this chapter, this study views the media as a policy actor and thereby its influences are interrelated throughout all policy cycle contexts.

3.4.1 Using a policy cycle approach as an analytical framework

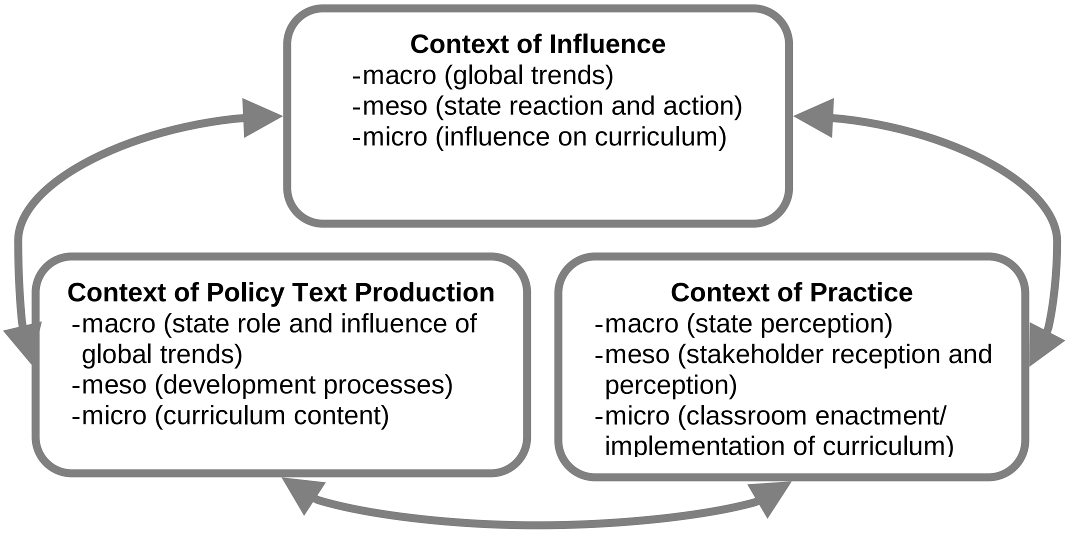
Bowe, Ball and Gold's (1992) policy cycle assigned a more limited role to the state in analysing policy while recognizing that the state and other agencies are empowered differentially over time within the policy process. The concept of the three interrelated coexisting contexts rejects the idea that there are separate stages of policy formation and enactment. Instead, it suggests a non-linear relationship between policy processes and their resulting texts and discourses, and that the three contexts can illustrate the complexity, interconnections and interrelationships among these contexts.

This differs from a state-centred policy analysis where the state is viewed as being central to understanding any education policy-making (Dale, 1992). Policy is analysed at the top of a hierarchical chain which then travels out and down to where it would be applied or implemented (Moss and Huxford, 2007; Fitz, 1994). This separation of policy formulation and implementation tends to reinforce a 'managerial perspective' on the policy process (Bowe, Ball and Gold, 1992, p.7; also see Looney, 2001).

Vidovich (2003, 2001) modified Bowe, Ball and Gold's policy cycle for analytic purposes, allowing for macro as well as micro-level analyses. Her modification provides for an analysis of global, regional and national levels and simultaneously an analysis of policy within individual institutions. Within each context, macro, meso and micro levels can be analysed to understand the complexity of curriculum policy and to see that these levels are not independent of each other, as shown in Figure 3C. These layers of analysis enable examining the degree of discourse congruency among levels and the interconnections among actors with interest in Ontario's education system such as government, the electorate, parents, business, industry, the media and educators.

Using this modified policy cycle approach, a macro analysis provides insights into a government's science curriculum policy origins within the context of broader global and national influences. A meso analysis examines how government reforms are translated into science curriculum policy documents. A micro analysis examines how policy is enacted, perceived and received by stakeholders. By analysing data using these multiple levels, their influences on development and interpretation of policy become evident (Caldwell and Mays, 2012; Taylor *et. al*, 1997).

Figure 3C A modified Bowe, Ball and Gold (1992) policy cycle for curriculum policy analysis



A policy cycle has possibilities as a heuristic model (Looney, 2001; Parsons, 1995) to organize and analyse this study. Implicit in a policy cycle approach is that policy changes over time as it passes through a range of contexts, often involving different actors who reshape it as it goes (Taylor *et al.*, 1997). Studies using a policy cycle approach have enhanced our understanding of complex preconditions of policy environments, central factors that influence policy formulation and implementation, and diverse outcomes of the policy process (Jann and Wegrich, 2007, p.57).

Furthermore, how a government chooses to take action at a local level requires examining how policy cycles within each government and across governments feed themselves. Typically, a policy cycle approach can trace the trajectory of a specific government policy from conception to implementation, including its struggles and responses across multiple levels (Lingard and Garrick, 1997; Ball, 1994). This is used to further analyse how policy is constructed and analysed from its inception to its outcomes and subsequent effects (Lingard and Garrick, 1997; Ball and Shilling, 1994). This involves 'a cross-sectional rather than a single level analysis by training policy formation, struggle and response from within the state itself to the various recipients of the policy' (Ball, 1993, p.16). Spanning 23 years of science curriculum policy in Ontario, a policy trajectory enables one to examine how science curriculum has changed over time and what influences contributed to these changes. Cuban (2008) argued that policy makers often have ready explanations for why reforms fail but these explanations may or may not be informed by historical research or ways of viewing the past. A policy trajectory enables one to look for patterns over time and across political agendas (Lingard and Garrick, 1997; Ball, 1994). It can be useful to analyse curriculum policy both within a government and across all governments.

This builds upon the modification of a policy trajectory used by Vidovich (2003). Both state-centred constraints and micro-political agency are incorporated into the policy trajectory. The multi-layered data and subsequence analysis can highlight the interrelationships between different levels and contexts of the policy process. Analysis from different levels can be compared and contrasted (Vidovich, 2003).

This study conceptualizes the policy process as continuous throughout multiple levels of analysis and contexts.

3.4.2 Criticisms of a policy cycle approach

A policy cycle approach has been criticised for focussing on the micro level of policy at the expense of a bigger picture of power (Hatcher and Troyna, 1994; Troyna, 1994; Dale, 1992). In this section I present my argument that for this study the modifications to a policy cycle approach as described in the previous section encompasses more than a micro-level of policy analysis. To illustrate this, I address three criticisms of a policy cycle approach: the perceived limited role of the state; its inadequacy to address and explore the nature of complex and contradictory relationships; and, finally, the recursive nature of a policy cycle as being more rhetorical than real.

As pointed out earlier, Bowe, Ball and Gold's (1992) policy cycle assigned a more micro-oriented role to the state, thereby differing from a macro-oriented state-centred approach. Dale (1992, p.388) asserted that 'a focus on the state is not only necessary, but the most important component of any adequate understanding of education policy'. Since this study defines curriculum policy as government-mandated curriculum documents, it can be presumed that the nation-state does have a major role by the very nature of this definition. Using a policy cycle approach as described in the previous section provides a framework to examine how extensive this role is, particularly when it comes to analysing texts, discourses and actions involving each government's science curriculum. The interrelated contexts of a policy cycle enable exploration of the linkages among the various levels of policy analysis and discourse congruence among these levels. For example, a nation-state may have the power and authority to initiate a new curriculum as a government decision; however, other groups and actors may have a major role and exert power in the development and content of the final documents.

Another criticism of a policy cycle approach, with its inherent examination of policy trajectories, is its messiness in being inadequate to characterize the nature of complex and contradictory relationships amongst the contexts of the policy cycle (Power *et al.*, 2004; Henry, 1993). There is a danger of using it as a theoretical construct rather than exploring complex relationships (Power *et al.*, 2004; Parsons, 1995). Henry (1993) critiqued a policy trajectory study for not necessarily leading to critical or theoretical exploration but rather for emphasising the problem solving aspect of policy making. She further critiqued the 'evershifting possible interrelationships' (Henry, 1993, p.103) among the three contexts of policy making. I argue that analysing relationships of actors in policy formation, generation and enactment using any approach is naturally messy and complex due to the interconnectedness. A case in point is Weaver-Hightower's (2008) policy ecology approach mentioned earlier. It conceptualises policy analysis as involving actors, relationships, environment and structures, and processes. Their interrelationships are complex and interdependent, and without a starting point. The nature of making curriculum policy is multi-dimensional and involves diverse actors. The policy cycle approach used in this study enables an analysis to identify who are the policy elites within each context and what are their interests to initiate new curricula, in the development processes and in determining the content of the documents. The interrelated nature of the contexts enables an examination of relationships among actors. For example, with the advent of New Public Management (NPM) and market-based models of service delivery, there is a growing popularity of partnerships leading to shared accountability for attaining desired outcomes, and service delivery by contractors or specialised government agencies (Segworth, 2003). This raises questions such as ‘how much do nation-state policymakers have to say about what is taught in school’ (Schwille et al., 1988, p.29). Curriculum policy documents by themselves may have authority but little or no power. The devolution of responsibility for implementation of curriculum policy is delegated to other agencies, local authorities and/ or individual schools and teachers. To provide meaningful analysis of the data for the research questions in this study, a policy cycle approach is suitable in that it helps to clarify the complex relationships between actors and events as curriculum policy is formulated and enacted.

The third criticism is that the recursive possibilities of the policy cycle may be more rhetorical than real as argued by Fitz (1994, p.60). He noted that centrally defined initiatives exemplify the centre’s capacity to exert direct influence in a variety of ways: demobilizing networks of influence, including key bureaucracies; redefining the composition of governing bodies and empowering parents; and, creating instruments to maximize the possibility of execution of policy (Fitz, 1994). This supports a hierarchical view of policy analysis; however, it is again important to note that users of curriculum policy and stakeholders in education can also exert influence. Teachers’ reactions to curriculum policy documents are mediated by social and cultural contexts as well as by their identities and the way these identities are affected by the demands for change (Laskey, cited by Kelchtermans, 2005, p.996). To understand these intricacies and interrelationships better, the policy cycle contexts of influence, policy text production and practice provide a useful underlying framework for analysing science curriculum policy at a local level while enabling one to also take into account global trends and political arenas. I suggest that the recursive nature of a policy cycle as it relates to curriculum is real and not rhetorical. Investigating these contexts can reveal important conflicts; for example, actors involved in text production can wrestle for control of the representation of policy (Looney, 2001; Ball and Bowe, 1992). Policy texts throughout a policy cycle consist of significantly different arenas and sites within which a variety of interests are at stake (Ball and Bowe, 1992).

It is worth noting that government curriculum reform often impacts on all school subjects. This study is specific to Ontario science curriculum policy. Other subject areas may have different processes and factors that are significant to their disciplines. However, the approach used in this study may be useful to examine the politics and decision-making processes that influence curriculum development of other subjects.

3.5 Chapter summary

This chapter has analysed literature that has informed the design and analytical conceptualisation for this study. It defined curriculum as what is intended to be taught and learned in schools in the form of government-mandated policy documents for a particular subject area - in this case science; and curriculum policy as a course of action shaped by political acts, events, actors and their interactions. The characteristics of curriculum policy were presented and illustrated as being both a process and a product. Curriculum policy involves more than understanding the curriculum documents and their construction but also entails examining the influences contributing to the origins, processes and content of these documents. The resulting policy documents are products of compromises, influences and agendas among a variety of actors in a variety of arenas. Curriculum policy is thus ultimately an expression of political intention involving both notions of policy-as-text and policy-as-discourse.

Selected literature in curriculum studies and education policy studies has informed the design of this study. Among the approaches that were examined to analyse policy processes were a state-centred approach (Rizvi and Lingard, 2010; Whitty, 2002; Taylor *et al.*, 1997; Dale, 1983) and a cyclical perspective emphasising feedback loops of policy inputs and outputs (Rizvi and Lingard, 2010; Jann and Wegrich, 2007; Vidovich, 2003, 2001; Bowe, Ball and Gold, 1992). A policy cycle approach adapted from Bowe, Ball and Gold (1992) and Vidovitch's (2003, 2001) modifications for macro, meso and micro levels of analysis, were also explored and found to be a useful analytical framework for this study. This offered a dynamic and comprehensive means to analyse and interpret the data that was to be gathered. While recognising that a policy cycle approach as used in this study may have limitations in accounting for all aspects of the multi-layered nature of science curriculum policy-making in Ontario; it was however, a useful tool through its multi-faceted approach. With few studies to draw upon, this provided an effective framework for gaining insights from the posed research questions. The next chapter, Chapter Four, discusses the research methodology and design of this study that was informed through the literature that was presented in this chapter.

Chapter 4 Methodology

4.1 Introduction

Qualitative research is situated in social experience and takes many forms (Denzin and Lincoln, 2000). In choosing a research methodology, consideration must be given to the nature and aims of the study as well as the associated research questions that are being explored (Mason, 2005; Cresswell, 2003; Cohen, Manion and Morrison, 2000; Maxwell, 1996). This study involves understanding curriculum origins, processes, who is involved and why, their relationships, and exploring political, economic and social landscapes. The nature of this study locates it firmly in qualitative methodology. This chapter describes the research design, methods and data that were used.

Qualitative research cannot be made researcher proof and one cannot escape the personal interpretation brought to qualitative data analysis but checks and balances can minimize biases (Cresswell, 2003; Ball, 1990b). As already mentioned, I have lived experiences as a practitioner with the curricula examined in this study and as a citizen of Ontario. I have worked with, been a colleague of, or known many participants who agreed to be part of this study. Reflectivity involves thinking within life experiences (Bolton, 2010). The influence of these experiences is discussed throughout this chapter. Accordingly, I am beginning with a brief account of myself.

4.2 The researcher's self

Critical self-reflection is located within political and social structures (Bolton, 2010). During the time period examined in this study, I have been a practitioner in

Ontario science education both within the formal school sector and informal education sector. This study has made me examine my experiences during the different political time periods that span my research. This section is a brief self-reflective account how these relate to my role as a researcher.

Since 1985, I have been a teacher, consultant, coordinator, resource developer, curriculum developer and currently have responsibility for education programs for a non-profit Canadian science education organisation. I have been and still am an active member of the Science Consultants and Coordinators' Association of Ontario (SCCAO) and was involved in the Science Teachers' Association of Ontario (STAO) including being its president in 2002-2003. My interest in researching science curriculum policy was heightened when I was involved in the development of the Ontario elementary science and technology curriculum in 1998, and somewhat involved in the development of the secondary science curriculum documents in 1999 and 2000. In 1998, I was also an Ontario representative on the development team of the *Pan-Canadian Framework of Science Learning Outcomes* (CMEC, 1997). These experiences raised my awareness about the complexities of science curriculum policy and piqued my curiosity about understanding it.

When I began my study, I thought Robson's (2002) description of insider research applied to me. Robson described insider research as an inquiry by a researcher who has a direct involvement or connection with the research setting. I believed that my career experiences over the past 30 years in Ontario science education, gave me insider status. As my study progressed, I quickly became aware that just because I was involved in a research setting where I am an active participant as a practitioner did not mean that I was conducting insider research. My role within the Ontario science education community differed from my role as a researcher within this setting. Razavi (1992, p.161) suggested that a researcher as an insider will always be something of an outsider in their own community. In fact, my experiences as a practitioner and researcher allowed relationships to be seen through a range of possible roles (Bolton, 2010). Table 4.1 summarizes my insider-outsider relationships in the research settings for this study. For example, although I was directly involved in developing Ontario science curriculum for one government and worked closely with government bureaucrats gaining privy to some insider-knowledge, I have never been an employee of the Ontario government. I cannot presume my experiences with one government would be the same with other governments or that they would be the same had I been employed by one of the governments for the time period of this study.

Table 4.1 Insider-outsider relationships in the research settings for the study

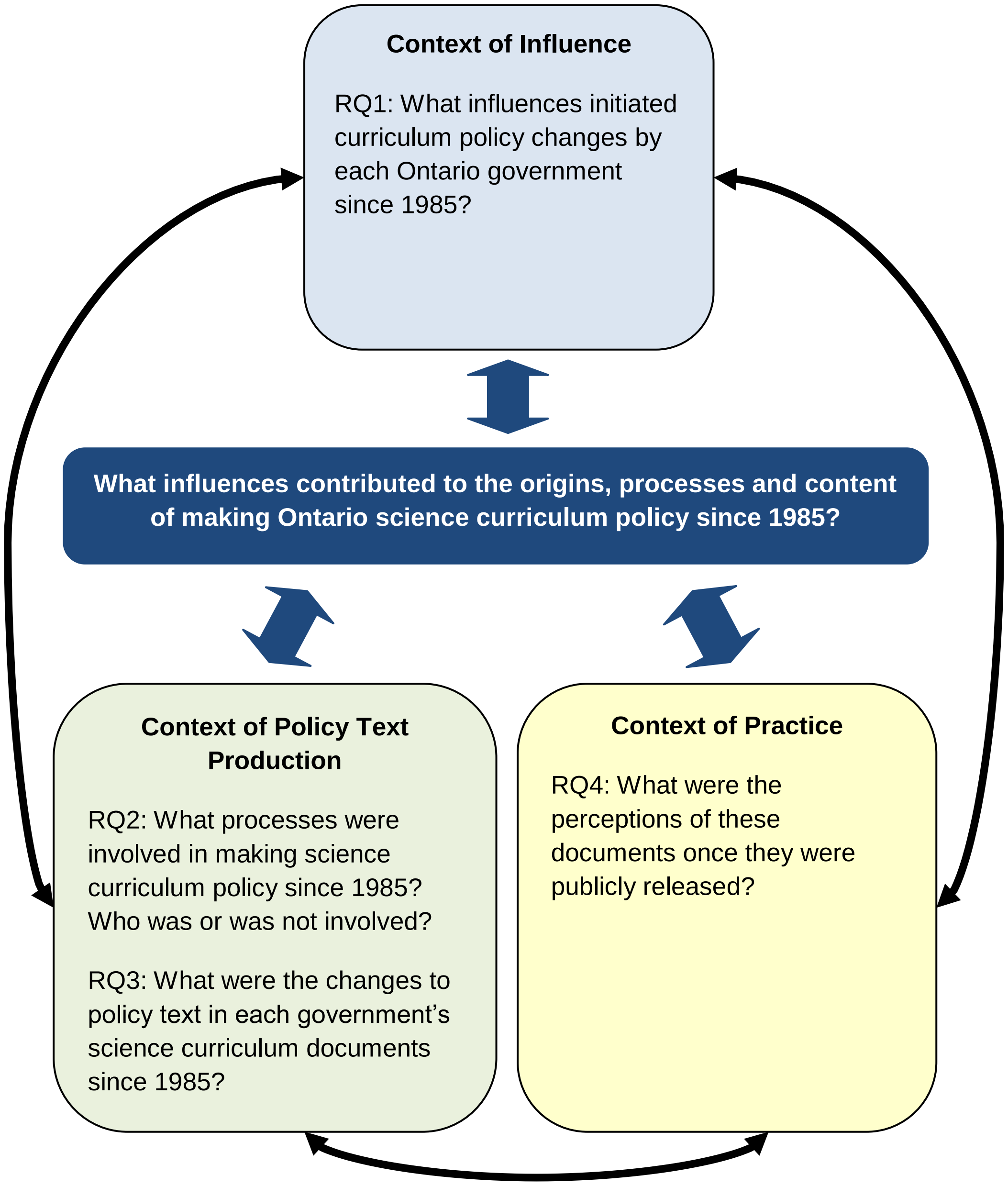
Setting	Insider	Outsider
Ontario government	• worked directly with government officials on science curriculum	• not a government employee • direct experience is only with one government being studied • student-researcher
Ontario science education community	• active member of major Ontario science educator organizations • working colleague with several Ontario science educators • worked with colleagues on the current science curriculum development and implementation • experienced Ontario science curriculum documents as a teacher and as a Board consultant	• no longer a member of the formal Ontario science education community • part of the Canadian informal science education community • worked directly with one government on science curriculum development • student-researcher
Resource developers	• worked with various publishers on the development of science textbooks aligned to the current Ontario science curriculum • seconded for one year working at a resource development (publishing) company	• not an employee of a resource developer company • developed resources aligned to only one government's science curriculum documents • student-researcher

Debates around insider-outsider research typically imply that one is at a point along a continuum (Bridges, 2001; Hockey, 1993; Merton, 1972). As I reflected on my own self as researcher, a linear model did not account for the complexities of relationships that I encountered in my study. Within one setting and even within one participant relationship, I alternated between insider-outsider relationships such as with participants who were interviewed and were well-known colleagues. This presumes that there may be a relationship with shared insider knowledge but having shared insider experiences does not mean that my researcher-relationship was as an insider. By interacting with colleagues as a researcher, I added an outsider relationship. This is more reflective of Jewkes and Letherby's (2001) argument that the complexities of insider-outsider relationships are due to continually negotiated relationships where outsiders sometimes occupy the social position as insiders and vice versa. Conducting this research became an interpersonal and socially dynamic process (Ball, 1990b). Nevertheless, it is important to understand how my presence as researcher with practitioner experiences shaped this study so that readers understand how to interpret the analysis and gain insights for further exploration (Hammersley and Atkinson, 1995; Ball, 1990b). Accordingly, I have embedded commentary related to the advantages and challenges of these experiences woven throughout this chapter wherever relevant.

4.3 Research design

As there is no tradition of policy analysis or policy research in the field of science education (DeBoer, 2011b), a review of the literature led me to consider various approaches as outlined in the previous chapter. A modification of Bowe, Ball and Gold's (1992) policy cycle with its interrelated contexts of influence, policy text production and practice provided a framework to conceptualise this study. In designing this study, the primary question was sub-divided into four questions. Each was assigned to a policy cycle context that it best addressed (see Figure 4A). Question identifiers (RQ1 to RQ4) helped during data collection to ensure sufficient evidence was gathered for each question and for every government time period.

Figure 4A Using policy cycle contexts to focus the design of this study



Additional questions, adapted from Vidovich (2001), and related to each policy cycle context provided further structure for macro, meso and micro levels of analysis as shown in Table 4-2. This provided a means to systematically identify data around issues, actors, topics, information, examples and themes, and remain aligned to the research questions informing this study. This enabled exploring linkages between the various levels of policy analysis.

Table 4-2 Policy cycle analysis questions

Context of influence **RQ1: What influences initiated curriculum policy changes for each Ontario government since 1985?**
Macro level analysis: (global and national trends) • What global and national factors influenced Ontario science curriculum policy documents? How are these evident? • Did the ideological, economic and political conditions in Ontario influence the science curricula that were developed? • What documents influenced or informed Ontario science curriculum policy documents? • Who were the policy elites and what were their interests? Who was not being heard? Meso level analysis: (state reaction and action) • To what extent were curriculum reforms by Ontario governments reacting to global, national and provincial influences? • How did these reforms influence science curriculum policy documents? Micro level analysis: (influence on curriculum) • What were the beginnings of the construction of science curriculum policy documents, and ‘why now’?
Context of policy text production **RQ2: What processes were involved in making science curriculum policy since 1985? Who was or was not involved?** **RQ3: What were the changes to policy text in each government’s science curriculum documents since 1985?**
Macro level analysis: (state influence) • What issues surrounded constructing the science curriculum policy documents, and how did they relate to provincial, national and global agendas? • What role did governments have in constructing science curriculum documents and what were their interests? Who was or was not being heard? Meso level analysis: (development processes) • What development and decision-making processes were used and why? • Who was involved in constructing science curriculum documents and who was not? • Whose views about science education were favoured, and whose were excluded? Micro level analysis: (curriculum content) • What was the dominant discourse of the science curriculum documents (e.g., stated intention of purpose, any ‘hidden agendas’, values, key concepts, format, language, inconsistencies and contradictions, audience), and which discourses are excluded? • How evident were provincial, national and global agendas in the curricula texts?

Context of practice **RQ4: What were the perceptions of these documents once they were publicly released?**

Macro level analysis: (state perception)
• What factors influenced how the science curriculum policy was perceived and received?
• How was the policy perceived by the government? How predictable was this?
• What was the implementation strategy and funding for implementation, if any?
Meso level analysis: (stakeholder perception and reception)
• How was the policy received by stakeholders? How predictable was this?
    • Was the policy actively received or passively rejected?
    • Was the policy actively resisted or passively received?
• Who could access the policy and who did access it?
• Who put policy into practice?
Micro level analysis: (classroom enactment/ implementation)
• How open was the policy for practitioners to interpret?
• Were policy users able to meet localised needs?

A research design chart, adapted from Mason (2005, p.3), provided an overview and served as a useful reference tool throughout the study (see Appendix A). This chart also summarized ethical protocols approved by the Roehampton Ethics Board prior to beginning this study. A more detailed discussion about ethical considerations and protocols are provided later in this chapter.

4.4 Methods

Methods using documentary analysis, interviews and focus groups generated multi-layered data. Reflexive notes helped to provide insights where personal experiences and relationships with participants could be considered outside of oneself (Bolton, 2010). This section describes these methods, why they were chosen and the sampling, procedures and challenges related to their use.

4.4.1 Document analysis

Bowen (2009, p.27) identified document analysis as a systematic procedure for reviewing or evaluating documents and like other qualitative research methods requires that data be examined for purposes of analysis and interpretation. For this study, document analysis used print documents that existed in the public domain such as legislative debates recorded in Ontario *Hansard*, government reports and discussion papers, science curriculum policy documents, implementation documents and newspaper articles. It did not include those generated for or through this study such as transcribed recordings of interviews and reflexive notes (Mason, 2005). Primary and secondary source documents are not rigid categories (McCulloch and Richardson, 2000). For this study, primary source documents provided first-hand accounts of political and economic arenas, and science curriculum policy processes and products. Newspaper articles were considered as primary sources as they reported on issues and events related to education reform at the time in which they occurred. Secondary source documents provided written accounts and interpretations of the times (McCulloch and Richardson, 2000). These included published books, articles in academic journals, chapters in edited books, and unpublished master and doctoral theses examining education or curriculum reforms in Ontario. Document analysis provided a means of triangulation (Bowen, 2009), particularly when used in combination with the other methods used in this study.

Document sources

Documents were collected through research libraries, bookstores, the Internet and my personal library. An unexpected source was participants who voluntarily brought documents to their interview that they thought I might find relevant and useful. These documents are primary sources and not easily accessible such as committee reports, draft science curricula, a government science curriculum implementation package and documentation regarding provincial reviews conducted for senior chemistry and physics in the late 1980s and early 1990s.

The Internet provided an electronic source for documents as follows. The Ontario Ministry of Education web site was useful to access documents and press releases for the current government as well as their memos to school boards on government policy initiatives, such as the Ministry Education memo describing the curriculum review feedback consultations for the McGuinty Liberal draft science curriculum documents (Ontario, Ministry of Education, 2006a). Reports and communications from previous Ontario governments were not archived or accessible on this site unless they were current policy or directly related to current policy. As new political parties are elected to govern, government web sites undergo change. I was alerted to this by the Ministry of Education librarian who suggested I try the web site of the Internet Archives Wayback Machine to access web sites of previous governments. This gave me access to the web sites of the Ontario Progressive Conservative government from 1995 to 2003, the Ministry of Education news releases from 1994 and 1995 for the New Democratic Party government, and as well as earlier versions of the current McGuinty Liberal government web site. These archived sites provided a rich source of data about a previous government's education and curriculum reforms such as related press releases, education reform task force reports, and committee reports. Another source of electronic data through the Internet was access to the legislative debates as recorded in Ontario's *Hansard*. These were available on the web site of the Legislative Assembly of Ontario. These debates involved elected officials of all political parties and were an informative source for issues involving policy including the related political rhetoric. Electronic access to these debates enabled me to use Internet word search features to select relevant debates for this study.

Newspaper articles reporting on education issues illuminated ongoing debates (Earl et al., 2004). They provided an account of what the public and politicians were reading, thereby placing events within the context of their times. Articles used in this study included the government's education and curriculum reforms and responses to these by various stakeholders; reports and commentary on released government reports; economic concerns of the times; preparedness of students for the marketplace; and the results of national and international science testing programs. I selected articles from five daily newspapers that provided national, provincial and regional perspectives: the *Globe and Mail* - Canada's largest English language national newspaper and somewhat centrist; the *Toronto Star* - available in Toronto and surrounding areas but also distributed throughout Ontario and supports liberal traditions; the *Ottawa Citizen* - regional within the Ottawa area of Ontario, the *Windsor Star* regional within south-western Ontario – both now owned by Postmedia Network with a conservative political leaning; and the *Kingston Whig-Standard* – a regional tabloid newspaper available in south-eastern Ontario and owned by Sun Media Corporation (Postmedia Network, 2011; Sun Media, 2011; Worldpress, 2011). I also used newspaper articles that I had collected over the years. Choosing articles from a variety of authors and newspapers minimized the dangers of examining education issues presented only from one newspaper's or one journalist's political leanings.

Analysing articles for media biases is beyond the scope of this study as it would require examination of ownership of newspapers over the past 25 years (Riffe, Lacy, and Fico, 2005). For example, the *Ottawa Citizen* has changed ownership several times since the 1980s and its editorial view has varied depending on its ownership. In the late 1980s under the ownership of the Southam family it supported the Liberals. Under Conrad Black's Hollinger Inc. ownership it aligned its support more towards conservatives. It is now owned by Postmedia Network along with the *Windsor Star* and other Ontario regional newspapers and has conservative leanings (Postmedia Network, 2011; Worldpress, 2011).

For this study, I limited media documents predominantly to newspapers. There were some instances where an article referred to a television advertisement or a government announcement. I checked the Internet to see if these were available for viewing and in cases where they were, primarily on YouTube, their content was included in data analysis. Further studies about the media and curriculum policy could include analysing the discourses of visual and audio text-based documents such as archived vodcasts (video podcasts) and podcasts (audio only) of television debates, documentaries and talk shows. Including these was beyond the time manageability for this study.

Primary source documents used in analysis were recorded on a chart identifying the type and/or name of the documents and their source (see Appendix B). Primary and secondary source documents that are used as evidence in Chapters Five to Eight are cited and listed in References.

Advantages and limitations of document analysis

Documents can provide details on a chronology of events and reveal information that cannot be obtained through interviews (Mason, 2005; Caulley, 1983). The inclusion of exact names, references and details were advantageous in the research process (Yin, 1994, as cited in Bowan, 2009). This was particularly useful in analysing the political arenas of previous governments as documents provided a record of the discourses and events of the times.

Documents can be considered unobtrusive and unaffected by the user (Bowen, 2009; Mason, 2005; Robson, 2002). Whenever possible it is important to consider the particular aim and audience of the document in order to appreciate the perspectives adopted by the author or speaker (McCulloch and Richardson, 2000; Caulley, 1983). For example, Ontario's *Hansard* debates are public records of legislative debates and speakers predominantly debate from their political party positions. Other examples include newspapers that may be more sympathetic to one political party over another, and government documents that are filtered through the communication office to be on message with government priorities. Examining a wide range of documents from different perspectives provided a means of cross-checking data. For example, newspaper articles reporting on an issue were examined and cross-checked with how the issue was presented in government media releases, Ontario's *Hansard* debates and participants' recollections of the issue.

How readily documents are available or accessible can be a limitation. Numerous documents that are poorly stored or filed may make finding the relevant few difficult within time and financial constraints (Bowen, 2009; Mason, 2005). This was not problematic for this study. Research libraries and the Internet, both of which have systematic search strategies, made documents accessible. My years as a practitioner and insider in the science education community were an advantage in that it also provided access to documents, and the knowledge in how to find relevant documents. Once documents were collected, an organisational system was essential to allow for easy retrieval; otherwise much time would be spent looking for data sources. The system that I used is described later in this chapter as it involved not only organising data from documents but also from recordings of interviews and focus groups, their transcriptions, reflexive notes and matrices.

4.4.2 Science curriculum document research instruments

To address the research question as to what changes occurred in each of the science curricula across the four governments, three instruments were developed to organize data for analysing of science curriculum documents that had different formats and structures. One was used to analyse the different components of the documents. The other two were used to examine the science content (knowledge, skills and attitudes). One of these focused on which view of scientific literacy was evident in the curriculum text and was based on Roberts' (2011) notion of two visions of scientific literacy that are discussed in Chapter Two. The third instrument was used to analyse what teachers were expected to teach in science. The following section describes each of these.

Science curriculum components

In order to examine changes in the policy text of each of the science curriculum documents, an instrument was required to compare specific sections or components that provided structure across all science curricula. Klein's (1991) nine elements in her curriculum decision-making framework were modified into eight curriculum components for this instrument. These are: target audience, acknowledgments, goals/purposes, format/structure, content, language, values/ attitudes/ beliefs, and strategies. Target audience was a component as this became significant over time as the audiences of the documents broadened. Similarly an acknowledgements component conveyed how transparent a curriculum was regarding who was involved in its development. Guiding questions were developed for each component and assisted with organising data input (see Appendix C). A matrix was used to input data for each component for each science curriculum document. Matrices are data displays (Miles and Huberman, 1994) and Appendix D is an example of the matrix for the curriculum document *Science is Happening Here* (Ontario. Ministry of Education, 1988i).

Although the final curriculum documents may not reveal the internal debates that occurred during their creation (Pollard *et al.*, 2008), this instrument assisted in analysing science curriculum policy texts to identify possible changes such as the underlying assumptions of the documents and whether they reflected any interest groups. For example, it enabled looking for themes that emerged in the data examining the political arena, and whose interests they represented, with how these were reflected in the science curriculum documents.

Scientific literacy instrument

As discussed in Chapter Two, scientific literacy has been an intended goal for school science since the late 1950s when the term was first introduced by Hurd (1958). To organize data as to how this goal was presented in the curriculum documents, an instrument was developed to determine how scientific literacy was represented. Was it looking inward towards science with a focus on science and scientists or was it looking outward from science with a focus on science in everyday life? These two views are reflective of Roberts' (2011) notion of Vision I and Vision II, with Vision I oriented towards school science to develop scientists, and Vision II oriented towards school science as relevant for everyone. Roberts' (1982) curriculum emphases were used as a source of criteria for each of these as shown in Table 4-3.

Table 4-3 Scientific literacy orientation instrument (based on Roberts, 2011, 1982)

Vision I (more like) - **Looks inward towards science** - **Focus on science and scientists**	**Vision II (more like)** - **Looks outward from science** - **Focus on situations**
Organisation of documents (see curriculum component instrument) • focus is the disciplines of science	Organisation of documents (see curriculum component instrument) • focus is on science-related situations and relevance
Robert's emphases (1982) • structure of science • scientific skill development (processes, inquiry) • correct explanations • solid foundation	Robert's emphases (1982) • everyday coping • self as explainer • science, technology and decisions • (STS-E)
Other • workplace: uses knowledge and scientific way of thinking for workplace	Other • attitudes: appreciate and understand impact of science and technology; take part confidently in discussions with others about issues involving science

Science content was inputted into an MS Excel workbook for each curriculum. Within each workbook, data was inputted into worksheets by course and by grade. A listing of all workbooks can be found in Appendix E. An example of this organisation of data for the Peterson Liberal Grade 10 Basic science curriculum is shown in Figures 4B and 4C. As noted at the beginning of this section, as this is a study on science curriculum policy, the content of the documents in how science is portrayed and what is to be taught is an important part of the analysis to examine the changes in the curriculum policy texts.

Figure 4B Screen shot example of Excel organiser for Vision I scientific literacy, Peterson Liberal *OS:IS Science* Grade 10 Basic science curriculum

	A	B	C	D	E	F
1	**OS:IS Grade 10 Basic**	**Structure of science** (How science functions intellectually in its own growth and development; nature and structure of	**Scientific skill development** (processes and inquiry skills; means (process) rather than end (product))	**Correct explanations** (products (ends) of science; consensus of scientific knowledge by scientists; authority of	**Solid foundation** (scaffolding of knowledge for future understandings)	**Workplace** (science-in-employment emphasis)
2			**Handling equipment** in a safe manner	**Explain** the role of the lens and the cornea of they eye	**Identify** on a diagram or in a sidesection the major structures of the eye, including the lens	The microscope is used in many aspects of **industrial and medical research**.
3			**Manipulating** and caring for a hand lens, a microscope, or a telescope and observing and **recording accurately** what they see with the instrument	**Name** and describe three disfunctions of the eye	**Identify** and describe various crystals, such as salol, salt, alum, and copper sulfate	The microscope is an important tool in **microsurgery**.
4			**Manipulating** lenses and mirrors to produce simple optical instruments	**State** that light travels in straight lines from an emitter to a received, for example, for an object to the eye		
5			**Observing** the stucture of the eye	**Explain** that a light beam is composed of many individual rays that combine to form an image		

Figure 4C Screen shot example of Excel organiser for Vision II scientific literacy, Peterson Liberal *OS:IS Science* Grade 10 Basic science curriculum

	A	B	C	D	E
1	**OS:IS Grade 10 Basic**	**Everyday coping** (Science is an important means for understanding and controlling one's environment; applies principles and generalizations, technology applications)	**Self as explainer** (science as a human endeavour; meta-cognition of own place in world; history of science; focus on student engagement)	**Sci/tech and decision-making** (limits of science in coping with practical affairs; distinguish science from technology; distinguish scitech considerations from value-laden considerations)	**Attitudes/ Appreciation of impact on daily lives**
2		The diagnosis of many diseases and the analysis of blood involve the use of the microscope.	**Describe** some legends of astronomy		A curiosity about the part of the environment that is too small or too far away to be seen with the naked eye.
3		Communication satellites move in orbits around the centre of the earth in the same way that planets move in orbits around the sun.	An appreciation of the scientific knowledge that has led to the development of scientific instruments		
4		Black holes, rocketry, and living in outer space are the topics of many present-day movies.			
5		The use of the microscope during surgery has led to new techniques for saving lives.			
6		Many disease organisms have been identified by means of the microscope.			
		Large amounts of money are spent to build bigger and more			

Science Content Analytical Instrument

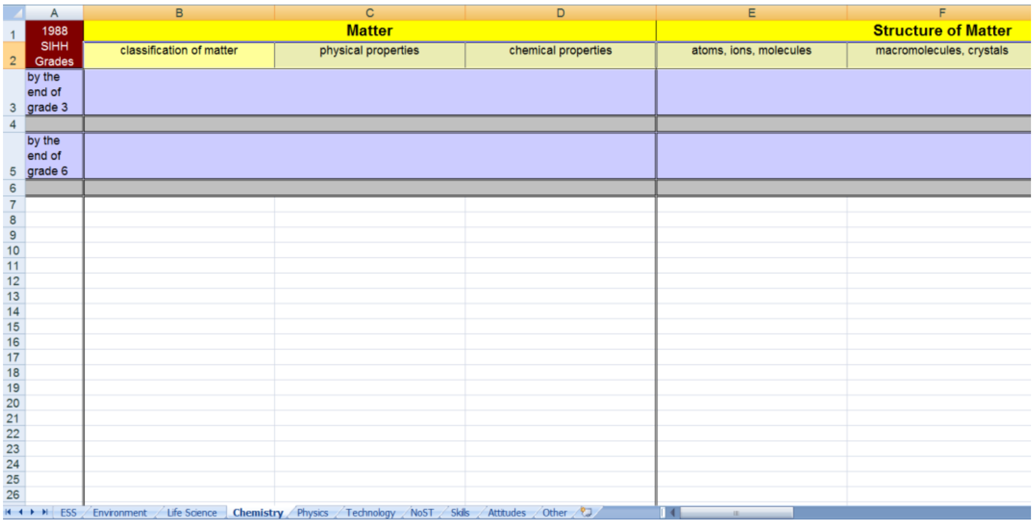
I developed a Science Content Analytical Instrument to compare the knowledge, skills and attitudes of what students were expected to learn in each curriculum. An instrument was needed to answer changes in science content across governments. It provided a common framework to examine and compare science content that was presented in different formats and grade organisers in each science curriculum document. This instrument was based on science content framework categories from three sources: the TIMSS curriculum frameworks for mathematics and science (Robitaille, 1994); the Assessment of Science and Technology Achievement Project (ASAP) (Orpwood and Barnett, 1996); and the *Pan-Canadian Framework of Science Learning Outcomes* (CMEC, 1997).

The initial categories were tested using the content from an elementary and a secondary curriculum document from two different governments (Ontario. Ministry of Education, 2000, 1988i). These categories encompassed the knowledge, skills and attitudes for the elementary curriculum but did not reflect the breadth of secondary science content. This could have been because both TIMSS and ASAP focused on elementary grades. The instrument was revised to add more categories to encompass secondary science content (see Appendix F for categories of the final instrument).

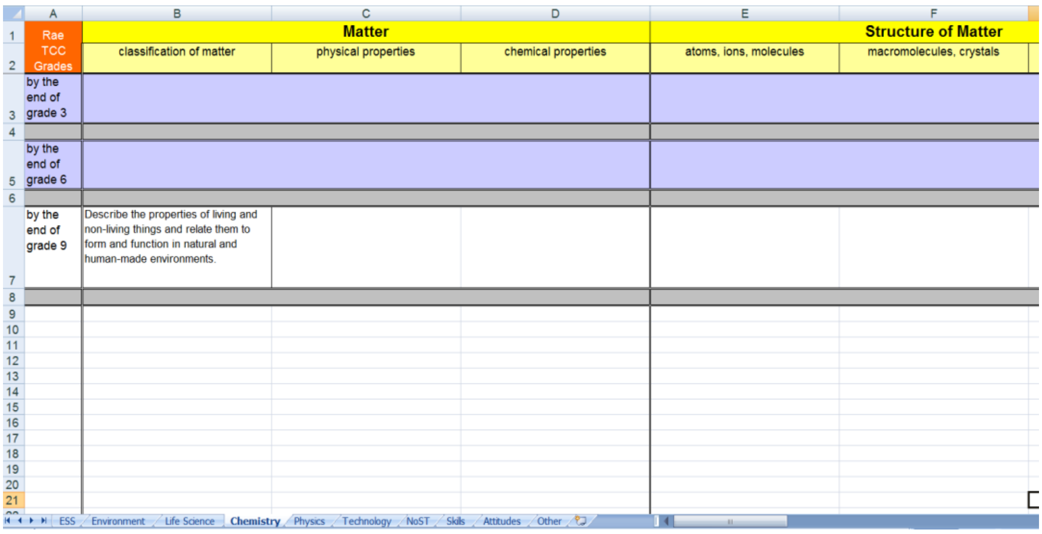
MS Excel workbooks organised these categories by grade and course. Science content was inputted into a relevant category. In situations where the data entry straddled more than one category, it was placed in each one that was relevant as the science content for both was required to teach the learning expectation. These workbooks are too numerous and large to include in this thesis. An example of their organisation is provided in Figure 4D. This shows four screen shots from four different elementary science curriculum documents for part of the chemistry curriculum. This Science Content Analytical Instrument provided a useful means to compare science content across documents. From the examples in Figure 4D, one can see even visually that since 1988, the chemistry content for these categories has significantly changed in terms of specificity. The issue of specificity as related to standards is discussed in the findings for each government in Chapters Five to Eight.

Figure 4D Four screen shot examples of a section of the chemistry science content matrices for four different elementary curriculum documents

Example 1: *Science is Happening Here* (Ontario, Ministry of Education, 1988i)



Example 2: *The Common Curriculum* (Ontario. Ministry of Education and Training, 1995f)



Example 3: *The Ontario Curriculum, Science and Technology Grades 1 to 8* (Ontario. Ministry of Education,1998d)

	A	B	C	D	E	F
1	1998 Harris Grades		Matter			Structure of Matter
2		classification of matter	physical properties	chemical properties	atoms, ions, molecules	macromolecules, crystals
3	1					
4						
5	2		Demonstrate an understanding of the properties of familiar liquids and solids, and of interactions between liquids and between liquids and solids.			
6			Describe the properties of liquids and solids, using their observations.			
7			Distinguish between solids that dissolve in water and solids that do not.			
8			Describe, using their observations, the characteristics of the three states of waters, and identify the conditions that cause changes from one state to another.			
9			Recognize that the states of liquids and solids remain constant in some circumstances, but may change in other circumstances.			
10			Identify reversible changes in materials.			
11			Identify, through observation, various substances that are buoyant, and that can dissolve another substance.			
12			Compare the properties of liquids with those of solids to determine which materials take the shape of their container.			

ESS / Environment / Life Science / **Chemistry** / Physics / Technology / NoST / Skils / Attitudes / Other

Example 4: *The Ontario Curriculum, Science and Technology Grades 1 to 8, Revised* (Ontario. Ministry of Education, 2007c)

	A	B	C	D	E	F
1	McGuinty 2007 Grades		Matter			Structure of Matter
2		classification of matter	physical properties	chemical properties	atoms, ions, molecules	macromolecules, crystals
3	1	Describe objects as things that are made of one or more materials.	Describe the properties of materials that enable the objects and structures made from them to perform their intended function.	Describe the properties of materials that enable the objects and structures made from them to perform their intended function.		
4		Describe materials as the substances from which something is made.				
5						
6	2	Identify objects in the natural and built environment as solids or liquids.	Demonstrate an understanding of the properties of liquids and solids.			
7			Describe the properties of solids and liquids.			
8						
9	3					
10						
11	4					
12						
13	5	Identify matter as everything that has mass and occupies space.	Demonstrate an understanding of the properties of matter, changes of state, and physical and chemical change.	Demonstrate an understanding of the properties of matter, changes of state, and physical and chemical change.		
14			Identify properties of solids, liquids, and gases, and state examples of each.	Identify properties of solids, liquids, and gases, and state examples of each.		
15						

ESS / Environment / Life Science / **Chemistry** / Physics / Technology / NoST / Skils / Attitudes / Other

Deeper analysis of this data is planned for writing articles examining the science content using Cuban's (1992) notion of the historical curriculum in that each curriculum continues to exert influence on successive curricula. Over the past decade there is an increasing body of literature about a growing concern in relation to students' interest in science either as a future career or as an intrinsic interest as a world citizen (Sjøberg and Schreiner, 2010; Jenkins and Pell, 2006; OECD, 2006b; Osborne, Simon & Collins, 2003). Studies report a confusing lack of correlation between students' achievement in school science and their interest in the subject (Ipsos Reid, 2010; Fensham, 2009; OECD, 2006c). Students acknowledge science and technology are important but they are less interested in it personally (Ipsos Reid, 2010; OECD, 2006c). Fensham (2007) has called for an urgency to reconceptualise science education. A deep analysis of what students have been expected to learn in various science curricula since 1985 would contribute to this discussion.

4.4.3 Interviews

Interviews provided an opportunity to gather data from participants who recounted their lived experiences with Ontario science curriculum policy. Literature related to conducting research interviews was reviewed to determine their design (Mason, 2005; Robson, 2002; Cohen, Manion and Morrison, 2000; Seidman, 1998; Kvale, 1996). I used face-to-face semi-structured interviews to gather in-depth information from those who I considered as science curriculum policy influencers and science curriculum policy users. Policy influencers were composed of career and seconded Ministry of Education bureaucrats, policy advisors and curriculum developers. Policy users were teachers and school board consultants who were responsible for implementing the science curriculum policy, and resource developers who used curriculum policy documents to publish textbooks aligned to curriculum intent.

Structured and unstructured interviews were not chosen for this study for the following reasons. Structured interviews have little flexibility in relating the interview to the context of the participants' experiences. They use questions fixed with exact wording and sequencing (Robson, 2002; Cohen, Manion and Morrison, 2000). Unstructured interviews, with no predetermination of questions or sequencing, provide the greatest amount of flexibility. The interview emerges naturally as a conversation from the immediate context of the dialogue between the interviewer and the participant (Mason, 2005; Robson, 2002; Fontana and Frey, 2000; Seidman, 1998; Kvale, 1996). This high degree of flexibility can be challenging when it comes to data analysis (Fontana and Frey, 2000). Having completed my study, I realise that a cohesive system of data analysis can address this concern and I will be more inclined to use unstructured interviews in future studies provided that they are appropriate to the study.

For this study, semi-structured interviews provided a good balance of structure and flexibility (Robson, 2002; Cohen, Manion and Morrison, 2000; Fontana and Frey, 2000). During the interview, predetermined questions were modified based on my perception of what seemed appropriate during a given interview situation. Questions that seemed inappropriate were omitted and additional ones added (Robson, 2002). This flexibility enabled exploration of unexpected areas that arose during the course of the interview. For example, participants recalling events that happened over 20 years ago were reconstructing information partially from memory but also from what they now considered important about past events (Seidman, 1998; Kvale, 1996).

Although flexibility is beneficial, it can result in substantially different responses to questions making comparability of responses challenging (Robson, 2002; Cohen, Manion and Morrison, 2000; Fontana and Frey, 2000). This was addressed by using a data analysis process that coded responses to key words. This process enabled comparability and is discussed later in this chapter.

Sampling

Purposive and snowball sampling identified participants for interviews. Purposive sampling was selected to meet the aims and purpose of the research (Robson, 2002; Cohen, Manion and Morrison, 2000; Kuzel, 1999). A key criterion was for participants to have been involved in some aspect of constructing science curriculum policy documents in Ontario since 1985. This included those who had experience with curriculum writing, leading an aspect of curriculum development, participating in reports that informed curriculum development as requested by the Ministry of Education, or involved in a review process of a curriculum being developed.

My personal knowledge based on 28 years in the Ontario science education community identified key people who had been involved in developing science curriculum. This was an insider-advantage as their names were familiar to me through meetings, curriculum implementation workshops and my involvement in Ontario's science education school board consultants association (SCCAO) and in Ontario's science teachers association (STAO). Their contact information was accessible through my practitioner experiences. Others were identified through document analysis. The Internet was a source of locating their contact information.

Snowball sampling (Robson, 2002; Cohen, Manion and Morrison, 2000; Kuzel, 1999) occurred while interviewing participants, some of whom voluntarily suggested names of people they thought would provide insights to this study. Often the names were ones that I had already identified, thereby supporting my choice of including them in this study. Occasionally new names were mentioned and participants volunteered to provide an introduction by email or by telephone. I did not request or solicit this. I discussed the issue of confidentiality with those who volunteered to contact their friend or colleague to make them aware that how they made this introduction could disclose their own participation in this study.

Twenty-eight interviews were conducted with 29 participants who had various roles in education during the different government time periods. Five of these were resource developers, the remaining 24 were Ontario educators. One interview included two educators who had requested a joint interview. They preferred to be interviewed together to assist their memories of events that had transpired many years ago. I accommodated their request and noted afterwards that the dynamics for this interview were more characteristic of a group interview. As mentioned by Robson (2002) and Fontana and Frey (2000), in a group interview the dialogue is not only with me as the researcher but also between the participants. Interviews were conducted over a two year period at a time and location that was suitable for participants and also for me as I was working full-time while conducting this study (see Appendix G).

The first interview question asked participants to describe their involvement with the Ontario science curriculum. This question revealed the breadth of their experiences across governments, something that I had not initially anticipated. Ontario's science education community is small and those involved in curriculum policy even fewer in number, therefore I became concerned that my initial intention of using one pseudonym for each educator participant could reveal their identity. I discuss this issue further in the section on ethical sensitivity towards the end of this chapter. Consequently, I addressed my commitment to honour the trust of participants to not have their identities revealed as follows. First, I assigned an identifying number for each participant that was interviewed. Educators were differentiated by an 'E' following the number and resource developers by an 'RD'. These are shown in Tables 4-4 and 4-5. For educator participants, whose identities may be revealed through the use of one pseudonym, I organised their experiences according to government time periods and whether they were a policy-maker or a policy-user during that time. A pseudonym was assigned to each participant for each government time period. For example, in Table 4-4, participant 24E was given a pseudonym for her role as a seconded bureaucrat policy-maker for one government, another as a policy-user for a different government for her role as a school board consultant, and yet another as a policy-user for her role as a teacher. In this case, this participant had three pseudonyms – one for each government time period.

The pseudonyms with their identifier for each educator are documented and kept on file but they are not available for public viewing and as such not included in this thesis. This method of preserving anonymity does not affect the integrity of the data or the arguments presented (Wiles *et al*., 2006; Christians, 2003) as I was not analysing the continuity of educator experiences but rather their experiences with

Ontario science curriculum policy-making within each government where they played a role. Table 4-4 summarises the experiences of the educators who were interviewed.

Table 4-4 Ontario science curriculum interview participants (educators)

ID#	Years in Ontario education (to 2008)	Role in science curriculum policy-making	Curriculum policy user experiences	Experience with governments' science curricula
1E	over 30	• School board consultant: Curriculum reviewer (secondary)	• Secondary school science teacher • School board secondary school science consultant • School board resource developer (second generation science curriculum documents)	• (PCs pre-1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)
2E	over 30	• Ministry of Education bureaucrat (seconded staff - secondary) • Involved in OAC-TIP and SAIP	• Secondary science teacher • School board elementary and secondary science consultant	• (PCs pre-1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)
3E	21-25	• Teacher: Curriculum developer (secondary) • Ministry of Education bureaucrat (permanent staff - secondary) • Involved in OAC-TIP	• Secondary science teacher	• (PCs pre-1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*)
4E	over 30	• School board consultant: Curriculum reviewer (secondary)	• Secondary high school teacher • School board elementary and secondary science consultant • School board resource developer (second generation science curriculum documents)	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*)
5E	over 30	• School board consultant: Curriculum reviewer (secondary)	• Secondary high school teacher • School board elementary and secondary science consultant • School board resource developer	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)

			(second generation science curriculum documents) • Writer for elementary science resources	
6E	26-30	• School board consultant: Curriculum developer (secondary) • School board consultant: Curriculum reviewer (elementary and secondary)	• Secondary science teacher • School board elementary and secondary science consultant • School board resource developer (second generation science curriculum documents)	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
7E	10-15	• School board consultant: Curriculum reviewer (elementary)	• Elementary science teacher • School board elementary science consultant • School board resource developer (second generation elementary science curriculum documents)	• (PCs pre-1985) • Peterson Liberals (*SiHH*)
8E	over 30	• School board consultant: Curriculum developer (elementary)	• Elementary science teacher • School board elementary science consultant	• (PCs pre -1985) • Peterson Liberals (*SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)
9E	21-25	• Ministry of Education (seconded staff – senior position, elementary and secondary)	• Secondary teacher • School board secondary curriculum consultant • School board senior administration	• (PCs pre-1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003) (*TOC*)
10E	over 30	• Ministry of Education bureaucrat (seconded staff – elementary and secondary) • Involved in OAIP and OAC-TIP	• Secondary science teacher • Senior school board administrator	• (PCs pre 1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (*1995-2003: TOC*)
11E	16-20	• Ministry of Education policy advisor, elementary • Project manager: Curriculum developer (elementary and secondary)		• Peterson Liberals (*SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)

12E	16-20	• Teacher: Curriculum developer (secondary)	• Secondary science teacher • School board secondary science consultant • School board resource developer (second generation science curriculum documents)	• (PCs pre 1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
13E	6-10	• Teacher: Curriculum developer (secondary)	• Secondary science teacher	• PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
14E	6-10	• Liberal Party policy advisor (education portfolio)	• N/A	• (pre-1985 Liberal Party policy advisor) • Peterson Liberals (*OS:IS, SiHH*)
15E	10-15	• Teacher: Curriculum developer (elementary) • Teacher: Curriculum reviewer (elementary)	• Elementary science teacher • School board elementary science consultant	• NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
16E	6-10	• Ministry of Education bureaucrat (permanent staff – senior position, elementary) • Involved in *Pan-Canadian science*	• N/A	• NDP (*TCC*) • PCs (1995-2003: *TOC*)
17E	26-30	• Teacher: Curriculum developer (secondary) • Teacher: Curriculum reviewer (secondary)	• Secondary school science teacher • Writer for secondary science resources	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
18E	21-25	• Ministry of Education bureaucrat (permanent staff – elementary and secondary) • Involved in *Pan Canadian science*	• Secondary school science teacher	• Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
19E	26-30	• Teacher: Curriculum developer (secondary) • Teacher: Curriculum reviewer (secondary)	• Secondary science teacher	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)

20E	21-25	• Ministry of Education (seconded staff – senior position, elementary and secondary)	• Secondary teacher • Senior school board administrator	• (PCs pre-1985) • Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*)
21E	21-25	• Ministry of Education bureaucrat (permanent staff – elementary and secondary)	• Elementary teacher	• Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*)
22E	over 30	• Ministry of Education bureaucrat (seconded staff - elementary)	• Elementary science teacher • Secondary science teacher • School board elementary science consultant • School board resource developer (second generation science curriculum documents)	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
23E	21-25	• Ministry of Education bureaucrat (seconded staff - elementary) • Involved in Ministry of Education exemplars project • School board consultant: Curriculum reviewer (elementary)	• Elementary teacher • School board elementary consultant	• Peterson Liberals (*SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
24E	21-25	• Ministry of Education bureaucrat (seconded staff - secondary)	• Elementary science teacher • Secondary science teacher • School board secondary science consultant • School board resource developer (second generation science curriculum documents)	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)

As mentioned above, in addition to the educator participants, I also interviewed five resource developers of science textbooks that were based on Ontario's science curriculum policy documents. I knew from my personal experiences of having previously worked for a publisher that the perceptions of resource developers provide a different perspective of curriculum users than educators. I had initially intended to conduct a focus group of resource developers but I failed to account for the highly competitive nature of the resource development industry, particularly as Ontario had just released new science curricula for implementation. After inviting their participation to be part of a focus group for this study, one resource developer commented that he would be more inclined to participate in an individual interview. I modified the research design and re-invited five resource developers to participate in individual interviews. All agreed. This was a more suitable method to explore their perceptions. In a focus group competitiveness could influence their responses or lead to a withholding of important information (Robson, 2002; Cohen, Manion and Morrison, 2000; Kruegar and Casey, 2000). Table 4-5 summarizes information about the gender and the science curriculum resources and governments' science curricula that these resource developers had experience developing. Included are their pseudonyms that are used in Chapters Five to Eight. The issue of using one pseudonym for each resource developer was less concerning as all had the same role across governments. Therefore I was able to assign one pseudonym to one resource developer without the same concern that their identities could be revealed.

Table 4.5 Ontario science curriculum resource developer interview participants

Pseudonym (ID#)	Gender	Elementary Science Resources	Secondary Science Resources	Experience with governments' science curricula
James (25RD)	Male	• N/A	• Grade 9 Science • Grade 10 Science • Grade 11 Biology • Grade 12 Biology	• Peterson Liberals (*OS:IS*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Ken (26RD)	Male	• Elementary Science and Technology (all grades)	• N/A	• PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Nancy (27RD)	Female	• Grade 7 Science • Grade 8 Science • Grade 7 Science and Technology • Grade 8 Science and Technology	• Grade 9 Science • Grade 10 Science • Grade 11 Biology, Chemistry, Physics • Grade 12 Biology, Chemistry, Physics	• Peterson Liberals (*OS:IS*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Rick (28RD)	Male	• Grade 7 Science and Technology • Grade 8 Science and Technology	• Grade 9 Science • Grade 10 Science • Grade 11 Biology, Chemistry	• PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Zack (29RD)	Male	• Grade 7 Science and Technology • Grade 8 Science and Technology	• Grade 9 Science • Grade 10 Science	• NDP (*TCC – Grade 9*) • PCs (1995-2003) (*TOC, Grades 7 to 10*)

Conducting interviews

Participants were contacted personally, predominantly through email. A one-page summary was sent to them to provide an overview of the purpose, aims and objectives of the study (see Appendix H). After a participant agreed to be interviewed, follow-up emails arranged for a suitable date, time and location for the interview and a copy of the Participant Consent Form was sent (see Appendix I). This enabled a participant to have time to review the form before we met. No participant was interviewed without signing a consent form. All participants readily agreed to sign the form.

A Semi-Structured Interview Guide was used to conduct interviews (see Appendix J). The questions were open-ended and distinct from each other although still related to each other. This provided participants with an opportunity to retell aspects of their experiences from different perspectives. It also provided a check to see if the information recounted was consistent. Inconsistencies in the recollections of the participants was flagged and probed deeper to gain clarification. Each question was coded to the research question that it addressed for later analysis using key words. The intent at this point was to ensure data was being collected encompassing all questions. Prompts and probes were included for each question in the guide as well as the relevance of the question to this study (Robson, 2002; Cohen, Manion and Morrison, 2000; Fontana and Frey, 2000; Seidman, 1998; Kvale, 1996).

Interviews were recorded digitally with participants having the option of refusal. The digital recorder was always placed in clear view and participants were notified prior to my turning it on, giving them the opportunity to rethink their decision. All agreed to have the interview recorded, although in two instances participants requested the recording be stopped for a brief period as they specified the information they were about to convey was to be kept confidential and not recorded. In two other interviews, participants requested some parts of the recording not be transcribed although I could keep the recorder running. In terms of conducting the interviews, in these four cases, participants deemed the information was acceptable for me to hear but not to transcribe or to be part of the official record of data. These were personally uncomfortable moments for me in my dual roles as insider to the community but outsider as researcher. It was also difficult to put aside what was spoken (Marshall and Rossman, 2011; Walford, 2005; Kvale, 1996; Ball, 1990b). I honoured participants' request not to transcribe the information that they wanted to remain confidential. This ethical consideration is discussed in more detail later in this chapter. I did not use this information for any cross-checking of data although it was not erased from my mind. (Walford, 2005; Kvale, 1996; Ball, 1994). In future interviews, should this request occur, I would let the participant know that it is difficult to objectively remove myself from what was said even if it is not transcribed. This would give them the opportunity to rethink what they wished to say and be aware that off-the-record comments still add to the general context of the event or situation being described.

Interviews ranged from 45 minutes to one of two-and-a-half hours (2½), the latter being an extreme case as the interview was held over lunch with a participant who had deep roots in Ontario's science education community for all of the time periods that I was examining. The majority of interviews were between one and a quarter (1¼) and one and a half (1½) hours long. See Appendix G for a summary of the length of each interview.

The following research guidelines were followed when conducting interviews: acceptance cues such as nodding my head to indicate understanding and interest in what participants were saying; comfortable seating allowing for an attentive posture and eye contact; listening more and talking less; following-up with prompts to probe deeper; re-stating parts of participants' comments for clarification thereby giving them the opportunity to confirm my understanding of the situation as well as expand or elaborate on what they were saying; avoiding leading questions that did not permit participants to reveal their own perspectives; and, avoiding interruptions (Robson, 2002; Seidman, 1998; Kvale, 1996).

Immediately, after each interview, I recorded my personal observations about the setting and interactions between myself and the participant. This included comments about any uncomfortable situations for myself as a researcher or as a member of the Ontario science education community as shown in the examples in Table 4-6. The reflexive notes in this table are taken from three separate interviews with three different participant-researcher relationships.

Table 4-6 Reflexive post-interview notes

Participant-researcher Relationship	Reflexive notes
Interview 1E (August 2006): • a colleague whom I have known for several years within the Ontario science education community and share some curriculum implementation experiences	• I need to watch against offering my perspectives especially when I have had direct experiences with what the participant is discussing. • I realize that there are science educators in Ontario who span many governments and science curricula. They can provide insights through their various roles as science teacher and then board curriculum leader or consultant. I should map the experiences of participants and their roles related to each curriculum. This could be interesting to cross-reference in regard to how they spoke about the various curricula.
Interview 2E (September 2006): • a colleague whom I have worked with and who has always been supportive of my career over the years	• When the formal interview began, the participant seemed somewhat nervous initially (could this possibly be attributed to different role of me as researcher); will this be evident on the recording in tone of voice?
Interview 10E (January 2007): • a participant where we both know of each other but have never worked together	• An issue that causes me concern is how to not have a participant identified even if pseudonyms are used since it is a relatively small community and even smaller when interviewing government representatives; I need to give some consideration as to how to classify participants so that comments can be used without readers of the study being able to identify who said what.

These notes helped to improve my interviewing technique. After listening to the first two interviews, I became aware of instances where I had to consciously restrain myself from contributing to the interview as a conversation rather than allowing the participants' recollections to unfold as they remembered their experiences. In the analysis of the interview data, I examined transcripts for instances where my relationship with participants contributed to leading the participants' responses. Data that could be interpreted as me 'leading' the interview was identified and as suggested by Kvale (1996) notes were made as to how this might or might not affect data integrity.

Each interview was taped and the recordings transcribed in full. Transcripts do not include non-verbal behaviour unless there was a motion emphasizing a point a participant was making, for example, pounding fist on table. Short pauses are noted by (…) and interruptions by //. Words or phrases that were spoken louder for emphasis or effect are underlined. Punctuation was added to be as faithful to the delivery of the dialogue and to make the text more legible and intelligible to the reader (Mason, 2005). An example of a transcribed interview is included in Appendix K. For this example, text that could identify the participant is noted by (***) but remains in the original. Recordings and of full transcripts are securely stored in both digital and hard-copy formats. Transcribing interviews using determined protocols was a means to analyse data in a form more amenable than working from taped recordings. The transcribing process in itself provided an initial analytical process (Kvale, 1996).

As mentioned above, with one exception, interviews were conducted on an individual basis. It is difficult to ascertain how a description of events by the interview with these two participants was influenced by each other's interactions and how these might have been different had each been interviewed on their own. An example is shown in Table 4-7 where 4E and 5E represent each of the two participants and their recollections were prompted by each others' account. As with other interviews, triangulation was used to cross-check participants' recollections with data from other sources.

Table 4-7 Excerpts from two-participant interview (September 2006)

4E	But Jack Bell [Ministry Education Officer in the 1980s] always figures in my mind in that he would come out to the Board talking about//
5E	We had him come to [science department] head's meetings//
4E	That's right, talking about curriculum changes and suffering the slings and arrows from the teachers.
5E	I can still remember Jack getting incensed over our physics heads [lead teachers]. We would invite our biology, chemistry and physics heads and he was the only person from the Ministry. Do you remember the battles we had when they decided that the grade 9 teachers would teach physics and some biology?
4E	Oh yeah.
5E	And the physics people would just almost nail him to the wall and he wanted//
4E	That was about the beginning of the mosaic curriculum for science.
5E	Yeah. That was the start of it and of us having some influence with the Ministry in developing the newer curricula.

Conducting interviews can be time-consuming to arrange. There is also a risk that the researcher's biases can control the conditions under which the questions are answered, including the setting and timing, and the tone used in asking questions and responding (Robson, 2002; Kvale, 1996; Ball, 1990b). Using a digital recorder enabled me to listen to the interviews multiple times and reflect on my skills as an interview-researcher and on the setting. Reflexive notes recorded my observations and impressions of each interview. These helped to examine how my interactions with a participant may have affected the interview (Bolton, 2010).

Each transcribed interview was prefaced by a description of the interview setting and a chart summarizing the participant's experiences in Ontario science curriculum as well as any relationships between myself and the participant. Relationships were categorized as to whether the participant was a colleague, an acquaintance (we have met but not worked together), knew of me (we have never met or worked together) or unknown (neither knew me nor I knew them). For relationships where I knew the person or the person knew of me, the nature of the relationship was identified. This information made me cognizant of how relationships may influence the data and subsequent analysis. The length of each interview was also recorded. This lends itself to further analysis for a journal article about relationships and interviews.

4.4.4 Focus group interviews

Focus group interviews gather data about people's perceptions of events or situations (Kruegar and Casey, 2000). They can encompass both group interviewing and focus groups although these terms are often used interchangeably (Robson, 2002). Focus group interviews for this study were informed by Robson (2002), Cohen, Manion and Morrison (2000), Kruegar and Casey (2000) and Lewis (2000). Focus groups were an appropriate method to gather insights, responses and opinions of users of the science curriculum policy documents. Unlike individual interviews, focus groups are structured small group interviews that emphasize the collective rather than the individual (Robson, 2002; Cohen, Manion and Morrison, 2000; Lewis, 2000). The purpose was to hear a range of perceptions rather than achieve consensus; however, the original intent did not come to fruition as planned. Arranging and conducting focus groups proved to be more challenging to organise and is described in the following section.

Sampling

A key criterion for identifying focus group participants was that they had experience using some or all of the science curriculum documents from 1985 to 2008. Initially this included teachers, consultants, coordinators and resource developers. As mentioned in the previous section, I modified the design and interviewed resource developers individually.

Initially eight focus groups were planned: three with elementary teachers, three with secondary teachers, one for consultants and coordinators and, originally, one for resource developers. Aside from changing resource developers to individual interviews, getting a sufficient sample of participants for the other focus groups was challenging. Several attempts with requests to professional teaching organisations and through a large school board failed to provide the planned sample. In the end only three focus groups were arranged. Interested participants were asked to complete an information form (see Appendix L) for demographic information on their teaching experience with the various science curricula as well as any involvement in developing curricula or implementing it at the school board level.

Of the three focus groups only two were conducted. One focus group had three participants and the other group had four participants. No one came to the third group which was to have been a combination of five elementary and secondary teachers who had expressed interest in participating. Only one emailed regrets ahead of time. The date for this group was towards the end of the school year and after the school day which may account for the lack of attendance.

Table 4-8 summarises information about the focus group participants' gender, years of experience in Ontario education, roles in Ontario education, curriculum experience as a user and implementer. Included is the pseudonym that was chosen by me and used in Chapters Five to Eight. I was not concerned that assigning a pseudonym for each focus group participant for all four government time periods would compromise their identity as there are many science teachers and school board science consultants across Ontario.

Table 4-8 Focus group participant information

Pseudonym (ID#)	Gender	Ontario education experience to 2008	Summary of roles as an Ontario educator	Experience with governments' science curricula
Daniel (FG-1a)	Male	31 years	• Secondary school science teacher • School board elementary and secondary science consultant • Member of SCCAO and STAO • Developer of a school board's secondary generation curriculum documents for elementary and high school science • Writer for high school science textbooks	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Evelyn (FG-1b)	Female	28 years	• Secondary school science teacher • School board secondary science consultant (1 year) • Member of SCCAO and STAO	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)

Felicia (FG-1c)	Female	16 years	• Secondary school science teacher	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Grant (FG-2d)	Male	25 years	• Elementary school teacher (all subjects) • School board elementary science consultant • Member of SCCAO and STAO • A developer of a school board's secondary generation curriculum documents for elementary science • Worked on Ministry of Education exemplars project for elementary science and technology	• (PCs pre-1985) • Peterson Liberals (*SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Harriet (FG-2e)	Female	12 years	• Secondary school science teacher • School board secondary science consultant • Member of SCCAO	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals
Ian (FG-2f)	Male	35 years	• Elementary school science teacher • Secondary school science teacher • School administrator • School board elementary and secondary science consultant • Member of SCCAO	• (PCs pre-1985) • Peterson Liberals (*OS:IS, SiHH*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)
Julia (FG-2g)	Female	18 years	• Secondary school science teacher • School board secondary science consultant • Member of SCCAO • A developer of a school board's secondary generation curriculum documents for high school science	• Peterson Liberals (*OS:IS*) • NDP (*TCC*) • PCs (1995-2003: *TOC*) • McGuinty Liberals (*TOC-R*)

As their experiences spanned across different government time periods, participants' recollections included their perspectives based on their various roles for the different government curricula; for example, as a classroom teacher for some time periods and as a school board consultant for other time periods. An interesting perspective was brought forward by one participant who remembered *OS:IS Science* curriculum as a student!

With the number of participants for the focus group not materializing in a timely manner, I used alternative methods to provide sufficient data for insights into the perception of the Ontario science curriculum documents. Some individual interviews provided insights in that some participants were involved in science curriculum policy for one government and users of the documents for another. Newspaper articles, Ontario *Hansard* and reports by professional teacher organisations became alternative sources of data.

Conducting focus groups

As with interviews, participants were contacted by email. They were sent a one-page summary of the study as well as the ethics consent form to review, sign and bring to the focus group (see Appendix M). Similar to interviews, focus groups can be time-consuming to arrange but even more so in trying to coordinate availability of multiple participants and arrange a suitable location that is most convenient for everyone (Robson, 2002; Cohen, Manion and Morrison, 2000; Kruegar and Casey, 2000). Two focus groups were conducted at a school board meeting room and the other in a hotel meeting room with good highway access for those would be travelling some distance. Both locations were selected to be convenient to those who would be participating.

The Focus Group Question Guide was used to conduct the sessions (see Appendix N). The introductory question was designed to make participants comfortable to talk with each other and to connect themselves with the study. The three questions that followed explored the perception of science curriculum users. The final question was open-ended for participants to reflect on what had been said and to provide an opportunity to add any critical aspects that they thought may have been overlooked (Robson, 2002; Kruegar and Casey, 2000). As with the Interview Guide, each question was coded to the research question that it addressed. Prompts and probes were included as well as the relevance of each question to this study.

A major challenge facilitating focus group sessions was to ensure that all participants had their voices heard. I did not need to manage conflicts that could have arisen between personalities and reduce power struggles that could have detracted from the data collection (Robinson, 1999 cited in Robson, 2002, p.285). As challenging as focus groups were to arrange, conducting them was less so. The setting was collegial as evidenced by good participation by everyone throughout the discussions. I was sensitive to visual and auditory cues of withdrawal or involuntary participation by some participants or dominance by others (Robson, 2002; Kruegar and Casey, 2000). Because of the small number of participants in each group, it was possible to find a balance between keeping the discussion open-ended and to the point (Cohen, Manion and Morrison, 2000).

Transcribing focus group recordings was more challenging than individual interview recordings because of the need to differentiate between different voices and deciphering what was being said when several participants were speaking at the same time (Robson, 2002). As my groups were small, it was not difficult to distinguish the different voices.

4.5 Data organisation

Organising and managing data turns collected data into a resource for analysis and this requires a system to locate information easily (Mason, 2005; Miles and Huberman, 1994). An invaluable organisation strategy was colour-coding each government time period. Colours were deliberately chosen to reflect the main colours of the political parties as these were familiar to me. Print documents were stored in colour-coded binders labelled by government timeframes. For example, newspaper articles were stored chronologically by year in three-ring binders labelled by government. Monthly tabs were used as a sub-organiser for years that had large numbers of articles, particularly from the mid 1980s to the end of the 1990s. Electronic documents were saved in folders organised by source such as the Ontario *Hansard*, committee reports, government memos and further organized into subfolders according to government and the relevant parliament session. A freeware application called *Rainbow Folders* (Chodzinski, 2008) was used to colour code electronic folders using the same designated government time periods. This provided a visual system to easily locate both print and electronic data throughout duration of the study.

For transcribed data, each speech segment was numbered along with an alphabetic identifier for the participant and included any notes made about that segment. This system enabled me to tag data to its original source when it was inputted into data analysis matrices. This allowed for cross-checks to minimize misrepresentation

(Mason, 2005; Miles and Huberman, 1994). Being able to track data back to its original source provided a means to re-examine it within the context within which it was discussed. Since most interviews transcended different government time periods, transcribed text was colour-coded to the government time periods for visual recognition.

Data from participants that were of a personal nature or that were requested to be kept confidential were not analysed although what was stated remained in my mind (Walford, 2005). Data from participants that did not directly or indirectly relate to a specific government time period were stored in a separate file for later analysis. These data were predominantly related to comments by participants who had various roles across several governments and experiences with different science curriculum documents. They were commenting holistically rather than specifically to one government. These data - using a new colour to differentiate them from specific government time periods- were examined after the analysis of each government time period. They supported overarching themes, patterns and trends that emerged. I did not use any colour code for data that were not directly related to the research questions but might be valuable. If data had been discarded at this early point, opportunities for analysis may have been missed.

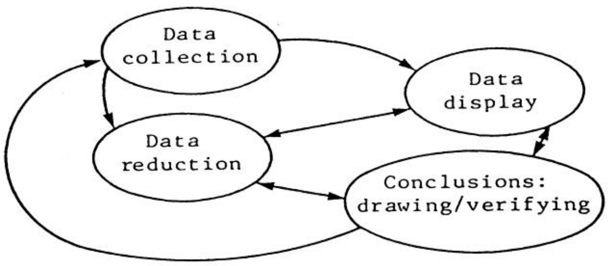
This iterative process of examining data provided an overview for each of the government time periods, an assessment if sufficient data was collected and an opportunity to assess if any of the questions required different methods or better sampling procedures. It provided a means of organising data for further analysis.

4.6 Data analysis

Mason (2005, p.147) commented that one of the merits of using a qualitative approach is the generation of data that can occur but it can also become 'less clear about what can be done with the 'products''. This section describes the systematic approach that turned large amounts of qualitative data into a resource that could be analysed and interpreted resulting in the findings of this study.

Data analysis was based on three concurrent interconnected components as suggested by Miles and Huberman (1994) and illustrated in Figure 4E. These components are data reduction, data displays, and the drawing and verification of conclusions. Analysis involved an iterative process that was grounded on the basis of an ongoing interpretation of collected data (Mason, 2005; Miles and Huberman, 1994).

Figure 4E Interactive model of data analysis components (Miles and Huberman, 1994, p.12)



The analytical practices used for this study followed a common set of sequential procedures: affixing codes to gathered data; noting reflections or other remarks; identifying similar phases, patterns themes, differences between sub groups; isolating patterns and processes, commonalities and differences; elaborating a small set of generalizations that cover the consistencies emerging from the data; and confronting generalizations with a formalized body of knowledge in the form of constructs or theories (Miles and Huberman, 1994, p.9).

Mason (2005) suggested that there are three levels of reading data: literal, interpretive, and reflexive. She commented that many qualitative researchers read their data on all three levels and indeed I found this to be the case for my study. A literal reading of data highlighted the words and language used by actors who had influenced science curriculum policy. An interpretive reading was important to think more deeply about what the data represented and what could be inferred. A reflexive reading was critical because of my practitioner experiences of conducting research within a community where I knew many of the actors or they knew of me. Journal notes and recorded personal reflections provided insights into personal experiences.

Additional questions adapted from Vidovich (2001), and presented earlier in this chapter in Table 4.2, provided further structure for data analysis at macro, meso and micro levels. This provided a means to systematically identify data around issues, actors, topics, information, examples and themes, and remain aligned to the research questions informing this study.

These sub-questions were organised into a matrix for each government time period using MS Excel worksheets. Data from participants and documents were examined, identified and categorised according to which question they addressed within a government time period. Data that transcended individual governments were entered into a general matrix and data that did not directly relate to the questions was categorized as ‘other’. These two data sets were initially set aside and revisited later in the study. They either confirmed patterns and themes such as an increased emphasis of accountability that emerged from the data or identified other considerations such as the influence of the government’s communications department in the science curriculum documents and their release.

Notes were made on emerging patterns, themes, actors and observations and organised into another matrix. One file was developed for each government time period. Each file was subdivided into specific Excel worksheets based on themes that emerged from the data (see Appendix O for sample matrices). I merged the Liberal-NDP Accord and Peterson government time periods into one time period when it became evident in reading documents and secondary sources that the Peterson Liberals were directing education reforms and curriculum development (Speirs, 1986; Peterson, 1985a).

This process systematically involved data reduction and created visual formats facilitating making informed conclusions to be drawn (Miles and Huberman, 1994). As themes emerged, an iterative process of simultaneously reviewing the literature and consulting with my supervisors allowed for deeper explanations. This moved analysis beyond descriptive summaries to explore explanations and develop a conceptual and analytical understanding grounded empirically in the data. Assumptions that I had about the different curricula and different governments were challenged through the findings. As my data highlighted, curriculum policy is indeed complex and messy and not immune to the political and economic landscapes that surround its development.

4.7 Validity and reliability

When I began my study, I considered validity and reliability from a positivist perspective as 'the researcher's goal' (Morse and Richards, 2002, p.168 cited in Marshall and Rossman, 2011, p.41). I understood the concept of validity as being whether the findings are meaningful representations of the data, and the concept of reliability as having consistency in the results of a research study so that whenever the research is conducted again, the same results would be produced. I was familiar with these concepts as they related to quantitative studies in the biological and physical sciences. This ignored the subjective interpretation of qualitative methods and my own place in the research setting. Through my study and as I gained familiarity with my data and an understanding of qualitative research, I found that alternative constructs were more applicable such as those suggested by Marshall and Rossman (2011), Robson (2002), Cohen, Manion and Morrison (2000), Seale (1999), Hammersley and Atkinson (1995) and Lincoln and Guba (1985). I will focus on the construct of validity as I agree with Cohen, Manion and Morrison (2000) that validity is an important construct to effective research and without it the research is meaningless. It can determine whether the findings are accurate from the perspective of the researcher, reader or participants in how the findings are interpreted (Creswell, 2003). Regarding reliability, I am aware that a different researcher with different relationships, responding differently, asking different questions and prompting different replies may unfold a different story. The intent is not to strive for uniformity but an acknowledgement that in qualitative research reliability can be viewed as a 'fit' between what is recorded as data and what actually occurs in the research setting (Cohen, Manion and Morrison, 2000, p.119).

Validity is a major area of discussion in qualitative studies (Denzin and Lincoln, 2000; Maxwell, 1996; Lincoln and Guba, 1985) as evidenced by the terms in the literature related to this concept such as trustworthiness, authenticity, and credibility (Gergen and Gergen, 2003; Creswell and Miller, 2000). This made me rethink my notion of validity and how it related to my study. For me, at the core of these debates is whether there is sufficient data to support the claims that I make in my findings. My approach towards addressing validity drew from Robson's (2002, p.170) suggestion that consideration should be given to the threats to validity, and from Cohen, Manion and Morrison's (2000) suggestion that in qualitative research, one strives to minimize invalidity and maximise validity. I addressed these considerations beginning with Maxwell's (1996) emphasis on the importance of identifying threats to validity as part of the research design as follows.

From the onset of this study, my design (see Appendix A) took into consideration the methods, sources of data and their purpose. This assisted the gathering of data from multiple sources for each government time period to address data completeness. An iterative process throughout conducting this study monitored credibility of data and plausible interpretations of the findings. Throughout this process, literature was reviewed and incorporated as another source of data whenever relevant.

The strategy of triangulation was used to cross-check participants' recollections and data from documents (Marshall and Rossman, 2011; Mason, 2005; Robson, 2002; Cohen, Manion and Morrison, 2000; Flick, 1998). As this study has an extensive array of data from documents and participant interviews and focus groups multiple sources helped to confirm or refute interpretations. This developed a comprehensive story of Ontario science curriculum policy within a government and across governments. I was not striving for a single reality or seeking generalisation to extrapolate my findings from a specific sample to the wider population. My aim was for theoretical generalisability meaning that findings may have meaning or relevance if applied to other contexts and further studies in curriculum policy.

Another consideration to maximise validity was to provide an audit trail as to what was done and why (Robson, 2002; Lincoln and Guba, 1985). My systems of data organisation and data analysis outlined earlier in this chapter provided a comprehensive record of my research. This enabled an iterative process that helped to identify data that may have initially seemed disconnected to this study but actually became significant as part of emerging patterns and trends. For example, legislated education reforms acts that on first glance did not seem to be directly related to curriculum, ended up providing rich contexts to understand the political arenas within which science curriculum policy was constructed.

Maxwell (1996) suggested that a main threat to data interpretation is imposing one's own framework and meanings rather than listening to the participant's meaning. From the very beginning and throughout this study I was very conscious of this threat. As an insider in the Ontario science education community, there was the possibility that I could interpret participants' experiences through my own personal experiences. To minimize this threat, as illustrated in Table 4-6, I analysed interviews and focus group transcripts through a self-critique of my research techniques and by identifying any insider-outsider issues that might have arisen if the participant and myself had shared collegial experiences. Another example is presented in a later section about reflexivity.

4.8 Ethical sensitivity

As mentioned at the beginning of this chapter, ethical considerations and protocols were considered from the onset of the research design as shown in Appendix A. These were informed by both the British Educational Research Association (BERA) *Revised ethical guidelines for educational research* (BERA, 2004) and the Canadian *Tri-Council policy statement on Ethical conduct for research involving humans* (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada, 2003). I draw upon this for further discussion in this section.

As I learned while conducting my study, a research design does not account for all of the complexities that can arise during the course of this enquiry. When I began my study, I thought that an informed consent form, along with using pseudonyms and promising confidentiality would protect participants' identities. Lincoln and Guba (1985, p.370) warn that 'The virtual impossibility of writing a foolproof report should be humbling to the inquirer who glibly promises protection without appreciating the full implications of the promise.' Signing an informed consent form indicates a trust relationship between those who have agreed to be interviewed and the researcher. For my study, participants were informed in advance about the purpose, aims and expected benefits of the study. They were told that at any time, they could discontinue their participation in the research without prejudice. Information from interviews was treated with confidentiality and I felt that by using pseudonyms that I would be able to prevent data from being linked to specific individuals. As participants' stories were told and findings emerged, I realized just allocating one pseudonym to a participant might not be adequate for the following reason. Readers of this study from Ontario's science education community might recognise who participated since they have their own knowledge of who has been involved in developing science curricula. Those who know the Ontario science education community may be able to connect participants' experiences by quotes attributed to their roles during the government time periods. Walford (2005) suggested that giving anonymity through pseudonyms is ethically questionable if it cannot be maintained. I wanted to honour the trust participants gave me in signing the ethics consent form and minimise having their identities revealed.

One solution could have been to not include quotes from participants in the findings nor reference their roles. This was not acceptable for me, as selected quotes reinforced the arguments being made in this study, and by not including the role of who said it, this could raise questions as to the validity of the quote (Wiles *et al.*, 2006). As mentioned earlier, to address this ethical dilemma, I assigned a different pseudonym to an educator for each government time period rather than using one pseudonym for each educator across governments. This method of disguising identity did not affect the integrity of the data or the arguments presented (Wiles *et al.*, 2006; Christians, 2003). As stated in the section about interviews, I was not examining the continuity of participants' experiences across governments but rather analysing their experiences with Ontario science curriculum policy-making within each government where they played a role.

I began this chapter with a discussion about my researcher's self and am bringing it forward again in this section as an issue of ethical sensitivity and personal challenge in relation to my roles as both an active member of the science education community and being a researcher within this community. In my role as researcher, I was an outsider within my professional practitioner community as my researcher's role took priority (Hammersley and Atkinson, 1995; Miles and Huberman, 1994; Razavi, 1992). For example, during the course of an interview some participants suggested names of people that I should contact. I made note of this without indicating whether or not I had already been in contact with that individual. It was up to the individuals who had chosen to participate in the study to decide whether or not they wished to acknowledge that they had been part of it. On two occasions I was directly asked if a specific person had participated in my study. I responded that I could not answer the question as not identifying participants' names was important to the ethics of the study. This is connected to the issue of confidentiality mentioned above. My response was accepted and not pursued by the individuals who asked the question. However, at that moment, I was keenly aware that my priority in responding was as an outsider to my professional community in my role as a researcher and reflected the continually negotiated insider-outsider relationships (Jewkes and Lethby, 2001; Razavi, 1992).

4.9 Reflexivity

Reflexivity examines the researcher's identity, background and experiences and the impact of these on the research process (Marshall and Rossman, 2011; Mason, 2005; Robson, 2002; Colombo, 2003; Breuer, Mruck and Roth, 2002; Ball, 1990b). I made reflexive notes and digital recordings describing interview and focus group settings, relationships and interactions with participants, and personal reflections on my roles as an actor in Ontario science education. These were an indispensable part of this study because of my personal experiences with the research setting, my familiarity of participants who were interviewed and the choice of study. Recording my thoughts, emotions and reactions provided insights as to when and how I might have influenced the research process and its findings (Marshall and Rossman, 2011; Mason, 2005; Robson, 2002; Ball, 1990b). The following example is taken from my notes for an interview with a resource developer on January 12, 2007:

- The table in the room is set up so that it was most convenient to sit side-by-side. We positioned our chairs so that they were angled towards each other although not directly facing each other.
- The references made about the existing science and technology curriculum seemed a little 'couched' in terms of body-language; I will need to check the transcripts if there was any direct avoidance to critique this document because of my involvement in it
- I found myself assessing as the interview was being conducted as to when to hold-back and when to prompt and probe; prompting and probing needs to be within the bounds of the original intent of the question and not 'investigative reporting'; I am gathering data for themes to emerge about the decision-making process with government science curriculum documents not write a history of the process

Further examples are in the transcribed interview in Appendix K such as lines P21 to P24, P44, and P45.

Reflexivity recognises that researchers are part of the social world that they are researching (Marshall and Rossman, 2011; Mason, 2005; Cohen, Manion and Morrison, 2000; Ball, 1990b). It contributed to shaping my identity as a researcher and reflecting about my identity as a science educator. Dated reflections over time provided snapshots of my journey and growth in developing critical analytical skills (Marshall and Rossman, 2011; Cohen, Manion and Morrison, 2000). This made me aware of contexts, power differentials and participants and dissonance between my researcher's self and the data (Bolton, 2010). As the study evolved and themes emerged, I saw my own practitioner experiences through my researcher's lens. This resulted in uncomfortable moments reflecting on my own naïveté in my various roles as an educator during these time periods with little awareness of the larger themes behind them. On a practical side, I learned more about the workings of politics, curriculum and education and this serves me well in the coming years as I continue to be a member of the Ontario science education community.

4.10 Chapter summary

This chapter summarizes the design, methods and data analysis used in this qualitative research. Documents, interviews and focus groups were chosen to understand the meaning of events, situations and actions of key actors and texts; to understand the contexts within which science curriculum policy-making is initiated and developed; to identify unanticipated factors and influences; and, to explore patterns and trends in Ontario science curriculum policy. Issues related to research integrity are discussed along with how these have been minimized.

An adaptation of Bowe, Ball and Gold's (1992) policy cycle and Vidovich (2003, 2001) provided an organisational framework to turn the data into a resource for analysis. Analysis was based on Miles and Huberman's (1994) interactive model of data analysis that included data reduction, data displays and the drawing conclusions. Resulting matrices and networks enabled exploration of patterns and trends across governments. They were used to examine if conclusions could be drawn or if further study and/or evidence was needed.

Throughout this chapter I comment on influences my experiences have had on this study and illustrate that I am both an insider-as-researcher in some circumstances and an outsider-as-researcher in others. This chapter describes checks and balances used to minimize biases and enhance integrity of the data analysis so that readers have confidence that the evidence and conclusions presented in this study stand the test of academic rigour.

The following four chapters discuss the findings for each government time period in chronological order. Findings were based on the research design, methods and data analysis as discussed in this chapter. Each findings chapter discusses the political discourses surrounding the development of the science curriculum documents and the discourses of texts of the documents that were developed by these governments. Chapter Five presents the findings for the Peterson Liberal government time period from 1985 to 1990.

Chapter 5 Peterson Liberal governments 1985-1990

5.1 Introduction

This chapter is the first of four presenting my analysis of Ontario science curriculum policy since 1985. Each chapter focuses on one government time period from 1985 to 2008. Over these 23 years, Ontario governments shifted from David Peterson's Liberal Party (1985-1990), to the New Democratic Party (1990-1995), to the Progressive Conservative Party (1995-2003) and back to the Liberals under Dalton McGuinty in the fall of 2003. For each of these time periods, I discuss the political arena of the government-of-the-day and the education reforms that surrounded the science curriculum policy for that government. As mentioned in Chapter Three, curriculum policy is more than the text and an analysis of the science curriculum documents alone does not illuminate the conflicting and competing interests related to their development and content. I approached this study and the analysis of the data by examining the interconnections between science curriculum policy and the broader political arenas of education and curriculum reforms undertaken by each government. I sought answers to my research questions with the view expressed by Ben-Peretz (2009) that curriculum policy is one component by which education policies are expressed within the practice of education. It exists in context and is shaped by interactions among the state, economy and society (Ben-Peretz, 2009; Cuban, 2008; Carter, 2007; Ungerleider, 2003). My research illustrates the influences of these evolving interactions and reforms on the origins, processes and changes to content of Ontario's science curriculum from 1985 to 2008.

Each of these four chapters begins with an overview summarising the science curriculum policy developed by the government for that time period. This is followed by an orientation of the ideology of the political party that formed the government to provide a point of reference. Each chapter is then organised into two major sections. The first section focuses on the political arena related to education within which science curriculum policy was formulated, generated and publicly released. This sets the context of the broader education and curriculum reforms undertaken by each government that were rooted in global and local political, social and economic landscapes. Three major themes that influenced these reforms emerged through data analyses. These are the global marketplace, public and political demands for standards, and for accountability. When examined across 23 years of government education reforms, these themes illustrate the evolution of Ontario's education system into an audit culture. Each theme is addressed in separate sub-sections. These three themes are then revisited in the second major section of each chapter where I draw upon my analysis of the content of the science curriculum documents to discuss how these themes were, or were not represented in the curricula. However, firstly this second section begins with a discussion about the development processes used to construct the science curriculum documents. These processes are important to examine in order to understand how they may have been influenced by the political arena and how they did or did not influence the text of the final documents (Fensham, 2012). This organisation of the findings enabled me to compare the science curricula across the four governments. Each chapter concludes with a summary discussing the evolution of science curriculum policy as an example of Ontario's progression towards an audit culture in education.

The final commentary is on the place, significance and role, if any, of the science curriculum documents.

This first of these four findings chapters presents the analysis of the Peterson Liberal government time period. Table 5-1 summarises the participants who were interviewed or participated in focus groups who had experiences related to the Peterson Liberal science curricula. Documents examined for this government are summarised in Appendix B. These documents and the participants' comments informed the analysis for the findings presented in this chapter.

Table 5-1 Summary of participants with experiences related to the Peterson Liberal science curriculum policy

Experiences/Positions	**Individual interviews**	**Focus group participants**
Ministry of Education bureaucrat (seconded)	Bill, Harvey, Linda	
Ministry of Education bureaucrat (permanent staff)	Carl, Yvette	
Government policy advisor	Mark, Quincey,	
Curriculum writer	Curtis, Hannah	
Elementary teacher	Avery, Cailin	Grant (FG-2)
Secondary science teacher	Adrian, Ben, Frank, William	Evelyn (FG-1), Felicia (FG-1), Harriet (FG-2) Julia (FG-2), Ian (FG-2)
School board science consultant	David, Evan, Ginny	Daniel (FG-1)
Resource developer	James, Nancy	

5.2 Overview: Peterson Liberal science curriculum policy

For Kindergarten to Grade 6, the Peterson Liberals initiated and developed a curriculum called *Science is Happening Here* (Ontario. Ministry of Education, 1988i) hereafter referred to as *SiHH*. For Grades 7 to the Ontario Academic Credit (OAC) or final year of high school, they continued with a reform policy initiated by the previous Progressive Conservative (PC) government called the *Ontario Schools:*

Intermediate Senior (Ontario. Ministry of Education, 1983), or more commonly known as *OS:IS*. During the Peterson Liberal's four governing years, 15 *OS:IS* curriculum documents were developed for science and released for implementation (Ontario. Ministry of Education, 1989a, 1988b, 1988c, 1988d, 1988e, 1988f, 1988g, 1988h, 1987b, 1987c, 1987d, 1987e, 1987f, 1987g, 1987h). From here on, I refer to these as *OS:IS Science* to differentiate them from the overall *OS:IS* policy which applied to all school disciplines.

A brief historical summary of the *OS:IS* initiative is relevant here as the origin of this policy was a result of concerns about Ontario's secondary education system that occurred prior to the Peterson Liberals forming the government. As will be shown in this chapter, these concerns continued to be expressed throughout the Peterson Liberal time period by policy influencers such as politicians, business and industry, the public and the media.

In the early 1980s, the PC government announced a comprehensive review of all aspects of secondary education in Ontario in response to a public that wanted more structure, more compulsory courses and more training for students in how to think (Gidney, 2002; Paquette, 1991). A 50-member project team, spent 18 months listening to various education stakeholders including the general public, business, industry, post secondary education and teacher organisations. Their final report formed the blueprint for the *OS:IS* curriculum renewal that occurred during Peterson Liberal's governing mandate (Gidney, 2002). Curricula for high school courses like science were to be standardised into three levels of difficulty (advanced, general and basic). The advanced stream was to prepare students for university or some college programs. The general stream was to prepare students for employment or for some college or non-degree post-secondary granting programs, and the basic stream was to prepare students for employment and to develop their personal skills, social understanding and self-confidence. (Ontario. Ministry of Education, 1987b). Thirty successfully completed courses or so-called credits were required for high school graduation. Sixteen of these were mandatory, with two of these to be science credits. The fifth year of high school was renamed from Grade 13 to Ontario Academic Credit (OAC). This course was required for students wishing to attend universities. This *OS:IS* policy direction for high school courses and graduation requirements reflected public expectations that schools would provide students with a basic education that prepared them for their futures through demanding curriculum (O'Sullivan, 1999; Paquette, 1991). As shown in this chapter and the ones that follow, these expectations became more vocal with subsequent governments.

5.3 Political orientation

The Liberal Party of Ontario of the 1980s was considered to be a centrist party, albeit slightly left of centre. As mentioned in Chapter One, Ontario governments were elected less on the basis of their ideology and more in relation to public perception of good governance (Wilson, 1997). Typically governments would govern from the centre, sometimes leaning more to the left or to the right depending on the issue (Wilson, 1997). The Peterson Liberal governments were no exception. The Peterson Liberals formed two governments from 1985 to 1990. The first one from 1985 to 1987 was a unique occurrence in Ontario politics and as such is noteworthy for further discussion below. The second was a majority government from 1987 to 1990.

As mentioned in Chapter One, the results of the Ontario election on May 2, 1985, created an opportunity for political change after 42 years of PC governments. Newly elected PC Premier Frank Miller, who had barely won a minority government, brought forward a neoliberal agenda that was uncommon at that time for the Ontario PC party (Gidney, 2002). In previous decades, the PCs had dominated the middle of the political spectrum, often forcing the Liberals to the right, and the New Democratic Party (NDP) to the left (Gidney, 2002, Wilson, 1997).With Miller having only a slight majority of seats, the Liberal and NDP opposition parties, concerned with his direction, formed a two-year Accord. The NDP agreed to support a Liberal minority government for two years and the Liberals agreed not to call an election during that time. With this agreement in place, five months after Miller's tenure in office, the NDP brought forward a non-confidence motion in the Legislative Assembly and together the two opposition parties defeated Miller's government (White, 2002). Peterson went to then Lieutenant-Governor John Black Aird to request that the Liberals form a government without having Ontarians return to the polls; a request to which Aird agreed.

The two years of the Accord from 1985 to 1987 were a time of cautious management and the passage of progressive legislation (Wilson, 1997). These two years provided the Peterson Liberals with an agenda and a timeline, and although many policies during that time were through negotiations with the NDP, the Liberal government received the credit (Wilson, 1997; Ehring and Roberts, 1993; Gagnon and Rath, 1991). As soon as the Accord expired at the end of June 1987, Peterson called an election that resulted in a large majority government for the Ontario Liberal Party when they won 95 out of 130 seats, with the NDP reduced to 19 seats and the PCs to 16. His new majority brought with it a return to the complacency that had plagued previous PC governments (Wilson, 1997; Ehring and Roberts, 1993).

Less than three years into his majority mandate, Peterson called for an election. This was interpreted by many voters as a sign of arrogance and confidence, particularly as the Peterson Liberals were unclear as to why they did not govern to the end of their mandate (Wilson, 1997). Furthermore, the Liberal election platform focused on a strong economy, caring communities and social reform (Ehring and Roberts, 1993); however, that agenda was not resonating with the middle class who wanted reassurance that emerging economic concerns were not going to erode their prosperity (Ehring and Roberts, 1993; Gagnon and Rath, 1991). Ultimately, the Peterson Liberals were defeated because voters wanted a government that was reform-minded although not too different from the one that they elected in 1997 (Gagnon and Rath, 1991). This supports Wilson’s (1997) argument that the Ontario electorate were inclined to vote on their perceptions of good governance rather than ideology. This opened the door for the NDP to form the next Ontario government.

5.4 Section One: Political arena

When the Peterson Liberals took office in 1985, they had inherited a bureaucracy that was accustomed to working with the Progressive Conservative Party for over forty years (Gidney, 2002; Speirs, 1986). When challenged in the Legislative Assembly by an opposition member about who would be running the newly appointed Accord government, Peterson responded, ‘Let me tell the member something: we run this place, not the senior staff’ (Peterson, 1985b). As illustrated in this chapter, when it came to curriculum policy, the Peterson Liberals were in control of its origins but the bureaucracy led the development and content of the curriculum documents. The first sub-section provides an overview of the Peterson Liberal’s reforms in education related to curriculum. The three sub-sections that follow focus on the political arena with respect to the global marketplace, the call for standards and accountability measures.

5.4.1 Education and curriculum reforms

During the 1980s public confidence in the quality of Ontario’s education system was decreasing. Results from a biennial survey of educational issues, conducted from 1982 to 1988 by researchers Hart and Livingston from the Ontario Institute of Studies in Education (OISE), showed a steady decline of confidence in schools by parents and non-parents. Public confidence dropped to a low of 36% in 1988 from 55% in 1982 (Livingstone and Hart, 2010, p.16). An analysis of the data from multiple sources, such as debates in the Legislative Assembly as recorded in Ontario *Hansard*; government reports (Ontario. Select Committee on Education, 1990c, 1990d,1989f, 1988m; Ontario. Premier’s Council, 1988j, 1988k, 1988l; Radwanski,1987;); and newspaper articles cited in this chapter, indicated that discourses related to this dissatisfaction revolved around concerns by politicians, business, industry and the public about the preparedness of Ontario’s education system to be competitive in a global economy, and for more government control of what students would be learning.

Articles and editorials, in national, provincial and regional newspapers as identified in Chapter Four, expressed concern about Ontario's education system. Throughout the late 1980s, newspapers reported concerns as to whether Ontario schools were successful in preparing students for a competitive global economic marketplace (Ainsworth, 1989; Contenta, 1988d, 1988e; Fox, 1988a; Martin, 1988a; Whipp, 1988; Orpwood, 1987; Schiller, 1987; Editorial, 1986; Walker, 1986). Related issues were often found in the front sections of newspapers such as criticism of the new *OS:IS* curriculum (Brown, 1987), government plans to expand science and technology education by introducing computer studies (Star Wire Services, 1987), and suggestions to revise Ontario's 13 education goals to mirror economic needs (Contenta, 1988d, 1988f, also see Martin, 1988b; Walkom, 1988).

These newspaper articles, accessible to Ontario's electorate, were among others that exerted influence on government action as affirmed by Bill's comments about his experience as a seconded Ministry of Education bureaucrat:

> Ministry policy is dictated quite often by what's on the front page of the [Toronto] Star in the morning. And this is what people who have not spent time in bureaucracies find impossible to understand but it is real life. It is impossible to have long term planning because policy decisions and priorities are determined by what is politically important to the public. And what's important today may not be important tomorrow. (Interview: 5 September 2006)

In 1987, shortly after the Peterson Liberals formed a majority government, Peterson commissioned George Radwanski, a former Toronto Star editor-in-chief, to review secondary school education and recommend ways to ensure Ontario’s education system was relevant to youth and to the realities of the labour market (Gidney, 2002). To that end his report was to have a particular emphasis on addressing the issue of high school dropouts. Radwanski (1987) delivered a harsh criticism of the education system as being entrenched in a progressive child-centred approach as evidenced by the tone in the following quote:

> We have tried, for the past two decades, to make education relevant to young people by letting them virtually design their own programs and by cramming the curriculum with courses intended to meet every kind of individual interest. It manifestly hasn’t worked, either in terms of making education seem sufficiently relevant to young people to keep enough of them in school until graduation or in terms of securing satisfactory pedagogical outcomes for those who do remain. The approach proposed in this report proceeds from a different premise -- that a relevant education is one that teaches young people what they need to know for effective participation in the work place and in society at large, in a rapidly changing world (Radwanski, 1987, p.88).

Among his 35 recommendations was one for the government to conduct province-wide tests as a form of accountability to the public and one to centralize curriculum development to the Ministry of Education. These recommendations supported a shift towards standards and accountability measures. As the Ministry of Education had always provided curriculum guidelines, I argue that his recommendation to centralise curriculum was more related to having the Ministry provide specificity as to what students were to learn. A recommendation to abolish streaming of Grade 9 as a strategy to reduce drop-out rates seemed premature as it came before *OS:IS* curriculum could be assessed as to whether its three streams of advanced, general and basic had any impact on high school dropout rates.

The public release of the *Radwanski Report* (1987) contributed to newspaper articles questioning the quality of Ontario’s education system (such as Contenta, 1988b, 1988c; Egan, 1988; Flavelle, 1988; Fox, 1988b, 1988c, 1988d; Wyatt, 1988, p.1). Quotes by then former Minister of Education Chris Ward displayed on the front page of the *Toronto Star*, did not help to instil public confidence.

> It all boils down to, 'What do you get with an elementary and secondary education in this province?' Obviously, most of the kids in the system think 'not much' in terms of being able to nail down a job.' (Contenta, 1988a).

His comment raises the notion of the market value of education suggesting that getting a job is a performance measurement of education.

The publication of the *Radwanski Report* (Radwanski, 1987) was followed within one year by a Select Committee on Education that the Peterson Liberals created in February 1988. Its representatives were Members of Parliament from all three political parties (Edighoffer, 1988). Their two-year mandate was to hold meetings to hear the views of the public, business, industry and educators on the role of the school system and how it 'can assist students in shaping and fulfilling career and work objectives' (Edighoffer, 1988; also see Peterson, 1988). This committee gave a mechanism for Ontarians to voice their concerns directly to elected politicians, bypassing Ministry bureaucrats. In its first year, this all-party committee heard presentations from 202 groups and individuals during seven weeks of public hearings (Ontario. Select Committee on Education, 1988m). During these hearings, Ontario schools were implementing the new *OS:IS* curriculum documents. A *Toronto Star* news article reporting about the Select Committee hearings noted:

> At the high school level, the committee heard one message loud and clear: Don't change a curriculum that has yet to be completely implemented (Contenta, 1988g, p.A24).

The article goes on to say that teachers and principals were telling the committee that the system was still struggling to implement this new curriculum as it involved all grades and all subjects. Nevertheless the government responded to pressure by those expressing concerns and inadequacies with the education system and announced a series of new education reforms (Alexander, 1989). This political action was responsive to an electorate dissatisfied with education. It was not responsive to the voice and concerns of educators trying to implement the government's new *OS:IS* curricula.

In 1989, the Peterson Liberals announced their five-year action plan targeting six areas of education reform: Early Years (Kindergarten), Formative Years (Grades 1 to 6), Transition Years (Grades 7 to 10), Specialization Years (Grades 11 to OAC), Technology Education, and Teacher Education (Alexander, 1989). These plans included revitalising the curriculum from Grades 1 to 6 and developing a core curriculum in Grades 7, 8 and 9 that would emphasise the development of basic skills and progressive problem-solving. They also stated a commitment to eliminate streaming in Grade 9 (Alexander, 1989; Ward, 1989). Curriculum policy that is in a constant state of development and renewal as was the case during this government may serve political purposes but does not gain the confidence of teachers who are required to implement curriculum documents related to this policy (Cuban, 2008). Educators were unhappy with the repeated attacks on the system and changes that were decided without their input; for example, the Ontario Teachers' Federation decided to launch an all-affiliate, co-ordinated political action program for the next provincial election (Farnan, 1990). The Peterson Liberals' commitment to these new education reform plans was never actualized. As noted earlier, Peterson prematurely called for an election and his government was voted out of office.

5.4.2 Economy and the global marketplace

When the Peterson Liberals took office, global economic competitiveness was dominating local economic concerns (Gidney, 2002; Speirs, 1986). Sterling (2004) referred to the mid-1980s as an ‘economic Sputnik’. Japan had emerged as an economic world leader dominating global markets with high technology. Politicians, business, industry, the general public and the media expressed concerns as to whether Ontario’s school system was preparing students for a new global economy and for a world increasingly dependent on the products of science and technology (Gidney, 2002, Ontario. Premier’s Council, 1988j).

In 1985, Peterson established the Premier’s Council, a 28-member panel which he chaired and whose membership included a number of cabinet ministers and key players in the business, labour and academic communities. They advised him in matters related to the economy and associated issues such as education, training and labour (for details see Ontario. Premier’s Council, 1990c, pp.v-vii ;1988j, pp.9-10). Their first report emphasised the importance of science and technology for global competitiveness (Ontario. Premier’s Council, 1988j). They saw education and training as investments in Ontario’s economic future and called for education to foster Ontario’s ability to complete in a global economic marketplace (Ontario. Premier’s Council, 1990c ,1988j). Similar to Radwanski (1987), they were critical of Ontario’s education system (Ontario. Premier’s Council, 1988j, 1988k, 1988l). They focused their second report on recommendations to education, training and labour to adjust to economic changes (Ontario. Premier’s Council, 1990c). Their views underscored those expressed by Radwanski (1987) in his report regarding the importance of having a highly educated workforce for Ontario to successfully compete in a knowledge-based global economy. He stated, ‘excellence in educating our workforce is our single most important strategic weapon’ (Radwanski, 1987, p.11). His choice of the phrase ‘strategic weapon’ was an aggressive call to action for the government to respond to the pressures of increasing global economic competitiveness. These views indicate that education was an investment of human capital for the workplace. At that time, approximately 30% of Ontario’s students were dropping out of high school. This raised economic concerns about Ontario’s future workforce (Morin-Strom, 1988; Ontario. Premier’s Council, 1990c, 1988j; Jackson, 1987).

Newspaper articles added to a public debate about education and economic growth including questioning the relevance of existing curriculum to economic needs:

> Now more than ever, they say - as brainpower becomes the new economic fuel - we must get rid of the unimportant, streamline what is important, and create a curricular launching pad for the 21st century. Indeed, not only do we have to stop stacking new courses on top of old - we need to reassess the old. We must stop crowding the curriculum with an insistence on learning outdated facts (Brown, 1987).

There was no mention as to what was considered ‘unimportant’ or who decides. As these discussions were taking place in political and public arenas, Ontario’s science teachers were beginning to implement the new *OS:IS Science* for Grades 7 to OAC. Public and political discourses were not addressing the reality that Ontario had just spent tax payer funds to develop new government-mandated curricula with a policy that was only a few years old.

5.4.3 Standards

Recommendations to centralise curriculum development to the Ministry of Education and for the Ministry to develop standards were similar across the reports of the Premier's Council (Ontario. Premier's Council, 1990c,1988j, 1988k, 1988l), Radwanski (1987) and the Select Committee on Education (Ontario. Select Committee on Education, 1990c, 1990d,1989f, 1988m). As mentioned earlier, I argue that underpinning these recommendations were expectations for the government to act and provide more specificity as to what students should learn and thereby reduce local development.

Although curriculum had been and continued to be developed under the direction of the Ministry of Education, further specificity for implementation was required at the local school board level (Ontario. Ministry of Education, 1988i, p.39; 1987b, p.59). This led to multiple interpretations of the curriculum, resulting in variations as to what students were expected to learn in each grade. It was common practice for school board consultants to create committees of teachers to develop local documents to support curriculum implementation (Ontario. Ministry of Education, 1987b). The intention of these 'second-generation documents', was to provide board-wide consistency for implementing mandatory Ministry curriculum policy (Ontario. Ministry of Education, 1987b, p.59). Evan, a former school board consultant commented that the curriculum "was not something that you could hand to the teacher and say go ahead. They would say what is there to go ahead with?" (Group interview: 26 September 2006). Consequently teachers would use these second-generation documents as though they were the required curriculum and not an interpretation of Ministry curriculum by their local school board colleagues. Relying on school board developed documents for curriculum implementation resulted in inequities of support as noted by David, who was a school board science consultant at that time.

> Yeah there were a lot of Board documents that were produced and it depended on how big a Board you were with or what the priorities of the Board [were] or who they had working at the Board. (Group interview: 26 September 2006)

A consequence of the recommendations for standards and specificity to be centralised within the Ministry of Education would reduce the ability of school boards and teachers to interpret curriculum based on local needs and interests. Apple (2005) argued that centralised control as a response to evaluation and measurement pressures gives rise to an audit culture in education. When the Peterson Liberals acted on the recommendations for a centralised curriculum, essentially this curriculum became a public record of standards thereby contributing to an audit culture in Ontario education.

5.4.4 Accountability measures

The Peterson Liberals initiated two mechanisms of centralised control to monitor what students were learning, and how well they were learning it. One was through participation of Ontario students in international tests and the other was through newly developed provincial reviews of curriculum implementation as recommended by the Select Committee (Ontario. Select Committee of Education, 1988m). Both of these accountability measures are relevant to this study as they were external indicators in communicating to politicians, the broader public and educators how well students were performing in school science.

Sean Conway, a Minister of Education for the Peterson Liberal government from 1985 to 1987, and again from 1989 to1990, supported the notion of using testing as an indicator of the market value of education. During his announcement of the new government provincial reviews for select subjects, Conway stated:

> We must also look to the international scene to ensure that our students in Ontario receive an education that ranks among the best in the world. ... In 1988, with seven other jurisdictions including the United Kingdom, the United States and Japan, we will take part in an international study of achievement in mathematics and science among 13-year-old students. With this initiative we feel we are supporting positive development within our Ontario schools and will be ensuring that we have a valid system by which we can assess how our student population is learning and performing (Conway, 1987).

This tenet of performativity linking the value of education to measures and comparisons of output (Ball, 2012) was emerging in public discourse. This is illustrated by the following example describing Ontario's participation in the test mentioned in Conway's quote. The *Second International Science Study* was administered in the mid-1980s for students in Grades 5, 9 and 12. Recalling from Chapter One that in Canada, education is a jurisdictional responsibility, it is important to clarify here that in international testing, Canadian jurisdictions can choose to oversample, thereby receiving results for their individual jurisdiction in addition to the national result.

Ontario's participation in this international test enabled comparisons as to how its education system compared to that of other Canadian jurisdictions and other countries. Twenty-three countries, including Canada, had participated (Rosier and Keeves, 1991). Compared with overall Canadian results, Ontario students performed slightly below the national average in Grades 5 and 9, and even more so for senior students in physics and biology. Chemistry was an exception where

Ontario's senior student achievement was among the highest within Canada (Postlethwaite and Wiley, 1992; Ontario. Ministry of Education, 1987a).

A front page headline in the *Toronto Star*, 'Western students beat Ontario's at science' (Contenta, 1987, p.A1) and the follow-up editorial several days later 'Second-rate learning' (Editorial, 1987, p.A18) emphasised the rankings of Ontario students with those of other participating Canadian provinces, and with other participating countries. These headlines reinforced public perceptions that Ontario's education system was falling behind and not measuring up to that of other provinces and countries. There was little discussion in the media that education systems in other jurisdictions might have different infrastructures, different value systems and/or different enrolment systems. This international accountability measure was influencing public perceptions of education at a local level. Connelly, author of a research brief (Ontario. Ministry of Education, 1987a) about Ontario's results in this international study, criticised the media in a letter to the editor in the *Toronto Star* stating that academic views about the study's research were given little prominence and media interpretations were simplistic (Connelly, 1987). There is no evidence that a more academic interpretation of the results gained prominence in the media. Tables ranking quantitative results were the substance behind media communications (Connelly, 1987).

A second accountability measure initiated by the Peterson Liberals implemented one of the 23 recommendations mentioned in the first report of the Select Committee on Education (Ontario. Select Committee on Education, 1988m). The Ministry was to conduct a thorough review of the *OS:IS* curriculum to better understand how it was being used in practice and to identify areas where more support was needed. An on-going evaluation was recommended to 'gather and analyse statistical information on how *OS:IS* has been implemented' (Ontario. Select Committee on Education, 1988j, p.7). Curriculum Project Management Teams were established in each of its regional offices to monitor the implementation of the *OS:IS* curriculum and to conduct these provincial reviews in mathematics, English and science. This is a centralised way of ensuring closer supervision of a school board's implementation activities. Using a 'curriculum-based approach to program assessment' (Ontario. Ministry of Education, 1988a, p.3) to report on student achievement was a means for the government to demonstrate that they were holding the education system accountable for its share of public funding. Implementation, which had previously been at the sole discretion of school boards, was being monitored by the Ministry of Education.

Provincial reviews were initiated and conducted for senior advanced-level chemistry and physics (Ontario. Ministry of Education, 1989c, 1989e). These reviews began only one year after the *OS:IS* chemistry curriculum was released for these courses, and in the same year as the release of the *OS:IS* advanced-level physics course curricula. The detailed report written for educators, acknowledged that implementation of these courses was not required to begin until September 1989 (Ontario, 1989c, 1989e). No such acknowledgement was made in the short summary reports published for the public (Ontario. Ministry of Education, 1989b, 1989d). This is a significant omission and suggests that the government was either deliberately misleading the public on the status of the *OS:IS* curriculum or it was a lack of understanding of the complexities of curriculum implementation by politicians and their communications officers.

Committing to these large-scale provincial reviews required public funds involving not only reporting on student achievement but also reviewing teacher-developed courses of study including teaching strategies used as well as resources and evaluation techniques. Students' attitudes towards the courses were also part of the review process (Ontario. Ministry of Education, 1989c, 1989e). Bill, who was involved in the review as a Ministry bureaucrat, commented:

> I mean the infrastructure is humongous in terms of getting assessment instruments developed. Of getting them field tested. Getting them looked at by the psychometrician so that they're statistically sound. And then keeping them secure and then printing and distributing them and encouraging teachers in schools to do what they're supposed to do which is a whole other issue. Then getting them scored and making the data accessible. I mean the racks and racks of [slaps hand] of shelves, documents that were created. (Interview. 5 September 2006)

Given the cost that this would require, and the government's determination to communicate accountability to the public, his additional comment that the reports that were produced were not widely read is ironic.

In the spring of 1989, near the end of the Peterson Liberals governing mandate, another centralised monitoring program began. Unlike the previously mentioned provincial reviews, this program monitored teacher-made examinations for the fifth year of high school and was called the OAC Teacher In-Service Program (OAC-TIP) (Ontario. Ministry of Education and Training, 1993a, 1993b; Ontario. Ministry of Education, 1991a). Although this program was initiated by the Peterson Liberals, the reports were not completed during their governing mandate. It is mentioned here as this program continued under the next government and is further discussed in

Chapter Six. The seeds for centralised accountability measures were put in place. They would grow and expand with subsequent governments as discussed in the following three chapters. Accountability measures were becoming a fixture in Ontario education.

5.5 Section Two: Science curriculum origins, development processes and content

5.5.1 Origins

As mentioned at the beginning of this chapter, the science curricula for Grades 7 to OAC originated in the *OS:IS* policy of the previous PC government and were enacted by the Peterson Liberals; on the other hand *SiHH* was initiated by the Peterson Liberals. Although the government supported the development of an elementary science curriculum, an incident recalled by Quincey, a policy advisor to the Peterson Liberals since their time in opposition, indicated that the bureaucracy did not want the government to refer to the importance of science education in their first throne speech which outlined their governing agenda. Linda, who was later seconded to the government, recalled her recollection about the government's view of science education:

> I certainly think the government was really concerned about being competitive and saw science as one of the drivers of competition. There's no question about that. They saw science as being a very important subject. (Interview. 19 January 2007)

Linda's comment is of interest as it underscores the difference towards science education between the government and Ministry bureaucrats. Quincey recalled a challenge when she had to include a paragraph about the importance of science education into this throne speech in 1986. She had reminded then Education

Minister Conway, about their party's platform when they were the official opposition to the government. While in opposition, the Liberals were vocally supportive of the recommendations of the *Science for every student* study (Canada. Science Council of Canada, 1984). Quincey had written a paragraph about the importance of science education in the throne speech only to have it removed by senior education bureaucrats. She recalled that this happened twice during the development of the speech, "And so finally Conway took it [paragraph] over in his breast pocket and gave it directly to Peterson" (Interview. 4 November 2007). Senior education staff were handed the final text with the paragraph reinserted. Conway took the unusual step and by-passed the bureaucracy to ensure the government's policy direction was consistent. Quincey remarked that the bureaucrats involved in reviewing the throne speech would have wondered "how the hell did that happen". In this instance the government was 'running the place' as Peterson claimed. However, as discussed later in this chapter in Section 5.5.2 about the development processes of the science curriculum, the interviews of participants who were involved in these processes, recalled that when it came to constructing curriculum, Ministry of Education bureaucrats were 'running the place'. Section 5.5.2 outlines how the Ministry bureaucracy determined the framework and structure of the documents, hired writers, project leaders and other developers, conducted the review process, and upon completion of the documents prepared a briefing note for the Education Minister for final approval.

The Peterson Liberals acted on their support of elementary science education as follows. Conway (1986) announced his appointment of Graham Orpwood, as his special advisor to develop the government's primary and junior science education initiative. Orpwood had just completed co-directing the *Science for every student* study (Canada. Science Council of Canada, 1984). Mark, a policy advisor at that time, commented:

> And it was barely tolerated by the powers to be. They [Ministry of Education bureaucrats] were incensed that the Minister had gone around them. This was a top down initiative. (Interview. 1 February 2007)

His comment illustrates the tension between the Ministry bureaucrats and a government that was intent on leading this direction for elementary science. Orpwood led a three month broad consultation process with various educators, educator groups and the science community resulting in a policy document for primary and junior science education (Ontario. Ministry of Education, 1986). It identified 24 initiatives in the areas of curriculum, support for teachers, equipment and learning materials, public awareness, leadership, implementation, and evaluation. This included:

> The development of science curricula from kindergarten to grade six in a way that devotes more time and attention to this important area in the early school years (Conway, 1986).

This political support by the Peterson Liberals for elementary school science resulted in the development and implementation of *Science is Happening Here* (Ontario. Ministry of Education, 1988i), regardless of whether or not the bureaucracy agreed. This was the first Kindergarten to Grade 6 subject-specific curriculum since the 1960s. Prior to *SiHH*, two government curriculum guidelines provided a philosophical orientation on what should be taught at these grades (Ontario. Ministry of Education, 1975a, 1975b). Government bureaucrats involved in *SiHH* had been responsible for supporting the implementation of these two documents which supported a child-centred approach since the 1970s (Interviews.

Bill, seconded bureaucrat, 5 September 2006; Harvey, seconded bureaucrat, 16 November 2006).

5.5.2 Development processes

This section illustrates that the development processes for *SiHH* and *OS:IS Science* were quite different. The data for understanding these processes was gathered predominantly through interviews by participants who were involved in these constructing these curricula (Interviews. seconded bureaucrats: Bill, 5 September 2006; Harvey, 16 November 2006; Linda, 19 January 2007; permanent bureaucrats: Carl, 19 September 2006; Yvette, 21 August 2007; policy advisor: Mark, 1 February 2007; curriculum writers: Curtis, 16 July 2007, Hannah, 18 October 2006). Each development process is discussed in a separate sub-section below. Common to both processes was that the key actors in the writing of these curricula were Ontario educators. Project leaders were seconded to the Ministry of Education from Ontario school boards. They worked under the direction of a Ministry career bureaucrat with expertise in either elementary education or in secondary science education. Advisory teams were comprised predominantly of educators from various Ontario school boards, provincial teachers' organisations and from universities and colleges (Ontario. Ministry of Education, 1988i, pp.45-46; 1987b, p.103). University and college science faculties provided content input and reviewed sections of curriculum for senior grades. According to Linda, a seconded Ministry of Education bureaucrat who was coordinating the development of the science curriculum at that time, "It was mostly a closed shop. Mostly teachers developing curriculum and evaluating curriculum." (Interview. 19 January 2007).

Although the bureaucracy was leading and driving the curriculum development process, within the bureaucracy there were different views of education as illustrated by the following example. An established protocol within the Ministry of Education curriculum review process required that all documents would be reviewed by bureaucrats with curriculum responsibility, regardless of whether their subject area expertise was in science. Yvette recalled:

> So we would have a meeting in which the total document, virtually page-by-page was reviewed. So, it was with a view to understanding what the science curriculum was, and whether philosophically we were of one mind in how we were approaching it. (Interview: 21 August 2007)

This validation process was internal to Ministry of Education bureaucrats and suggests the control of the bureaucracy in having all subjects convey a common philosophy. However, Yvette's perceptions that the Ministry of Education bureaucrats were "of one mind" was not recalled by Bill, who commented that there were internal politics between the elementary and secondary curriculum teams (Interview. 5 September 2005). Yvette agreed that there was:

> A very strong elementary team and a team that was very strong in secondary. However, because the two leaders were not very supportive of one another, we didn't cross over the way we might have. (Interview: 21 August 2007)

By this she meant that the development of the elementary and the secondary curriculum documents were separate processes that were not interconnected. Carl, who was involved in the development of the secondary science curriculum, also commented about this internal politics:

> There was an elementary section in curriculum and there was a secondary section in curriculum in the Ministry at that time. And certainly from a continuity point of view it would've been nice to at least talk with each other you know so that there's some carry-over as you wish from [and] into the intermediate division. So there is politics. There's no question about that. (Interview. 19 September 2006)

This illustrates that within the Ministry of Education bureaucracy, there were value differences. This may account for the different writing processes, structure, format and specificity of learning requirements for the elementary and secondary science curricula. For example, Bill singled out that having specific content in the elementary curriculum was a major area of disagreement among bureaucrats responsible for elementary education and those responsible for secondary education. He commented that having specificity in the elementary curriculum was “like waving a red flag” in front of the manager of the Ministry’s elementary curriculum branch. As mentioned earlier, the elementary curriculum since the 1970s was not subject-specific but rather more philosophical in providing guidelines for a child-centred approach (Ontario. Ministry of Education, 1975a, 1975b). Examples of differences between the elementary and secondary science curricula are provided in later sections discussing science content.

The next two sections describe the separate development processes of the elementary science curriculum *SiHH*, and the *OS:IS Science* curricula documents. There were clearly two different processes in place; however, neither involved actors outside of the education community. Data based on documents and interviews showed that non-education actors who may have had competing values and beliefs amongst themselves and with the education community were not engaged in curriculum development processes, even though they were becoming increasingly vocal with their dissatisfaction of the education system. Political tradeoffs as to what curriculum documents should look like such as their purpose, structure and content were not deliberated among the diverse views of curriculum policy actors and policy influencers. There was no mechanism to understand each others' perspectives nor for political negotiation or compromises.

Upon the Minister of Education's approval, the final curriculum documents were released to Ontario school boards for implementation. Linda commented:

> At that time [the] government process was pretty simple and straightforward to bring the curriculum through. Everything being relative. (Interview. 19 January 2007)

Politicians did not become involved in the process (Interviews: seconded bureaucrats: Harvey, 16 November 2006; Linda, 19 January 2007). This was in spite of the political and public discourses about dissatisfaction with what students were learning in Ontario schools as presented earlier in this chapter. I suggest that the Peterson Liberals did not view these curriculum documents as political documents, an outlook that was to change with the next government.

***Science is Happening Here* (*SiHH*)**

As discussed earlier, the government set the policy direction for a new Kindergarten to Grade 6 science curriculum; however, based on an analysis of the data that was their only major influence as the development processes were led by the Ministry bureaucracy and educators (Interviews. seconded bureaucrats, Harvey, 16 November 2006, Linda, 19 January 2007). *SiHH* had one writing team that consisted mainly of primary and junior educators, who were not necessarily science specialists. They worked intensively over a period of one week to write a first draft. A prior meeting with the *SiHH* advisory committee provided ideas of what should be in the document. Harvey recalled that a professional writer, hired for the writing session, took the ideas that the writing team had brainstormed, discussed and written on charts and produced a written summary each day for the team to review. The development of *SiHH* was internal amongst the practising school board educators selected to be involved in the process.

> The writing team if I remember correctly was made up of 8 people. They had to be representative of school boards but primarily classroom teachers. ... My perception of the way that document [*SiHH*]was put together. It was a primary education document and the people who had the greatest influence on it were primary educators. (Interview: Harvey, seconded bureaucrat, 16 November 2006)

Draft documents were distributed for a broad review within the education community. Project leads and Ministry project managers reviewed and assessed the feedback and decided which to incorporate, which to discard or which needed further discussion with others. As Linda commented, it was a “closed shop” among educators who controlled and made the decisions regarding the development and content of *SiHH*. The process did not include politicians or non-education actors who were expressing the need for standards and centralised curriculum by the government.

OS:IS Science

The writing of *OS:IS Science* was led by school board science consultants who in turn led writing teams for the different areas of study in science. Participants who were involved in the process recalled that writing teams were composed of secondary science classroom teachers, secondary science department heads and school board science curriculum consultants (Interviews. seconded bureaucrats: Bill, 5 September 2006, Linda, 19 January 2007; permanent bureaucrat: Carl, 19 September 2006; Yvette, 21 August 2007; curriculum writer: Curtis, 16 July 2007). Writing teams chose, discussed and wrote the content for draft documents. Input and feedback was provided by advisory teams. Recollections of participants regarding the development of *OS:IS Science* were of a process that was fairly transparent to the science education community. David, a secondary science school board consultant, commented:

> It wasn’t that they suddenly released this document that we didn’t know anything about. We probably had a lot of talk for years before it really came out. (Group interview: 26 September 2006)

As with *SiHH*, the development of *OS:IS Science* was internal within the education community including education bureaucrats. This is noteworthy here for comparison to the development processes used by other governments in subsequent chapters.

Final approval to release these curriculum documents to school boards followed a basic formalised procedure (Interview: Linda, seconded bureaucrat, 18 January 2007). The Minister of Education was informed by the Deputy Minister about the completion of the documents through a briefing note. This included any anticipated issues that the Minister might have to answer in the Legislative Assembly or the media. One of these issues identified by Linda was the inclusion of evolution in the biology curriculum.

> In science the hotspot in biology was evolution at the time. There was a fairly strong objection to the teaching of evolution. I do recall there was a significant groundswell against the teaching of evolution and we had to meet with a lot of people. (Interview. 19 January 2007)

James, a developer of textbooks, recalled that there was a movement “to have certain books taken off the Ministry approved resource list because they had evolution in them” (Interview: 8 January 2007). Similarly, Bill also mentioned that there was controversy about including evolution as the natural selection of species survival in *OS:IS* senior biology courses (Interview: 5 September 2006).

This issue arose in the media once the *OS:IS Science* biology curriculum was released as noted in Strauss' *Globe and Mail* article 'Creationists, opponents criticize new school guidelines on biology' (Strauss, 1988). At issue was that equal time should be given to teaching evolution and creationism since they 'are completed acts in the past [thereby] neither can be proven nor disproven' (Reycraft, 1990a, 1990b; Smith, 1990; Smith, 1989a, 1989b). This view of evolution as a 'completed act' indicates a lack of scientific understanding about its core premise that species survival evolves over time; indeed, it is the premise of any scientific theory that it is subject to change whenever evidence consistently shows that this is required. Petitions to include creationism alongside evolution were presented by elected members of the Legislative Assembly with some of them signing the petition along with their constituents whereas others presented the petition on behalf of their constituents. Although creationism was not added to the *OS:IS Science* biology curriculum or mandated to be included in the teaching of biology, it did continue to be a source of petitions in subsequent governments (Wood, 1998; Carrol, 1996; Cunningham, 1991e; Cleary, 1991), signalling its controversy.

One would presume that the public release of *OS:IS* curricula would signify the government's approval of this curriculum yet the political discourse suggests otherwise. This is most notable in a statement by Chris Ward, Education Minister in 1988, who announced that in January 1989, there would be a review of *OS:IS* (Ward, 1988). Ward, who was responsible for approving the release of these curricula for implementation, was presumably well aware that the implementation process had just begun and that not all *OS:IS* curricula was finished. In fact, his statement for this review was made the same year as the public release of seven

OS:IS Science documents (Ontario. Ministry of Education, 1988b, 1988c, 1988d, 1988e, 1988f, 1988g, 1988h) and a year after the release of six other *OS:IS Science* documents (Ontario. Ministry of Education, 1987b, 1987c, 1987d, 1987e, 1987f, 1987g). Furthermore, in the case of *SiHH*, a year after its release, the government announced that changes would be made to the curriculum for Grades 1 to 6 (Alexander, 1989). These statements were announced to the education community to expect new curricula whilst they were in the midst of implementing recently released curricula! Similarly, these statements announced to the public that the government was taking action on their concerns and acting on recommendations by the non-education policy influencers. Interestingly my data did not show evidence of any groups of actors questioning the use of government funds for new curriculum when current curricula were barely in the hands of school boards and teachers.

Ward's political announcement calling for new curricula either reflected the government's lack of understanding about implementing curricula or a lack of commitment towards the curricula that they released. Regardless, curriculum policy was gaining political significance for politicians. Parents, business, industry, and the public who were dissatisfied with Ontario's education system were pressuring politicians to act. New curricula were one way the government could show action.

5.5.3 *SiHH* and *OS:IS Science* content

5.5.3.1 Economy and the global marketplace

Using the science curriculum components instrument described in Chapter Four, an analysis of the text in both *SiHH* and *OS:IS Science* portrayed a world increasingly shaped by science and technology, and reliant on its products. Students were to develop an appreciation for what scientists do and what science and technology offered to society (Ontario. Ministry of Education, 1988i, 1987b).

SiHH's introductory sections stated that the primary and junior science and technology programs should encourage students to 'appreciate the scientific and technological contributions of Canadians' (Ontario. Ministry of Education, 1988i, p.6), to 'feel competent, and therefore self-confident, in a society that uses and is influenced by science and technology', and to relate applications of science to their own and other's needs (Ontario. Ministry of Education, 1988i, p.17). Learning opportunities were written to help students become 'active, concerned participants in society' (Ontario. Ministry of Education, 1988i, p.5, pp.22-31). Clearly *SiHH* conveyed that science and technology were necessary for themselves and for society. These messages reflected the government's support for science education.

> The Ministry of Education recognizes that scientific and technological literacy is a vital part of education. ... However, I believe we can do more in science education in Ontario.... One of the central messages in science education must be that science is a part of all our lives. Science is not just for the scientists, the university-bound student or only for boys. Science is for everyone (Conway, 1986).

SiHH positioned science as part of an integrated program (Ontario. Ministry of Education, 1988i, p.33) rather than as a distinct subject. The Preface stated that this new curriculum supported and extended the aims in the environmental studies section of *Education in the Primary and Junior Divisions (P1J1)* (Ontario. Ministry of Education, 1975b, p.3). The distinction of science as a separate subject began at Grade 7 (12-years-old) which is the beginning of the intermediate division (Grades 7 to 10) and was the first *OS:IS Science* grade. What is surprising about this view of science in *SiHH* is that it was contrary to the announcement by the government about developing a curriculum specifically for primary and junior school science. In the quote above, the government plainly indicated its support of science education and furthermore had announced a $3-million program to renew this curricular area in the primary and junior divisions (Conway, 1986). The approach in *SiHH* was also contrary to the government's support of the recommendation of the Science Council of Canada's report for jurisdictions to move beyond a token experience for elementary students and to guarantee science education in every elementary school (Conway, 1986; Canada. Science Council of Canada, 1984, pp.33-34). This is an example of policy actors, in this case, educators, leading the writing of curriculum and asserting their values despite the government's pronouncements. It illustrates that curriculum policy is value-laden (Cuban, 2008; Ungerleider, 2003) and that actors may have conflicting or competing values about the purposes of science education and seek to influence the agenda to their own views.

The emphasis in *SiHH* on skill development, both throughout the introductory text and in the learning opportunities, suggested support for an economic argument (Ontario. Ministry of Education, 1988i, pp.5, 7, 9, 18-19, 22-29) but this conclusion cannot be drawn here. A process-view of learning science had gained prominence among science educators as an important component of a school science program (Miller and Driver, 1987; Driver, 1983; AAAS, 1965). Given the comments of participants who were responsible for implementation of *SiHH* or those who were involved in its development, I argue that it is the influence of the latter that is reflected in this curriculum document. David, who had responsibilities to implement *SiHH*, recalled, "We were trying to get them [teachers] to [do]more inquiry-based than opposed to just, you know, here's the anatomy of a frog. Learn it. Which is what a lot of people thought was science." (Group interview: 26 September 2006).

Statements in *OS:IS Science* supported the government's positioning of the importance of science and technology both for societal needs and for economic growth; for example, *OS:IS Science Part One* had statements such as 'many of the current and future needs of students and society relate directly or indirectly to science' and 'much human knowledge, which is the major resource of the post-industrial era, along with its processing and retrieval is rooted in science' (Ontario. Ministry of Education, 1987b, p.6). One of the 11 aims of *OS:IS Science* was to raise students' awareness that many careers require familiarity with science and that this 'will increase as many traditional jobs are replaced by high-technology employment' (Ontario. Ministry of Education, 1987b, p.11). This is similar to the economic concerns expressed by government, business and industry at that time; however, *OS:IS Science* gave emphasis on school science as a high priority due to an increasingly science and technology oriented society (Ontario. Ministry of Education, 1987b, p.7). No similar explicit statements were noted in *SiHH*.

Both *SiHH* and *OS:IS Science* conveyed that one of the purposes of learning science was that it was an important component of everyday life (Ontario. Ministry of Education, 1988i, 1987b). In that sense, these documents could be seen as supporting a notion of scientific literacy for all. As noted in Chapter Two, scientific literacy had evolved since the 1950s as a legitimized goal of school science but did not resolve its dichotomy of purposes. A closer examination of the learning requirements in both *SiHH* and *OS:IS Science* showed a notion of scientific literacy as looking inwards towards science with a focus on knowledge, skills and applications or what Roberts' (2011) called Vision I scientific literacy. Students were required to know about fundamental science concepts and skills, and to understand how science impacts on their lives and on the environment. I analysed the depiction of scientific literacy across all four governments to note whether this changed over time.

5.5.3.2 Specificity and standards

Using the three analytical instruments described in Chapter Four, the text of the science curriculum documents were analysed regarding their structure and specificity. This enabled comparison of these documents with the political and public discourses regarding what should be in the curriculum documents.

The *SiHH* and *OS:IS Science* curricula were less influenced by the discourse of standards and achievement advocated by politicians, industry, business and the public and more influenced by the views of educators involved in the processes of constructing the documents, and by the philosophies and reforms within both education and science education. Educators, both within the bureaucracy and in school boards had greater influence on the Peterson Liberal science curriculum documents than political and global discourses about standards.

SiHH reflected the child-centred philosophies of the *Hall-Denis Report* (Hall and Denis, 1968) and *The Formative Years* (Ontario, Ministry of Education, 1975b) and *Education in the Primary and Junior Divisions* (Ontario, Ministry of Education, 1975a) curriculum guidelines. Influential to *SiHH* and *OS:IS Science* was also the *Science for every student* study (Canada. Science Council of Canada, 1984) advocating science literacy for all and that the inclusion of technology and the role and impact of science in society was part of studying science.

SiHH de-emphasized knowledge. The message of *SiHH* to policy implementers was for science programs to be integrated and child-centred with a focus on the processes and skills related to science rather than attaining specific conceptual knowledge. This was consistent with the child-centred philosophies that the Ministry of Education bureaucrats had been implementing since the 1970s. It is also illustrative of a bureaucracy leading curriculum content. Within a political arena calling for standards and accountability, *SiHH* stated that conceptual understanding was to develop 'from the perspectives of the children rather than from the concepts themselves' (Ontario. Ministry of Education, 1988i, p.19). Technology learning opportunities encouraged 'awareness of and involvement with simple technologies rather than acquisition of detailed knowledge' (Ontario. Ministry of Education, 1988i, p.21). Teachers were to provide learning opportunities for students to explore, inquire, ask questions and enjoy the process of discovery (Ontario. Ministry of Education, 1988i, pp.11, 15, 41). *SiHH* stated that students' understanding was 'embodied in the child's response to the experience' not in demonstrating attainment of a specific learning (Ontario. Ministry of Education, 1988i, p.21). This flexibility is in contradistinction to actors calling for the government to develop standards and specificity. It reflects the earlier comment by Bill about the views of Ministry bureaucrats who were leading the development process of *SiHH* in being resistant to the government's direction for specifics and standards in elementary curriculum.

In accordance with *OS:IS* policy, *OS:IS Science* curricula for Grades 9 to 12 were organised into three streams of advanced, general and basic. The exception was OAC, because these courses were specifically for students who intended to go to university. I focus a discussion about my analysis on two points: the public demands for a common curriculum; and, secondly on the recommendations for a destreamed Grade 9.

The design of *OS:IS Science,* with its different categories of learning statements, and mandatory and optional units, gave teachers flexibility and contributed to inconsistencies in what students would learn within a grade. This is contrary to the demands for a common curriculum. Having flexibility would also make it difficult to set standards; for example, a teacher could select from a choice of optional units to make up the required 110 hours per course for Grades 9 to OAC, and the 80 hours per grade for each of Grades 7 and 8 (Ontario. Ministry of Education, 1987b, p.20). Given the recommendations to have a destreamed common curriculum for all students in Grades 9, this is particularly significant. For example, the *OS:IS Science* Grade 9 basic-level curriculum only had one 30-hour mandatory unit with a majority of the remaining 80 hours of instruction for teachers to choose which optional units they would teach (Ontario. Ministry of Education, 1987g). In comparison, the *OS:IS Science* Grade 9 advanced-level science curriculum had five 16-hour mandatory units comprising of 80 hours, and a choice among three optional units for the remaining hours of instruction (Ontario. Ministry of Education, 1987f). Students graduating with the required credit for Grade 9 science would have different knowledge and skills depending on whether they had taken advanced, general or basic courses. This inconsistency was an area of concern for those recommending destreaming Grades 9 and 10 and creating a common core curriculum for all students. The intent of the *OS:IS* curriculum was to provide flexibility for teachers to plan courses that could vary based on student interest, and local needs while still providing a core set of units that all students would learn (Ontario. Ministry of Education, 1987b). The result was that what students learned could vary within a school and across the province.

As both *SiHH* and *OS:IS Science* required approval at the political level by the Minister of Education before they were publicly released, the discourses in the political arena and the curriculum development arena as to the purpose, structure and specificity of the documents seems contradictory. In the political arena actors wanted reforms to centralise and specify what students were to learn in a common curriculum. In the curriculum development arena, educators wanted flexibility for teachers to have choices as to what students would learn and to decide this at a local level. Although the demand for standards and more specificity was not realised through *SiHH* or *OS:IS Science*, the political and public discourses clearly indicated public dissatisfaction with the government's curriculum.

5.5.3.2 Accountability in the curriculum

SiHH and *OS:IS Science* made no mention of provincial, national or international accountability measures. The emphasis was on local enactment of curriculum within the classroom, a school and its community (Ontario. Ministry of Education, 1988i, 1987b). Both *SiHH* and *OS:IS Science* emphasised teacher classroom practice. This was expected as curriculum is enacted locally within the classroom. A noticeable difference between *SiHH* and *OS:IS Science* was the direction that was provided to teachers regarding evaluation and reporting.

In *SiHH* the emphasis on assessment and evaluation was to provide feedback to students and to inform day-to-day and long-term planning (Ontario. Ministry of

Education, 1988i, p.35). Outside of classroom assessment, mention was made of an Ontario Assessment Instrument Pool (OAIP) for the Junior Division. Its purpose was not as an accountability measure but as a source of practical science activities for teachers to use at their discretion (Ontario. Ministry of Education, 1988i, p.35).

By comparison, each *OS:IS Science* document had a specific evaluation section for each course. This provided assessment pressure for Grades 7 to OAC teachers as to how they should be allocating percentages of marks. Evaluation practices were to be included on course outlines so that ‘parents, principals, and supervisory officers should be able to receive an explanation of how student grades are determined’ (Ontario. Ministry of Education, 1987b, p.72). Regardless, there was no centralised monitoring of this practice outside of the OAC-TIP program mentioned in the previous section. Furthermore, different courses and different streams had different allocations. This led to grades that represented various combinations of knowledge, skills, applications and attitudes depending on the teacher’s marking scheme. In general, the *SiHH* and *OS:IS Science* curriculum documents were not structured for the accountability measures that were being demanded by politicians, the public, business and industry.

5.6 Chapter summary

During the Peterson Liberal governments, Ontario’s education system was not an auditable commodity but the discourses in the political arena by politicians, business, industry, the general public and the media signalled a shift in this direction. They were demanding standards and accountability towards greater efficiency and effectiveness of Ontario’s education system. Influencing these discourses were concerns over an increasingly globalised marketplace and having a workforce that could compete within this marketplace. Market-oriented rhetoric gained ascendency and education was not immune as non-education actors presented economic arguments as a purpose of education. Curriculum reform was typically rationalised as a means to provide students with the skills and competencies that Ontario's future workers were expected to need in an increasingly globalised world. Accountability measures emerged in the form of Ontario's participation in international tests, and provincial reviews of *OS:IS* curriculum implementation.

Within this political arena, science curriculum documents were developed spanning all elementary and secondary grades. Discourses surrounding their development were by educators and for educators. An analysis of their development processes and content suggests these did not reflect the political discourses concerning standards and accountability measures by non-education actors. There were two parallel discourses, both occurring within the same time period, but seemingly unconnected.

The next chapter presents the findings related to the origins, processes and content of the science curriculum documents developed by the NDP government and the political arena surrounding their development. Comparisons are made to this chapter where relevant to illustrate that over the 23 years examined in this study, science curriculum policy evolved as governments shaped policies to transform Ontario's education system into what Power (1994) refers to as an auditable commodity.

Chapter 6 New Democratic Party government 1990-1995

6.1 Introduction

In 1990, political control shifted from David Peterson's Liberal Party to the New Democratic Party (NDP) with Bob Rae as their leader. For the first time in its history Ontario had an NDP government. Its mandate began by adopting the five-year education reforms announced by the Peterson Liberals in 1989, renaming them, *Restructuring of Education for the Future* (Ontario. Ministry of Education, 1990a). One result was new curriculum for Grades 1 to 9. Five years later, by the end of their mandate, they announced a series of new reforms (Ontario. Ministry of Education and Training, 1995d). Similar to the previous government, they were unable to act on these as an election was called and they were voted out of office.

The NDP began their governing mandate with an inaugural throne speech that indicated their view as to who could participate in shaping policy decisions:

> As a group of people accustomed to being on the outside of the established power structures in Ontario, my government will open Queen's Park to those who have never before had an effective voice in the corridors of power. It is a government that will listen to the people and respond to their needs to the best of its ability (Alexander, 1990).

Indeed, as shown in this chapter, the NDP curriculum included the opportunity for input and feedback from Ontarians both inside and outside the education sector. This process clearly differed from Linda's description of the "closed shop" model used by the Peterson Liberals as was mentioned in the previous chapter. This involved groups of actors outside of the education sector responding to the new curriculum through their own perceptions and expectations. The development of the NDP curriculum was multi-dimensional, dynamic and interactive, and inherently political.

This chapter continues with the organisation used in the previous chapter. It begins with an overview of the NDP science curriculum. Unlike the Peterson Liberals there was more than one version of their curriculum that was publicly released. This is followed by a section presenting a brief political orientation of the NDP government. This chapter then unfolds into two major sections as was the case in the previous chapter. The first section presents the political arena within which the NDP's education and curriculum reforms were formulated and generated. It begins with a sub-section presenting an analysis and discussion that illustrates the evolution of the NDP education reforms from adopting the Peterson Liberals reforms to new ones encompassing neoliberal needs for increased accountability. The seeds of transforming Ontario education into an auditable commodity that had been sown during the Peterson Liberals' governments took root and were nourished by the NDP during the second half of their time in office. The second major section focuses on the new NDP science curriculum and how the political arena influenced its development processes and content. Both sections continue with sub-sections related to the three themes of global marketplace, standards, and accountability.

Findings for this chapter were based on an analysis of documents as summarised for this government in Appendix B and an analysis of the comments from participants who were interviewed or participated in focus groups and had experiences related to the development of the science component of the NDP curriculum. Table 6-1 summarises their positions and pseudonyms as used in this chapter. A discussion of the findings also takes into account the analysis of the previous chapter to note any trends and patterns that emerged across these two governments.

Table 6-1 Summary of participants with experiences related to the NDP science curriculum policy

Experiences/ Positions	Individual interviews	Focus group participants
Ministry of Education bureaucrat (seconded)	Lydia	
Ministry of Education bureaucrat (permanent staff)	Corey, Tom, Vern, Yvonne	
Elementary teacher	Aaron, Sabrina	Grant (FG-2)
Secondary science teacher	Allan, Cate, Wyatt	Evelyn (FG-1) Felicia (FG-1) Harriet (FG-2) Julia (FG-2)
School board science consultant	Edward	Daniel (FG-1) Ian (FG-2)
Senior school board administrator	Ida, Xandra	
Resource developer	James, Zack	

6.2 Overview: NDP science curriculum

The NDP government released a new curriculum called *The Common Curriculum Policies and Outcomes, Grades 1-9* (Ontario. Ministry of Education and Training, 1995f), or more commonly known as *The Common Curriculum*. Science was part of an integrated Mathematics, Science and Technology program area and was not presented in separate documents as was the case with the Peterson Liberal science curricula for these grades.

The Common Curriculum replaced five science curriculum documents developed by the Peterson Liberal government. These were *Science is Happening Here* (Ontario. Ministry of Education, 1988i) and the four *OS:IS Science* curriculum for Grades 7 to 9 (Ontario. Ministry of Education, 1987d, 1987e, 1987f, 1987g). It also replaced two elementary curriculum guidelines from the mid-1970s that had influenced a child-centred pedagogical approach to teaching in the elementary grades (Ontario. Ministry of Education, 1975a, 1975b). There was no change to *OS:IS Science* curriculum for Grades 10 to OAC. These remained the policy for these four grades and their related courses throughout the NDP's mandate.

Three versions of *The Common Curriculum* were released between 1993 and 1995: a working draft; a version for parents and guardians; and, the final policy document. The working draft version invited educators and the broader public to submit suggestions on how it could be improved (Cooke, 1993a; Ontario. Ministry of Education and Training, 1993d). The second version was called *The Common Curriculum Grades 1-9: Version for parents and the general public* (Ontario. Ministry of Education and Training, 1993c). The working draft had been criticised as being written in unintelligible education jargon (Cunningham, 1994; Papp, 1994; Walkom, 1994). The government paid an outside agency to have the document rewritten into plain language (Gidney, 2002; Cunningham, 1994; Walkom, 1994). The intent was to make the language of the document more accessible to the general public. The third *Common Curriculum* was the final policy document (Ontario. Ministry of Education and Training, 1995f). It was released during the NDPs final governing year in 1995.

6.3 Political orientation

In 1990, the NDP formed the first social democratic party government in Ontario's history. The election of the NDP to a governing party with only 37 per cent of the popular vote was not only a shock to the electorate but also to the party (Rachlis and Wolfe, 2001; Williams, 2001; Ehring and Roberts, 1993). This surprising victory seemed out of place for Ontario (White, 2002; Tanguay, 1997).

As a government they were highly inexperienced. Of the 74 party members who had been elected, only 17 had previous experience as elected members of the party. None had any experience being part of a provincial government, either as a member of parliament or as a member of the cabinet (Rachlis and Wolfe, 2001). They were ill-prepared to govern (Rachlis and Wolfe, 2001; Ehring and Roberts, 1993). Compounding the challenges they would have with their inexperience was the high degree of uncertainty that existed between new Ministers and the government's bureaucracy. Rachlis and Wolfe (2001, p.337) commented that 'The public service was even less prepared than the NDP for a change in government'. The bureaucracy had assumed that the Peterson Liberals would return to office and had to scramble to acquaint themselves with the NDP election platform and translate their own priorities into its language (Cameron and White, 2000; Rachlis and Wolfe, 2001).

The NDP's inaugural throne speech outlined their principles of social justice and equity in their governing priorities such as sharing wealth that is created, providing a decent quality of life for all Ontarians, and, reducing the poverty and inequality in Ontario (Alexander, 1990). In spite of the challenges that they faced as an inexperienced government, they tried to adhere to their socialist principles and enacted policies related to welfare support, pay equity, employment equity, child care and long-term care, the minimum wage, and advocacy for vulnerable and disabled people (Rachlis and Wolfe, 2001). However, in their attempts to govern for all Ontarians, their inexperience alienated their traditional union and labour supporters and they were abandoned by the corporate and business communities (Williams, 2001).

Although the NDP's roots lie in a social democratic ideology, Ontario's major political parties shift their ideology to gain and remain in power (Williams, 2001). Ehring and Roberts' (1993, p.356) comment is illustrative of this regarding the NDP's time in office:

> Now in government, the Ontario NDP has proven to be what many people worried it would be: a party of the political centre much like the others. Defying the laws of both physics and politics, the NDP has occupied the same space at the same time not just as the Liberals but also as the Conservatives as well.

As shown in this chapter, their policies in education illustrate this shift of moving to the right after the NDP's initial education agenda failed to resonate with the electorate.

6.4 Section One: Political arena

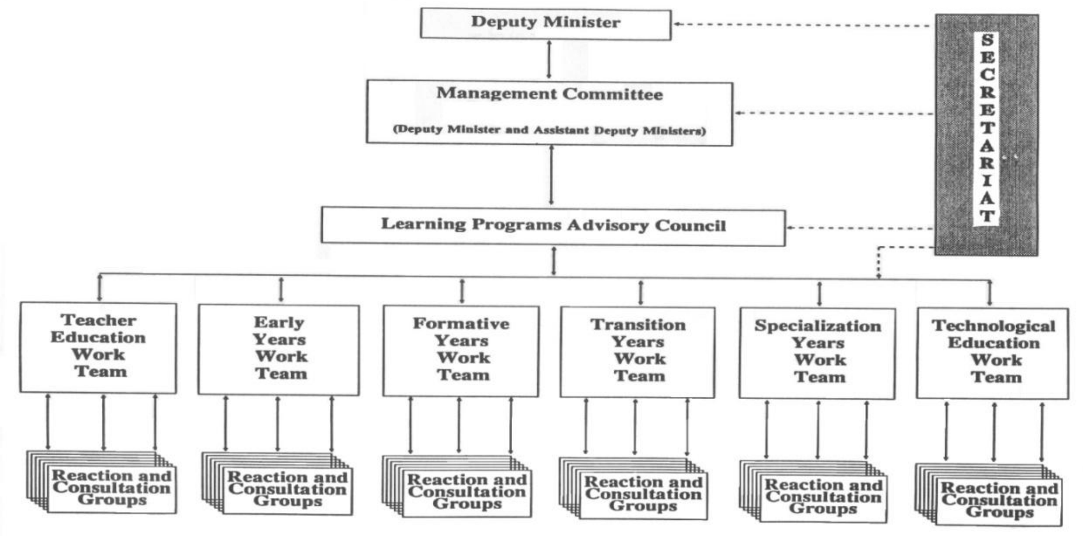
This section outlines the political arena within which the NDP science curriculum emerged. As mentioned earlier, unlike the Peterson Liberal science curricula, in the NDP curriculum, science was integrated and not portrayed as a distinct subject. In order to examine influences on science curriculum policy for this government, it is important to understand the broader processes and issues that surrounded the development of *The Common Curriculum*. The first sub-section provides an overview of the NDP policy-making process that resulted in this curriculum and the controversies that surrounded its development. The three sub-sections that follow discuss this political arena more specifically with respect to the global marketplace, the continued call for standards and accountability measures. This analysis sets the context for Section Two which provides further examination of how science is represented and outcomes were developed within the Mathematics, Science and Technology strand of *The Common Curriculum*.

6.4.1 Education and curriculum reforms

As with any new government, the NDP had to design a policy-making system to suit their priorities and style of governing. With a large number of inexperienced elected members, Bob Rae opted for expanding the capacity for policy-making and analysis within the cabinet office (Cameron and White, 2000; Wolfe, 1997). One outcome of this change was that NDP politicians had more involvement in the approval process for the final release of *The Common Curriculum* (Interview. Tom, permanent staff bureaucrat, 18 April 2007). As noted in the preceding chapter, this differed from that of the Peterson Liberals where the Minister of Education had the authority to release curricula. The NDP decision-making process meant that final approval to release *The Common Curriculum* was required by the cabinet committee and not just by the Education Minister as was the case with the previous Peterson Liberal government (Interview. Lydia, seconded bureaucrat, 19 January 2007; Tom, permanent bureaucrat, 18 April 2007).

Another outcome of this changed process was the shift in power from Ontario's tradition of a decentralised system where deputy managers enjoyed autonomy in managing the business of their departments to one that was centralised to cabinet (Wolfe, 1997). As noted in the previous chapter, the curriculum policy-making of the Peterson Liberal government was centred within the Ministry of Education and controlled by its bureaucracy. When the NDP formed the government, a Learning Program Secretariat was created to manage the planning, consultation, policy development and implementation of the NDP's education reform (Ontario. Ministry of Education, 1990a). As noted before, this reform was based on the restructuring of elementary and secondary education that the Peterson Liberals had announced at the end of their governing mandate (Alexander, 1990; Ontario, Ministry of Education, 1990a). This involved curriculum reform in the areas of early years (Kindergarten), formative years (Grades 1 to 6), transition years (Grades 7 to 9), specialization years (Grades 10 to OAC), as well as areas of technological education and teacher education. A two-year province-wide consultation related to this reform was organised within the structure of the Secretariat as shown in Figure 6A (Ontario. Ministry of Education, 1990a, p.9). A resulting document was *The Common Curriculum*.

Figure 6A Consultation process for *Restructuring Education for the Future* policy directions (Ontario. Ministry of Education, 1990a, p.9)



As described in the document, *Restructuring Education for the Future* (Ontario. Ministry of Education, 1990a), members of the various committees were answerable to the Learning Programs Advisory Council. This Council included representatives of provincially-based organisations, labour, business and parents. They reacted to and advised the Ministry on all aspects of the policy development process. For example, they reviewed all consultation papers that were developed by the various Work Teams prior to their release to the Reaction and Consultation

Groups. Representation in these groups included organisations, groups and agencies that had requested formal involvement into the education reform consultation processes such as professional science teacher associations. The Reaction and Consultation Groups received the consultation papers and were invited to give their feedback.

The Work Teams were significant to this structure as their task was to write the consultation papers and manage the feedback from the Reaction and Consultation Groups before a final version of the consultation papers were disseminated throughout the province. These Work Teams consisted of approximately eight educators who were bureaucrats and representatives from the education system. These educator-led Work Teams were answerable to the Learning Programs Advisory Council (Ontario. Ministry of Education, 1990a, p.5).

The Secretariat and resulting consultation process was designed to maximize participation of major stakeholders to develop direction, come to agreement on major policy changes and to identify preferred options (Ontario. Ministry of Education, 1990a, p.5) or as explained by Minister of Education Marion Boyd in the Legislative Assembly:

> This is an education system that needs to win the consensus of all Ontarians, and that is exactly what the process is designed to do' (Boyd, 1991f).

However, having input is not the same as having decision-making authority. Since Work Teams, comprised of educators including education bureaucrats, were responsible for writing the consultation papers, a direction was already predetermined and groups could only be responsive to what was presented. In that sense, educators were still leading the reforms, although the process had broadened to other actors being involved in providing feedback on the direction that these reforms would take.

A criticism expressed by Diane Cunningham (1991a), who was the PC education critic was that was that the Work Team's documents were not all simultaneously released for response and feedback; for example, the transition years (Grades 7 to 9) consultation document came before the document on specialization years (Grades 10 to OAC) had been released (Cunningham, 1991a). The significance of this to curriculum policy is that providing feedback on reforms for Grades 7, 8 and 9 without knowing what was being considered for specialization years or for that matter for formative years (Grades 1 to 6) removes the opportunity to design a holistic curriculum policy for the restructuring of Kindergarten to OAC. As it turned out, the curriculum for the specialisation years (Grades 10 to OAC) remained unchanged and new curriculum was only developed for Grades 1 to 9. This curriculum had a different structure, format and approach from the *OS:IS* curricula that continued to be used in the remaining secondary grades. This created a challenge for secondary school teachers and described as follows.

The Common Curriculum was organised by grade groupings, one of these being Grades 7 to 9. The inclusion of Grade 9 in *The Common Curriculum* and the discontinuation of the *OS:IS* Grade 9 curriculum documents was due to the government's policy to destream Grade 9. This had been a recommendation to the Peterson Liberal government by various policy influencers and was discussed in the previous chapter. The NDP government's intent was that destreaming would provide equity of common learning outcomes for all students, at least until the end of Grade 9 (Ontario. Ministry of Education and Training, 1994a; Campion-Smith, 1993; Ontario. Ministry of Education, 1992a; Silipo, 1992; Sheppard, 1992a; Boyd, 1991a). This intent became lost with the criticisms about *The Common Curriculum* working draft when it was released in 1993, as well as criticisms about the overall lack of government support to implement this policy (Daly, 1993a; Ritchie, 1993b; Vincent, 1993; Walker, 1993c, 1993d; Arnott, 1992; Beer, 1992a, 1992b). Newspaper articles reported the concerns of teachers and school board administrators on implementing the destreaming policy due to lack of funds, no new curriculum, inadequate training of teachers and lack of resource support (Gidney, 2002; Beer, 1992a; Ferguson, 1992; Walker, 1993a; Crawford, 1993; Daly, 1993a, 1993c; Ritchie, 1993a; Vincent, 1993).

The release of *The Common Curriculum* working document may have been a culmination of the NDP's education reform efforts for Grades 1 to 9 but it did not address the concerns mentioned above. In Ontario, Grade 9 is taught by secondary school teachers whereas Grades 1 to 8 are taught by elementary school teachers. They are typically in different buildings and in different locations, and in different teacher unions. In addition, secondary schools, being larger, have more than one elementary school that they draw upon for the enrolment of Grade 9. In order to implement the curriculum for the destreamed Grade 9, secondary teachers would need to work with their elementary colleagues in Grades 7 and 8 to coordinate what would be taught. The broad curriculum outcomes for this grade grouping did not differentiate among these three grades. This would require teachers to make time for collaborative planning, thereby increasing their workload. Furthermore, teachers who had been teaching with the Grade 9 *OS:IS* curriculum would have noticed a significant difference regarding specificity in comparing *The Common Curriculum* working draft outcomes to the Grade 9 *OS:IS* documents, regardless of whether they were the curriculum for the advanced, basic or general streams. It is no wonder that secondary school teachers had a negative reaction to *The Common Curriculum* (Vincent, 1993; Arnott, 1992; Beer, 1992a; Ferguson, 1992; Innes, 1992; Mitchell, 1992; Sheppard, 1992a).

However, secondary school teachers were not the only group criticising the NDP's curriculum reform. *The Common Curriculum* working draft was also not well-received by the public as illustrated by the *Globe and Mail* headline: 'Revised Curriculum under fire, parents group says proposed changes still amount to 'child-centred learning'(Lewington, 1993c, also see Walkom, 1994; Papp, 1994; Payne, 1994; Daly, 1993b; Ritchie, 1993a). At a time when the electorate was clamouring for more standards and accountability from the education system, *The Common Curriculum* was perceived as vague (Walkom, 1994; Cunningham, 1994; McLeod 1994; Daly, 1993b; Lewington, 1993b; Wittmer, 1993). Tom, a senior career bureaucrat at that time, commented on the government's response to this negativity:

> And here was the government taking on the responsibility for weaving together this learning process in Ontario. And then the disappointment if you will [that] registered with the result, the first version of the curriculum. (Interview. 18 April 2007)

The result was a new political focus on education and on curriculum as discussed in the remainder of this section. The significance to this study is that science was interwoven into the integrated nature of *The Common Curriculum* and therefore not immune to the political and public discourses that were occurring.

One aspect of *The Common Curriculum* working draft that received government attention was criticism of this document as being unintelligible education jargon (Cunningham, 1994; Papp, 1994; Walkom, 1994). Furthermore its structure of broad learning outcomes organised around four integrated program areas and by grade groupings was quite different from the general public's perceptions of curriculum as traditional subject disciplines with specific content expected for each grade. Rita Daly reported in a *Toronto Star* article:

> If you don't understand much of it [*The Common Curriculum*], don't be embarrassed. Premier Bob Rae admits he, too, doesn't understand a lot of the jargon – call it "**edu-babble**" – used in academic circles today (Daly, 1993c, p.A8, bold emphasis mine).

This derogatory reference to the professional language of educators as 'edu-babble' was repeated in other newspapers. Vern, a bureaucrat on permanent staff, recalled, "Bob Rae called it edu-babble and said that if he can't understand it then what change do parents have and so it had to be rewritten in plain language." (Interview. 25 May 2007). Education Minister Dave Cooke went as far as to wearing a button with 'edu-babble' written on it and a slash through it to express his strong views for wanting plain language at the Ministry (Payne, 1994). With their comments, Rae and Cooke were openly criticizing their own bureaucracy who led the process and had written *The Common Curriculum* working document. Whereas *SiHH* and *OS:IS Science* were written for educators as the target audience of curriculum policy, *The Common Curriculum* was available for anyone to read, and as a result the target audience for curriculum expanded to include non-educators. This continued with subsequent governments and elevated curriculum policy to a political communication tool with the next government and discussed in the next chapter.

The NDP government took quick political action on the language criticisms and paid $10,500 to have the document rewritten into plain language by an outside agency (Gidney, 2002; Cunningham, 1994; Walkom, 1994). Consequently *The Common Curriculum Grades 1-9: Version for parents and the general public* (Ontario. Ministry of Education and Training, 1993c) was released that same year to make the language of the document more accessible to the general public but it did not address the criticisms about the vagueness of its learning outcomes. Vern recalled, “The purple [general public] version was shot down in flames.” (Interview. 25 May 2007) As debates about what students should learn were played out in the media, Tom commented that unlike his previous experiences with curriculum, the consciousness of politicians was raised regarding the program aspect of curriculum policy (Interview. 18 April 2007).

If the public release of *The Common Curriculum* was to build confidence in the government’s policy direction for education, politically it had the opposite effect. Premier Bob Rae was quoted in the Globe and Mail as saying:

> I became more and more convinced that somehow the debate had gone wrong and we hadn’t had a focused discussion on how we can respond to what most people’s aspirations are…somehow we have to move this discussion into the 21st century (Lewington, 1993a).

The government’s initial education policy agenda had failed to gain support and the government took action. I mention two of these as each had implications for curriculum policy-making. One was the creation of a provincial parent council to advise the Minister of Education and the other was the creations of a royal commission to conduct a comprehensive view and set new directions for Ontario’s education system. Each is discussed in the following paragraphs.

In September 1993, Cooke announced the creation of the Ontario Parent Council to represent parents' interests at a provincial level and advise the Minister of Education on issues related to elementary and secondary school education (Ontario Parent Council, 1994). This included providing feedback on curriculum documents and in the development of provincial standards. Parent Council members served on Ministry committees that were involved in establishing school councils and developing curriculum, standards and assessment (Ontario Parent Council, 1996; Cooke, 1993b). To be eligible, members had to have children in one of Ontario's elementary or secondary schools and a strong interest and involvement in education or community affairs (Ontario Parent Council, 1996). On one hand, this strategy reflected the NDP's value of parents having the right and responsibility to participate in their children's education (Ontario. Ministry of Education and Training, 1995e). On the other hand it was also a strategy to address parent activists who were dissatisfied with Ontario's school system and were lobbying for change that supported testing, standards and more accountability (Gidney, 2002; Lewington, 1993c, 1992a, 1992b). In February 1995, the NDP strengthened parents' involvement in education when Cooke introduced legislation which mandated school boards to have school councils established in each of their schools by June 1996 (Ontario. Ministry of Education and Training, 1995e). The responsibility of supporting and implementing school parent councils was devolved to local school boards and individual schools. The NDP government was legislating policy that was once left to local school boards to determine. This required school boards to enact policy for which they once had control. The significance of this policy to this study is that the newly legislated school councils had advisory powers on matters such as curriculum goals and priorities, school plans and budgets. This parental involvement in curriculum matters continued to be supported by the next government, and was in fact strengthened as discussed in the next chapter.

On May 4, 1993, in response to increasing public demand for Ontario's schools to be effective and efficient, Minister of Education, Dave Cooke announced the creation of a royal commission to conduct a comprehensive review of Ontario's public education system (Cooke, 1993c; Ontario. Ministry of Education and Training, 1995d). Its purpose was to 'make recommendations about the goals, standards, and programs that will guide Ontario's elementary and secondary schools into the twenty-first century.' (Ontario. Royal Commission on Learning, 1994b, p.5). The five-member Royal Commission on Learning consulted almost 1400 groups and individuals in twenty-seven cities, and received more than 3600 written submissions (Ontario. Royal Commission on Learning, 1994b) including a submission by the Science Coordinators' and Consultants' Association of Ontario (SCCAO, 1993). The Commission had also requested background papers to be prepared in several areas. Among these was an overview of the history of science education in Ontario (Orpwood, 1995a) and three papers on assessment and accountability (Earl, 1995; Nagy, 1995; Orpwood, 1995c). Overall there were 167 recommendations that covered virtually all programmatic, organisational and resource dimensions of Ontario's elementary and secondary education (Ontario. Royal Commission on Learning, 1994b, 1994c, 1994d, 1994e). I will focus on those that were significant for curriculum policy as this had implications for science curriculum.

The Royal Commission raised the same notion that was made in reports during the Peterson Liberals time period in that curriculum should be more centralised to the Ministry of Education (Ontario. Premier's Council, 1990c, 1988j; Radwanski, 1987). As mentioned in the previous chapter, I argue that this suggestion refers to not having localised second generation curriculum documents developed by local school boards and schools. Government curricula had always been centralised such as *SiHH*, *OS:IS* and *The Common Curriculum*; however, these curricula did vary in their specificity. The Royal Commission stated that curriculum writing was more decentralised in Ontario than in other provinces. This adds to my argument that specificity in government curriculum was the issue. The Royal Commission did recommend that more clarity of what was to be taught was needed. It suggested that a centralized specific curriculum would be more efficient and allow 'teachers to focus on teaching without constraining their professional development or creativity' (Ontario. Royal Commission on Learning, 1994c, p.5). This reference to efficiency has financial implications in that school boards would no longer have to spend funds to develop second generation documents if the government curriculum was specific enough for implementation. Although this may be more financially efficient, it removes local autonomy for school boards to interpret the curriculum to reflect the interests of their communities and their students. A centralised curriculum with specificity would contribute to shape Ontario education towards an audit culture. In addition, the Royal Commission suggested that curriculum needed to be written so that it was clear to parents so that they could be 'well-informed, well-respected, and equally powerful partners (Ontario. Royal Commission on Learning, 1994c, p.1). This reinforced the direction noted earlier that teachers were no longer the only target audience of curriculum policy.

The Royal Commission report was not policy. Similar to other reports conducted for the government, any courses of action would be decided by government policy-makers. Data analysis of the government's reform plan (Ontario. Ministry of Education and Training, 1995d) as well government press releases (Ontario. Ministry of Education, 1995b) indicated that the Royal Commission recommendations did influence NDP education and curriculum policy changes (Ontario. Ministry of Education and Training, 1995d). Less than two weeks after the report was released, the government responded with an education reform plan called *New Foundations for Ontario Education* (Ontario. Ministry of Education and Training, 1995d). It summarised major initiatives to be implemented with the goal of having a system that 'focused on the students, dedicated to excellence, and accountable to the public it serves.' (Ontario. Ministry of Education and Training, 1995d, p.2). The NDP's new education reforms placed an emphasis on accountability as an engine of change. Accountability was described as integral and fundamental for reforms. This included reallocating existing financial resources to remove duplication and waste and to direct more funds to classrooms (Ontario. Ministry of Education and Training, 1995d, p.32). The government's new plans were to be practical and affordable with little or no additional cost to the taxpayer (Ontario. Ministry of Education and Training, 1995d, p.4) reflecting the rhetoric of efficiency and effectiveness. This left-of-centre social democratic party took a turn to the right with its new education reforms reflecting neoliberal tenets of accountability, surveillance and regulations.

To assist the government with implementing their new curriculum and accountability policy direction, Michael Fullan was appointed by Cooke as a special advisor (Ontario. Ministry of Education and Training, 1995c). Fullan was then the Dean of the Faculty of Education at the University of Toronto. He was cited by the government as an international expert in educational change and implementation (Ontario. Ministry of Education and Training, 1995c, p.5). The government looked outside of its bureaucracy to put its new policy into practice. However, as with the Peterson Liberals, the NDP education reforms came towards the end of their governing mandate. On June 8, 1995, six months after announcing their new reforms, Ontarians went to the polls and elected a new government.

6.4.2 Economy and the global marketplace

When the NDP began their mandate in 1990, Ontario was entering the worst recession since the 1930s (Rachlis and Wolfe, 2001). Unlike the fiscal restraint that was happening in the rest of Canada, in their first budget, the NDP government approved for the deficit to increase to $9.7 billion. They were determined to fight the recession through government spending to create jobs and by raising taxes. They adopted a Keynesian approach to stimulate the economy disagreeing with the direction of the Canadian federal government’s approach which was using the trickle-down theory (Walkom, 2002). Rae (1996) considered this latter approach as promoting inequality. He did not support a neoliberal view of having the economy stimulated by those who could spend and invest their money in the marketplace to eventually end up in the pockets of the less fortunate. Rae (1996, p.321) stated that he did not believe that a redistribution of income toward the wealthiest automatically produced the best result for everyone. This core principle of equity was reflected in NDP policies including the text of *The Common Curriculum*.

By the winter of 1991, the economy was in deep recession, tax revenues had plummeted, the deficit had mushroomed and there were significant numbers of job losses (Gidney, 2002; Rachlis and Wolfe, 2001; Tanguay, 1997). The recession of the early 1990s stimulated the electorate's resistance to property tax increases, and with over 300,000 job losses by 1993, there was growing resentment against public sector employees who were deemed to have good salaries, benefits and apparent job security. In order to gain control over the budget and a burgeoning deficit, the government announced more tax increases, more spending and a reduction in the costs of the public sector through an initiative called the Social Contract (Gidney, 2002; Walkom, 2002; Rachlis and Wolfe, 2001). The Social Contract was a legislated means for the government to save $2 billion through wage cuts within the public civil service. It required public service employees, including teachers, to take twelve days of forced unpaid leave - referred to as Rae Days, so named after NDP Premier Bob Rae. It froze the wages of public service employees and paved the way for public union collective bargaining agreements to be reopened. Notable to this discussion, is that the provision of funds for the Royal Commission on Learning occurred at the same time as when the government was trying to control Ontario's largest deficit and when public servants were subject to the Social Contract. Three million dollars was allocated to conduct this review, signifying the importance the NDP placed on using this mechanism to set education policy directions for their government and future governments. It was also a political means for them to demonstrate to a discontented electorate critical of *The Common Curriculum* that the government would address their concerns.

Many NDP core supporters including teacher unions, who had actively participated in bringing the NDP to power, felt the government was betraying its traditional labour electoral base and was shifting allegiance to a pro-business right-of-centre agenda (Sheppard, 1992b; Walkom, 1993; Rachlis and Wolfe, 1997; Tanguay, 1997; Gidney, 2002). This perception was mentioned by participants in one of the focus groups. Daniel commented that “teachers’ federations had always tended to be looked upon as more favourable to the NDP” but that there were a lot of political issues related to reception of *The Common Curriculum*. Evelyn’s response that “we had our Rae Days too” resulted in laughter among the other two participants as they nodded in agreement (Focus group 1. 18 June 2007). In his interview, Vern, a Ministry bureaucrat at that time, affirmed that *The Common Curriculum*, “was just not well received. The teachers were up in arms about the Social Contract.” (Interview. 25 May 2007). Julia, a secondary school science teacher clearly remembered the Rae Days and described *The Common Curriculum* “like a little blip” and could not recall what it looked like nor its structure (Focus group 2: 18 March 2008). Lydia commented, “And the way it's [curriculum] perceived by users depends on how they perceive the government as well” (Interview. 19 January 2007). In general, findings indicated that educators’ attitudes towards a curriculum were influenced by their relationships with a government. A major factor contributing to this was how government education policies were impacting on teachers and whether or not governments valued them as professionals. In the case of the NDP, the supportive relationship that they had with teachers and their unions became eroded during their time in office.

Documents examined in this study such as the NDP throne speeches outlining the government's priorities (Jackman, 1993, 1992; Alexander, 1990), and *The Common Curriculum* working and final documents (Ontario, Ministry of Education and Training, 1995f, 1993d) did not indicate that the NDP placed the same importance of science to Ontario's global economic competitiveness as did the Peterson Liberals. Mention was made of the service and high-technology industries as playing a larger role in the knowledge economy (Ontario. Ministry of Education and Training, 1995f). Rae (1996) commented that the progress of the technological revolution was dramatic and its scope was global. This view was also expressed in the Ontario Premier's Council report (1994, as cited in Ontario. Ministry of Education and Training, 1995f, p.7) as follows:

> Technology and global competition are transforming the workplace; a work role that was in demand last year may not exist next year. The days when education stopped after graduation are over.

This emphasis on technology was reflected in the text of *The Common Curriculum* and is discussed in the section on science content related to the economy and the global marketplace.

An electronic search for the word science in all three throne speeches, which outlined the government's priorities (Jackman, 1993, 1992; Alexander, 1990), resulted in zero results for the 1992 and 1990 speeches. By the time the economy was in deep recession and the deficit had mushroomed, science was mentioned. The 1993 throne speech included science as a 'basic skill' along with language and math (Jackman, 1993); however, there was no indication of government action towards more support for science in the curriculum. This was also the case with their new education reforms even though the Royal Commission supported the direction of the *Science for Every Student* study (Canada. Science Council of Canada, 1984) in that science education should begin in the elementary grades and continued to graduation. Their report urged that support for school science be provided through more and better science education for teachers, adequate laboratory resources, and the development of clear and high standards for student achievement (Ontario. Royal Commission on Learning, 1994, p.37). This urgency was not addressed in the new NDP reforms.

6.4.3 Standards

As mentioned earlier in this chapter, there was a public demand for the government to develop standards to measure how well students were achieving. This discourse had begun during the Peterson Liberal government and the PC political party was taking notice. Diane Cunningham, their education critic, described what her party was hearing.

> But I think the big problem in education is that parents are advising us, and teachers and educators across the province ... are repeatedly asking us, grade by grade, subject by subject, for a specified, defined curriculum with standards (Cunningham, 1992).

Her comment is notable given the direction the PCs would take with their curriculum reform when they formed the next government. Their move towards specificity was opposite to the direction that the NDP government took with *The Common Curriculum* and its broad outcome statements.

As mentioned previously, *The Common Curriculum* organised school subjects into four program areas rather than as specific disciplines. This organisation of curriculum was in contradistinction to the expectations of the broader community who expected curriculum to be subject-specific. Interestingly, school boards and schools were not restricted to organise their programs as presented in *The Common Curriculum* and were free to organise them in other ways (Ontario. Ministry of Education and Training, 1993d, p.13, 1995f, p.31). For example, *The Transition Years* policy document for Grades 7 to 9, released a year earlier, stated that schools could continue to develop programs organised according to distinct subjects (Ontario. Ministry of Education, 1992b, p.2). These messages within the Ministry's policy documents are inconsistent with their clear support for integrated programs as stated in *The Common Curriculum* as 'the need to move past narrowly defined subjects and disciplines' (Ontario. Ministry of Education and Training, 1993d, p.13). They also illustrate that curriculum policy including its enactment interacts with other education policies. In this case, there was a lack of cohesion among the government's various reform policies.

The public criticisms in the media about the vagueness in *The Common Curriculum* working draft did not result in significant changes when it was revised to the final version. A comparison of both documents shows that the overall structure, broad outcome statements and lack of content specificity remained in the final *Common Curriculum* (Ontario. Ministry of Education and Training, 1995f, 1993d). However, one notable change between these two documents was the wording of the 10 essential outcomes (see Appendix P). The removal of subject-specificity in the wording of these outcomes seemed contrary to the public discourse for more specificity in the curriculum and the Royal Commission recommendation for the curriculum to have subject specificity. The Royal Commission report had been released prior to the release of the final version of *The Common Curriculum*. In *The Common Curriculum* working draft, each of the first four essential outcomes related specifically to a subject area, one of which was science (Ontario. Ministry of Education and Training, 1993d, p.10). In the final version all references to specific subjects was removed from these 10 essential outcomes. They were all worded supporting a skills emphasis of the curriculum that was generic and not subject specific. This analysis indicates that public concerns and recommendations for subject-specificity were not addressed by educators making the final revisions to *The Common Curriculum*.

The Royal Commission cautioned against having additional curriculum guidelines or support documents that added content without considering what no longer needed to be taught (Ontario. Royal Commission on Learning, 1994c). As to addressing the vagueness of *The Common Curriculum*, they suggested that the Ministry needed to develop documents with more clarity and distribute these to all school boards and schools, rather than have school boards create their own (Ontario. Royal Commission on Learning, 1994c). Indeed, to address the negative criticism about the lack of specificity in *The Common Curriculum*, the Ministry created two new curriculum-related policy documents for language (Ontario. Ministry of Education and Training, 1995g) and mathematics (Ontario. Ministry of Education and Training, 1995h). They referred to these as standards documents and differentiated them from *The Common Curriculum* outcomes as follows. Outcomes were observable and measureable knowledge and skills as to what students were expected to know and do at key stages in their schooling (Ontario. Ministry of Education and Training, 1995f). Standards were indicators of student achievement of these learning outcomes at various levels (Ontario. Ministry of Education and Training, 1995g, 1995h). This connected standards directly to assessment, evaluation and reporting of student performances. These new curriculum-related standards documents formed the basis to assess the effectiveness of school programs and student performance. Technologies of surveillance and control were emerging with this government.

Although *The Common Curriculum* had clustered subjects together so that they could be integrated, the provincial standard document for mathematics made no reference to integration with science and technology let alone other program areas or subjects. Even though these two standards documents were to provide more specificity for language and mathematics; they continued to be organised by grade groupings and did not address the demands for grade specific standards. No provincial standards documents were developed for other subject disciplines, although as the NDP government neared the end of its mandate, it announced that standards for the remaining curriculum areas would be ready by September 1997. This presumed that they would win the 1995 election or that a new government would continue with their policies. Neither of these happened. The overall *Common Curriculum* policy with its supporting standards documents was incomplete for science, and for subjects other than language and mathematics.

6.4.4 Accountability measures

This section begins with the NDP's initial resistance in participating in national and international testing programs, and their decision to proceed with each new program. Using relevant legislative debates as recorded in Ontario *Hansard*, government press releases and newspaper articles, this section will illustrate that as political pressure mounted their decision added to the evolution of Ontario's education system towards an auditable commodity. This is followed by a discussion about the OAC-TIP program that had been initiated under the Peterson Liberals and continued by the NDP government. As mentioned in Chapter Five, this latter program was a means of developing province-wide consistency of implementation of the curriculum for OAC courses; in science this was for chemistry and physics (Ontario. Ministry of Education and Training, 1993a, 1993b; Ontario. Ministry of Education, 1991a). The OAC-TIP accountability measure serves as a comparison to the testing programs that the NDP announced towards the end of their governing mandate.

An accountability mechanism that had begun with the Peterson Liberals was Ontario's participation in international tests to measure the effectiveness and quality of its education system. During the first three years of their governing mandate, the NDP government was inconsistent as to whether Ontario would participate in international testing programs, and in a new Canadian national testing program. Each one of these three years had a different Minister of Education - Marion Boyd 1990-1991, Tony Silipo 1991-1993, and Dave Cooke 1993-1995. Each reversed the decision of their predecessor. These decisions illustrated the NDP government's shift in ideology from the left to neoliberal needs for increased accountability and surveillance. I only focus on tests that included science as one of the subjects being tested, as the results of these tests indirectly reflected on what students learned in school science, and thereby were also a reflection of the curriculum.

In the NDP's first governing year, a new Canadian testing program, mentioned in Chapter Two, called the Student Achievement Indicators Program, or more commonly known as SAIP was being developed for reading, mathematics and science and coordinated through the Council of Ministers of Education, Canada (CMEC). Then Minister of Education Marion Boyd (1991b) announced that Ontario would only be an observer in this program. Boyd (1991a, 1991c, 1991e) was concerned that the tests would not take into account Ontario's demographic diversity and give little or no information that would serve the interests of Ontario's education reforms.

> A standardized testing system allows an outside body – in this case two other provinces whose systems of education are quite different from ours in Ontario – to determine what it is we ought to be teaching our students (Boyd, 1991a).

The government's decision was in solidarity with teacher union perspectives. In a letter to the editor in the Toronto Star, Jim Head (1991, p.D3), then president of the secondary teacher union, applauded Boyd's 'strong stand against national testing' and wrote that teachers were not afraid of accountability. The decision by the government reflected the NDP's commitment to equity and agreement with teachers' concerns about standardized tests as noted by Boyd's (1991d) comment:

> Teachers in this province are very concerned about that [accountability], but they are equally concerned about the way in which standardized tests have been used to further disadvantage the marginalized in our society, and that is what we intend to protect them against. We are absolutely in concert with our professional teaching partners when it comes to ensuring that any testing that is done does not further marginalize children.

The government's decision received criticism in the media and with Liberal and PC parliamentary opposition members who called for its reversal (Beer, 1991; Cunningham, 1991d; Lewington, 1991). Both opposition parties were supportive of having an education system that was accountable to how well students were achieving through standardized testing.

One year later, in 1991, Boyd was replaced as Minister of Education by Tony Silipo. He quickly announced that Ontario would indeed participate in SAIP citing as reasons for this reversal that CMEC would be basing the national assessment on provincial curricula and ensure that the tests would be free from cultural and gender bias and from stereotyping. Provinces would be able to choose the test samples and have adequate time to consult with their educators about the form and content of the tests (Silipo, 1991). Silipo did not address Boyd's concerns that the tests would provide little information given Ontario's demographic diversity. The government's decision had political currency and was applauded by parents, business leaders, trustees, the media and opposition critics. Cunningham (1991c), the PC education critic, who had been vocal in her criticism about the government not participating in Canada's first national assessment program, gave rare praise. 'Parents, trustees and business leaders all applaud the minister's decision to participate in the national testing program.' Underlying her arguments for Ontario to participate was the notion that the results would be an indicator of the market value of education:

> With over $13 billion being spent to educate our children, I think taxpayers, parents and students have a right to know if they are getting value for their money. Our children deserve to know that their education measures up to students in other provinces (Cunningham, 1991b).

Less than two years later, the government did a similar reversal regarding Ontario's participation in the Third International Mathematics and Science Study (TIMSS) that was scheduled for 1995 (Walker, 1993b, 1993c; Lewington, 1993d).

In January 1993, Silipo announced that Ontario would not participate in TIMSS citing that the government did not feel the results justified the time and expense to participate (Walker, 1993c). One month later his position was reversed by Dave Cooke, who replaced Silipo as the first Education Minister of the NDPs newly organised Ministry of Education and Training. In his first days as Minister, Cooke was quoted as saying:

> I want this system to be more accountable and for the public to develop confidence. It won't happen if we continue to be seen resisting accountability (Lewington, 1993b, p.A8).

He was clearly supportive of accountability measures to demonstrate the market value of education, similar to Cunningham's quote. His comments came at a time when the NDP was in the midst of hearing negative criticisms about *The Common Curriculum* and about their fiscal policies. His comments signalled a new political focus by the NDP on education. Ontario did participate in TIMSS and by the time Ontario students' science results were released, a new PC government was elected. The results provided the new PC government with public evidence to support the education and curriculum reforms that it was putting in place.

The NDP's government's resistance to allocating government funds to testing programs during the first years in their governing mandate, had taken an about face. The public wanted evidence of how well Ontario students were measuring up to their peers in other Canadian jurisdictions and countries. Politicians and taxpayers wanted measures of accountability. Cooke moved the NDP towards adopting mechanisms of accountability thereby strengthening neoliberal tenets that were gaining hold in Ontario education. Prior to Cooke's appointment as Minister of Education and Training, the OAC-TIP program was continuing for various subjects, including OAC chemistry and OAC physics. This program was a mechanism for surveillance and accountability created and administered by the Ministry of Education bureaucrats. Its focus was to determine compliance by teachers in implementing the curriculum policy for these courses. If examinations or marking schemes were non-compliant, schools had to take corrective action and resubmit their exams before the school was authorised to provide students with a credit. OAC-TIP was discontinued after 1993. This model of accountability was curriculum-focussed and quite different from the five new provincial programs that were announced by Cooke (1993a). OAC-TIP enabled teachers to continue to set their own examinations provided that they were in compliance with Ministry criteria. This was a different model than having one centralised provincial examination for all students.

A year later when the Royal Commission recommended Ontario should have mandatory provincial testing (Ontario. Royal Commissions on Learning, 1994e), the NDP government announced the creation of a new arms-length agency that would oversee the development of the tests, conduct them and report the results to the public. This new agency, called the Education Quality Accountability Office, or commonly known in Ontario as EQAO would begin testing in September 1996 (Ontario. Ministry of Education and Training, 1995b). Although science was part of national and international testing programs, it was not included in Ontario's new provincial testing program. Only reading, writing and mathematics were to be tested even though by then science was considered as a basic skill along with language and math. The legislation to create EQAO and its mandate was not actualised by the NDP government. Their announcement came at a time when the Legislative Assembly was no longer sitting and an election was called. A few months later the PC government was elected and they introduced legislation for the creation of EQAO and its ordinance (Ontario. Ministry of Education and Training, 1995a).

6.5 Section Two: Science curriculum origins, development processes and content

6.5.1 Origins

As mentioned in the previous section, *The Common Curriculum* was developed as a result of the consultation process for the NDP's restructuring education reform (Ontario. Ministry of Education, 1991b; Ontario. Ministry of Education and Training, 1993d). This was discussed in detail previously in sub-section 6.4.1 and is not repeated here.

6.5.2 Development processes

As *The Common Curriculum* was not structured around specific subjects like science, I used the policy text related to the Mathematics, Science and Technology (MST) program area for my analysis of the development processes and subsequent sections about content. It was this program area that teachers used to determine what content to teach in science for Grades 1 to 9. The data to understand the development processes was gathered predominantly through interviews by participants who were involved in constructing *The Common Curriculum* (Interviews. seconded bureaucrat: Lydia, 19 January 2007; permanent bureaucrats: Corey, 19 September 2006, Tom, 18 April 2007, Vern, 25 May 2007). An informative secondary document was the unpublished Masters of Education thesis by Jenson (1997) which examined the development of *The Common Curriculum* and was written two years after its release.

The development processes related to the MST program area was similar to the Peterson Liberals science curriculum in that the writing was done by educators. The MST writing team consisted of six permanent and seconded Ministry of Education bureaucrats, and two members representing teacher unions (Ontario. Ministry of Education and Training, 1995f, p.112). A difference between this curriculum and the Peterson Liberals science curricula is that both *SiHH* and *OS:IS Science* writing teams included practicing teachers whereas *The Common Curriculum* writing team was mainly written by Ministry bureaucrats. Vern, involved in the writing process, noted that as part of the writing process, the writers consulted with other educators including practising teachers, although the responsibility for the writing remained within the Ministry (Interview. 25 May 2007). In addition, Vern mentioned that the writers had the *Science is Happening Here* document, and the *OS:IS Science* Grades 7, 8 and 9 documents to draw upon. Corey commented that the MST writers would draw upon second generation documents developed by various school boards across the province that were based on *SiHH* and *OS:IS Science* (Interview. 19 September 2006). In this case, *SiHH* and *OS:IS Science* were influencing the science and technology content of *The Common Curriculum*. Corey mentioned that other sources included the influential U.S. science reform developed by the American Association for the Advancement of Science (AAAS) called *Project 2061* (AAAS, 1990).

Thirty-one organisational groups were identified in *The Common Curriculum* final document as being involved in the review process (Ontario. Ministry of Education and Training, 1995f, page 110). There was no indication as to whether they reviewed the whole document or specific sections in the document like the MST program area. Nevertheless, this list reflected the government’s commitment to involve a broad consultation of multiple actors. Included were representatives from 18 educational organisations such as teacher unions, subject associations, school boards, universities, parent-teacher groups and student groups, and 13 organisations from business, labour, publishers, community groups, cultural and religious groups and other Ministries (Ontario. Ministry of Education and Training, 1995f, p.110). This was a change from the Peterson Liberal process where development, review and revision remained within the education community. It should be noted that consultation can be a broad term and listing who was consulted does not convey what feedback was acted on regardless of how many groups were consulted, or if the feedback of any group carried more weight than others. By comparing the policy texts of *The Common Curriculum* working draft, the final document and documentation of public criticisms, it became evident that the public and political discourses were not addressed in the revisions to the final document.

Jensen (1997), in her examination of the development of *The Common Curriculum*, noted that major criticisms of the working draft included: to make the document more usable; to generate more concisely written outcomes; to reduce the overall number of outcomes; to have only one version of the curriculum that was also intelligible to parents; and, to provide a clear explanation of outcomes-based learning. I consider these to be technical criticisms as they do not address the major concerns related to standards and accountability. Indeed in comparing the content of *The Common Curriculum* working draft to its final version, the overall number of outcomes were reduced and more concisely written. However, these revisions did not reflect public, media and the Royal Commission criticisms presented in Section One. *The Common Curriculum* final version continued to be criticised by actors wanting grade-by-grade standards and accountability measures.

Tom commented,

> Education in Ontario certainly has always been a pretty hot button issue with the public. But in this case curriculum in particular had come into focus as something around which the government-of-the-day would have a significant political stake whether it wanted to or not. In the case of *The Common Curriculum* it was specific to a government at that time but I think when the next government came along the criticism were such that they could reform curriculum and the education system once again. (Interview, senior level bureaucrat, 18 April 2007)

A significant influence evidenced by the very nature of *The Common Curriculum* text was the outcomes-based education movement that was occurring in the U.S. and Canada. Based on my practitioner experiences with this movement, I suggest that this was a contributing factor influencing this curriculum document. In the 1990s, Ontario school boards were interested in the broad premise of outcomes-based education as a means of providing success for all students. It claimed to provide greater curricular focus with an emphasis on what students learn and not on what teachers teach. This would result in greater clarity to assess student achievement (Capper and Jamison, 1993; McNeir, 1993). Vern from his experience in writing for *The Common Curriculum*, commented that writers were instructed to write outcomes in an open-ended manner to accommodate individual differences in learning (Interview. 25 May 2007). In outcomes-based education the integration of skills was considered important because it emphasised assessment over time rather than a singular observation (Spady, 1994). *The Common Curriculum* policy texts clearly reflected these two aspects. Indirectly this indicates that education bureaucrats were key actors in constructing *The Common Curriculum*. Outcomes were open-ended such as by the end of Grade 3 students will ‘investigate and describe simple cause-and-effect relationships’ (Ontario. Ministry of Education and Training, 1995f, p.77).This outcome could be demonstrated over time and be applicable to any student in Grades 1, 2 or 3. A skills emphasis was evident through the skills-based verbs that started each outcome and in the previously skills-based 10 essential outcomes.

NDP politicians had little involvement in the curriculum content (Interviews. Lydia, seconded bureaucrat, 19 January 2007; Vern, permanent staff bureaucrat, 25 May 2007); however, in general, *The Common Curriculum* reflected their priorities of equity; a commitment to peace, social justice, and the protection of the environment; respect for human rights; and, to be motivated to fulfil the responsibilities of citizens in a democratic society (Ontario. Ministry of Education and Training, 1993d, pp.10-11). These outcomes characterised the NDP's social democracy ideology.

6.5.3 *The Common Curriculum*/ Mathematics Science and Technology program area content

6.5.3.1 Economy and the global marketplace

The policy texts of *The Common Curriculum* acknowledged that students were living in a changing world. The influence of science and its discoveries as being part of that change was not explicitly mentioned, rather the impact of technology and the importance of students developing skills to live and work in a rapidly changing world were emphasised (Ontario. Ministry of Education and Training, 1995f; 1993d). This reflected the NDP emphasis on technology as a significant area in both the economy and global markets. The 'effective' use of technology and its impact on society was one of *The Common Curriculum's* 10 essential outcomes (Ontario. Ministry of Education and Training, 1995f, p.26). These outcomes were to guide school programs from Grades 1 to 9 (Ontario. Ministry of Education and

Training, 1995f, p.25). None of the essential outcomes in the final document made explicit reference to science nor conveyed the government's message in their 1993 throne speech that science was a basic skill.

In *The Common Curriculum*, science was portrayed as both utilitarian and as having cultural and political significance (see Ontario. Ministry of Education, 1995f, pp.70-71). This suggested to curriculum policy users that there were humanist and cultural components to understanding science, and these should be taught to students. This portrayal of science is more reflective of scientific literacy that emphasised science in life situations in which science has a key role such as in the STS-E movement as discussed in Chapter Two. In this depiction of science, students learn to appreciate and understand the impact of science and are able to discuss and problem-solve issues involving both science and technology. This is reflective of Roberts'(2011) notion of Vision II scientific literacy implying a broad and functional understanding of science for general education purposes rather than preparation for specific scientific and technical careers.

The final version of *The Common Curriculum* had a distinct section about employability skills that applied to all program areas. These included academic skills relating to communication, thinking and learning; personal management skills and teamwork skills (Ontario. Ministry of Education and Training, 1995f). These skills were similar to those described in the Conference Board of Canada's brochure *Employability skills profile: What are employers looking for?* (Conference Board of Canada, 1992). This required policy users to make students aware of work and career opportunities, to assess these in relation to their own abilities and to counter occupational stereotypes (Ontario. Ministry of Education and Training, 1995f, p.71). The latter reflecting the NDP value of equity. *The Common Curriculum* reflected McEneaney's (2003) argument that a curriculum with a skills emphasis supported economic growth. This intent may not have been explicit to those responsible for implementing the curriculum or for users of the curriculum.

6.5.3.2 Specificity and standards

Broad learning outcomes for MST, called specific outcomes, were written for the end of Grades 3, 6 and 9 and as noted previously, there was no differentiation as to what was to be learned at specific grades within these groupings. With schools continuing to organise themselves by subject and by grade, local interpretation of what to teach created inconsistencies as was illustrated by Aaron's experience when he was a school board consultant during this government time period:

> But what it [*The Common Curriculum*] demanded was a lot of communication with other teachers. Not only in your grade level but in the grade levels that came before and after you as well. I remember doing a math-science resource night. And the Kindergarten teacher said well we're gonna do flight. And the Grade 1 [teacher] no we're gonna do flight. And the Grade 3 [teacher] said well wait a second, flight's in the Grade 3 curriculum. And the Grade 6 teachers were doing flight. So you know, four years of flight in six or seven [years], that's a lot of flight. That was part of the problem. (Interview. 1 April 2008)

It should be noted, that just prior to elementary schools adjusting to this new curriculum document, the *SiHH* elementary science initiatives of the former Peterson Liberal government were being implemented in Ontario's elementary schools. A progress report, published in 1991, stated that science programs in Grades 1 to 6 had improved significantly (Ontario. Ministry of Education, 1991c). Ontario elementary schools recognized the importance of science in curriculum planning (Ontario. Ministry of Education, 1991c). Regardless of these positive results, having science as a specific subject area was no longer the case in *The Common Curriculum*. This view towards science was more reflective of the earlier elementary curricula from the mid-1970s where science for Grades 1 to 6 was part of an integrated area and not a distinct subject. With the Ministry only releasing standard documents for mathematics and language, elementary science was subsumed within the MST strand with little clarification for teachers on what they were to teach.

In the absence of any provincial standards to further clarify the science and technology outcomes in *The Common Curriculum* MST program area, an initiative at York University in Toronto, called the Assessment of Science and Technology Achievement Project, and commonly known as ASAP, initiated development of grade specific content standards. At the time, ASAP was undertaking an elementary science assessment project with 17 Ontario school boards. I was directly involved with this project, first as a participating school board science consultant, and then more extensively when I was seconded for two years to be a research associate to the project. The ASAP school board representatives, including myself, had decided that developing science assessment instruments would be challenging without common content standards. The different school boards had a variety of second-generation curriculum documents that they had developed to provide teachers with more direction to implement *The Common Curriculum*. The first step with the ASAP project was to develop a set of common content standards that the 17 school board representatives would agree upon before any assessment instruments could be designed. As provincial standards for mathematics had already been developed, in the spirit of the integrated nature of *The Common Curriculum* MST program area, ASAP school board representatives requested that ASAP expand its mandate and include both science and technology.

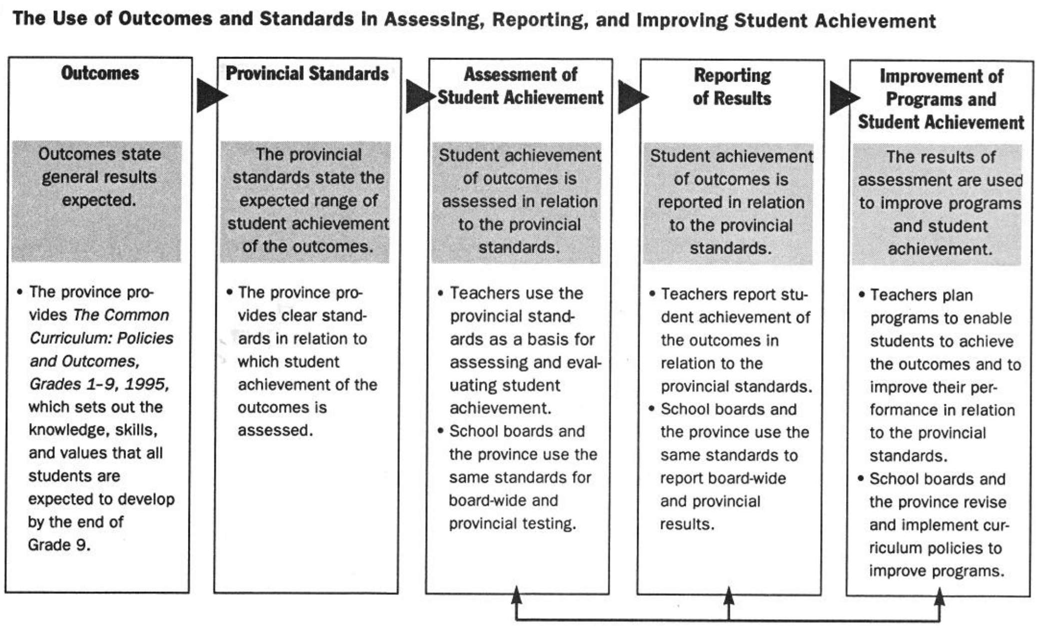
The ASAP project is discussed in detail in the next chapter as it had a significant role in the origin of the content for the elementary science curriculum for the next Ontario government. It is mentioned here as the processes to develop this content occurred during the final year of the NDP government. The government may not have had provincial standards for science, but 17 Ontario school boards and a team at York University, led by Graham Orpwood, formed a consortium and took the initiative to develop these.

6.5.3.3 Accountability in the curriculum

Unlike the Peterson Liberal *SiHH* and *OS:IS Science* curriculum documents, *The Common Curriculum* was explicit in stating to curriculum policy users that the government had a focus on accountability and illustrated the role of curriculum within their accountability framework as shown in Figure 6B.

One problem with this linear progression of accountability is that the outcomes in *The Common Curriculum* were directly connected to having provincial standards but these had only been developed in language and mathematics. The government's accountability framework was incomplete for other subjects and program areas. Furthermore in Cooke's (1993a) announcement of the government's accountability measures, his emphasis was on testing and reporting to the public the results of student achievement in reading, writing and mathematics.

Figure 6B Outcomes, standards, assessment and reporting to improve student achievement (Ontario. Ministry of Education and Training, 1995f, p.12)



This testing emphasis continued with the next two governments and diminished the significance of other subject areas including science. This is discussed further in Chapters Seven and Eight.

6.6 Chapter summary

The NDP undertook a broad consultation process to restructure education that resulted in a new curriculum for Grades 1 to 9. *The Common Curriculum* was different in its organisation and presentation of content from the Peterson Liberal curricula. It emphasised an integration of school subjects. Science for Grades 1 to 9 was part of the MST program area. In that sense, it was not a subject on its own but rather learning outcomes were integrated with mathematics and technology. The processes for the development of the MST program area and its content were influenced by this overall restructuring of curriculum for all subjects for these nine grades. Science was not an exception. The support for science education by the Peterson Liberals was not evident with the NDP.

This NDP approach to organising its curriculum was not well received by the public. *The Common Curriculum* had text that adhered to principles of integrated learning, excellence, equity, accountability, standards and collaboration among multiple stakeholders but its outcomes-based approach and different way of organising school subjects did not satisfy the standards and accountability demands of the public. They wanted specifics but what they got was a document with broad outcome statements by the end of Grades 3, 6, and 9. The final version of *The Common Curriculum* stated that a curriculum needed to clearly identify what students needed to know and be able to do and must clearly measure student achievement. This captured the discourse of actors demanding standards and accountability; however, the structure and content of *The Common Curriculum* did not reflect what they expected. In essence, subject specificity and grade-by-grade outcomes were missing.

In addition to criticisms from the public, many secondary teachers and the Ontario Secondary School Teachers Federation accustomed to streamed courses for Grade 9 had been outraged at an earlier decision by the government to destream Grade 9 and were unhappy with a common set of outcomes for all Grade 9 students clustered together with Grades 7 and 8. As mentioned, their outrage centred on concerns for implementing this policy without a lack of funds for training teachers and for resources to support its implementation. Furthermore, there was no curriculum in place. *The Common Curriculum* was released after implementation plans were to begin and did not alleviate teachers' concerns. Its grouping of Grades 7 to 9 outcomes into one cluster made no differentiation as to what was to be taught in which grades.

By the middle of their mandate, reeling from the negative response to *The Common Curriculum*, the NDP had a renewed focus on education. Even though this did not result in significant changes to *The Common Curriculum* from the working document in 1993 to the final document in 1995, it did result in announcing Ontario would have provincial testing programs to meet public and electoral demands for accountability. The government also supported Ontario's participation in national and international testing programs to measure Ontario's student achievement with students in other provinces and other countries. *The Common Curriculum* was a component of the government's new accountability framework in that it described what students were to learn. How well they were learning the intended curriculum was to be measured by provincial standards documents. Standards were developed only for language and mathematics. Although mathematics was part of an integrated MST strand, there was no mention of science and technology in this document. The presence of these subject-specific standards documents signalled the NDP moving away from implementing *The Common Curriculum* as a new way of organising school subjects to moving towards subject-specific documents. Their accountability framework may have had gaps and inconsistencies but its structure of linking *The Common Curriculum* to standards and student achievement moved Ontario closer to an auditable commodity.

The next chapter presents an analysis of the science curriculum policy of the PC government that governed for two successive mandates. As discussed in the next chapter, the PCs brought about significant change to Ontario governance and education with their neoliberal policies. This included another restructuring of curriculum.

Chapter 7 Progressive Conservative (PC) governments 1995-2003

7.1 Introduction

By 1995, the Ontario political arena related to education was volatile (Greenberg, 2004; Sears, 2003; Gidney, 2002; Walkom, 2002; Cameron and White, 2000; Bedard and Lawton, 1998; Noel, 1997). There was growing accord among the public to have accountability mechanisms to monitor, evaluate and compare Ontario's educational system (Livingstone and Hart, 2010; Galt, 1997b; Gerard, 1997b). Questions were being raised as to whether taxpayers were getting value-for-money on government spending in education (Gidney, 2002; Ontario. 1997; Lewington, 1996a; Duffy, 1995b; Progressive Conservative Party, 1994). At a government level, stakes were high because of the spending of public funds and politicians wanting to be seen accountable to the electorate (Progressive Conservative Party of Ontario, 1994; Ontario Progressive Conservative Caucus, 1992). When the political climate heats up, political actors take action (Cuban, 2008; Goodlad, 1991). This was evident in the findings presented in the previous chapter. Curriculum policy became part of the public arena and remained so with the government presented in this chapter.

On June 8, 1995, after 10 years, the Progressive Conservative Party (PC) was voted back into office with a political agenda that declared:

> ***The people of Ontario have a message for their politicians—government isn't working anymore. The system is broken. If we are to fix the problems in this province then government has to be prepared to make some tough decisions. It's time to take a fresh look at government. To re-invent the way it works, to make it work for people.***
> (Progressive Conservative Party, 1994, p.1 bold and italics in original)

Notable is their call to re-invent government, a term used by Osborne and Gaebler (1992) in their influential text advocating a steering not rowing role for governments as a means to provide them with more power. Osborne and Gaebler (1992) argued that the global marketplace created conditions for governments to restructure promoting privatisation, devolution and a new paradigm of public management. The PC government pursued an aggressive restructuring agenda passing legislation including tax cuts, deregulation, outsourcing, privatisation and the withdrawal of state responsibility for adequate funding (Schuetze *et al.*, 2011; Coulter, 2009; Sears, 2003). Most remarkable was that much of this occurred within their first three years of governing (Schuetze *et al.*, 2011)!

The PCs viewed Ontario's education system as ineffective in that it was not a matter of spending more money but rather that the money being spent was considered to be wasted through too much bureaucracy and inefficient practices (Janigan and Wilson-Smith, 1997; Lewington, 1996a; Duffy, 1995b; Progressive Conservative Party of Ontario, 1994). This chapter discusses the PC's education policies that are relevant to this study as they interact with curriculum policy. As indicated in Chapter Three, a curriculum policy study involves more than understanding the 'mechanisms' (Hart, 1989, p.607) of constructing curriculum and examines the influences contributing to the origins, processes and content of these documents. This chapter continues to illustrate that curriculum policy is complex, interactive and multilayered. As with the previous two chapters, I begin with an overview of the science curriculum policy released by the PCs followed by a brief political orientation of this government. The remainder of this chapter is divided into two sections following the same structure as the previous two chapters. The first of these presents my analysis of the political arena within which science curriculum policy was developed. A significant legislative act, *Bill 160: The Education Quality*

Improvement Act (Ontario. Legislative Assembly, 1997a), is presented in the sub-section about this government's education reforms. The second major section presents my analyses of the science curriculum policy in relation to the political arena and discusses its origins, development processes and content. Both sections continue with sub-sections related to the three themes of global marketplace, standards, and accountability as they relate to the political arena and then again as they relate to the content in the science curriculum documents.

The findings for this chapter are based on an analysis of the comments from participants in interviews and focus groups who had experiences with the PC's science curriculum. Table 7-1 summarises their positions and pseudonyms as used in this chapter.

Table 7-1 Summary of participants with experiences related to the PC science curriculum policy

Experiences/ Positions	Individual interviews	Focus group participants
Ministry of Education bureaucrat (seconded)	Isabel, Lorraine, Xia	
Ministry of Education bureaucrat (permanent staff)	Terry, Van,	
ASAP consortium member	Adam, Edgar, Floyd, Harry, Martin, Marietta (myself)	
Secondary science curriculum developer	Martin, Pat	
Elementary teacher	Anthony, Susan	
Secondary science teacher	Uri, Wayne	Evelyn (FG-1) Felicia (FG-1) Julia (FG-2)
School board science consultant	Adam, Alex, Beth, Bob, Carla, Edgar, Floyd, Harry, Sara	Daniel (FG-1) Grant (FG-2) Harriet (FG-2) Ian (FG-2)
Senior school board administrator	Ingrid, Lisa	
Resource developer	James, Ken, Nancy, Rick, Zack	

Participants who were members of the Assessment of Science and Technology Achievement Program (ASAP) consortium are listed as a category. They contributed to the ASAP standards document, and as mentioned in the previous chapter, this evolved into *The Ontario Curriculum, Science and Technology Grades 1 to 8* (Ontario. Ministry of Education and Training, 1998d). This includes myself as I was a research associate to ASAP during its evolution from a consortium project of 17 school boards to the provincial curriculum for elementary science. My personal recollections are embedded with the findings and analysis for this chapter. My experiences, then as a practitioner, and through this study as a researcher, allowed events surrounding the development of the PC's elementary curriculum to be seen through a range of roles and perspectives (Bolton, 2010). At the time of the curriculum development, my experiences as a practitioner raised my awareness that curriculum policy is multi-dimensional and complex. This led to my interest and decision to attend graduate school and conduct this study. The findings for this chapter also drew upon analysing documents such as government policies and memos, curriculum documents, education reports, *Ontario Hansard*, newspaper articles, media releases, and secondary documents. These are summarised for the PC government in Appendix B. Any that are cited within the text of this chapter are included in the reference section of this thesis.

7.2 Overview: Progressive Conservative science curriculum policy

The PC education reforms included having new grade-by-grade curriculum for Grades 1 to 12. For science, these new curricula were released in three documents: *The Ontario curriculum, science and technology, Grades 1 to 8* (Ontario. Ministry of Education and Training, 1998d); *The Ontario curriculum, science, Grades 9 and*

10 (Ontario. Ministry of Education and Training, 1999); and *The Ontario curriculum, science, Grades 11 and 12* (Ontario. Ministry of Education, 2000). They are all referred to as *The Ontario Curriculum* in this thesis. A descriptor is used to differentiate these three documents when needed such as *The Ontario Curriculum* for Grades 9 and 10 or the elementary *Ontario Curriculum*.

The Ontario Curriculum for Grades 9 and 10 discontinued the policy of a de-streamed Grade 9 that had been introduced by the NDP government. The new PC curriculum had two streamed courses for both Grades 9 and 10. One course was designated as academic - with a focus on theory, and the other course was designated as applied - with a focus on applications. *The Ontario Curriculum* for Grades 11 and 12 discontinued the *OS:IS* curriculum organisation around three streams of advanced, general and basic and were instead organised around post-secondary destinations of university, college, workplace and university/college (Ontario. Ministry of Education and Training, 1998c).

There was no curriculum policy for OAC. This year of secondary schooling was phased out by the PC government and so curricula for these courses were no longer required. As early as 1992, the PCs had stated their commitment to reduce Ontario's five-year secondary programme to four years. They projected that this would save an estimated 350 million dollars a year (Progressive Conservative Caucus, 1992). To offset the number of lost instructional hours by removing this grade, an increase in high school instruction time was legislated (Ontario. Legislative Assembly, 1997a).

In February 2003, the PC government launched a multi-year initiative called Sustaining Quality Curriculum (Ontario. Ministry of Education, 2004b). This initiative was to review the Grades 1 to 12 curricula for consistency across all grades within a discipline. It had been six years since the first elementary curriculum had been released and the Grade 12 curriculum was being implemented in the 2002-2003 school year. This gave little time for teachers in senior grades to assess how this curriculum was working in practice. Since the political rhetoric of the PCs questioned the value-for-money that the Ontario taxpayers were getting from the education system, it is reasonable to question whether spending funds on a Grades 1 to 12 curriculum review was efficient and effective use of taxpayers' money. Between 1996 and 2000, while the PCs were in power, $16 million was spent to develop the new curriculum policy documents for all subjects, and an additional $472 million in implementation costs (Office of the Auditor General of Ontario, 2003). Nevertheless, the PCs began the review process with the Social Studies, History and Geography curricula and science was to begin in 2005 (Ontario. Ministry of Education, 2004b). This initiative had barely begun when the PCs were voted out of office and the McGuinty Liberals formed the next government.

7.3 Political orientation

The PC party that gained power in 1995 was not the same centrist PC party that governed Ontario for 42 consecutive years from 1943 to 1985. Ideologically they had shifted far-right-of-centre along the lines of Margaret Thatcher in the U.K. and Ronald Reagan in the U.S. (Schuetze *et al.*, 2011; Kozolanka, 2006; Sears, 2003). As noted at the beginning of this chapter, the PCs *Common Sense Revolution* election platform heralded that they would usher in a period of significant reforms. Indeed once elected, their declaration to re-invent government led to legislation that altered how business was done in the public sector. Dominating their policy reforms were neoliberal tenets of reduced governance, support for market-based solutions, and restructuring around centralisation and decentralisation (Morse, 2007; Sears, 2003; Gidney, 2002; Walkom, 2001; O'Sullivan, 1999). With their two consecutive majority governments, the PCs passed legislation to create so-called efficiencies thereby steering a new course for Ontario's education system. Opposition parties aired their concerns but had little impact on having amendments approved due to the PCs majority of seats in the Legislative Assembly (Paquette, 1998; Ontario. Standing Committee on Social Development, 1997l).

During their second term in office, the PCs began to face declining public approval over their reforms (Mackie, 1997). Citing mainly personal reasons, Premier Mike Harris resigned as PC leader in April 2002 and was succeeded by Ernie Eves. The PCs continued to govern with Eves as their leader for another 18 months. In October 2003, Ontarians elected a new Liberal government under the leadership of Dalton McGuinty. This government and its education and curriculum reforms are discussed in the next chapter.

7.4 Section One: Political arena

This section begins with a discussion about the PC's education reforms. As mentioned in Chapter Three, curriculum policy production and policy practice do not enter a vacuum, void of influences. Understanding the political arena enabled me to identify influences on the science curriculum documents. This included analysing data from transcribed interviews and the two focus groups, newspaper articles and documents from teacher federations to explore how educators' attitudes towards a curriculum can be influenced by their relationships with a government The three sub-sections that follow explore the political arena in more depth related to the themes of the global marketplace, the call for standards and for accountability measures. All three were consistent themes across the four governments examined in this study. Conclusions about these are made in Chapter Nine.

7.4.1 Education and curriculum reforms

The PCs were determined to move aggressively on their education reforms (Education Improvement Commission, 1997a). At one of his first staff meetings of bureaucrats and deputy ministers, then Education Minister John Snobelen declared that a crisis was needed to bring about transformational change to the educational system (Moore, 2003; Sears, 2003; Cohen and Greaves, 2001; Dei and Karumanchery, 1999; Sheppard, 1997; Crone, 1996; Wright, 1996a; Brennan, 1995). The word crisis was intentional and repeated six separate times in his speech (Cohen and Greaves, 2001). Snobelen, a high school dropout, was a successful business owner and management consultant and used the language of business when referring to education (Duffy, 1995a). He called it a service organisation with students as clients, parents and taxpayers as customers and teachers as front-line providers. (Snobelen, 2008; Editorial, 1996; Duffy, 1995a; Lewington, 1995). Government legislation related to education reform indicated that this view of education was not only Snobelen's as discussed in the following paragraph.

The language of a market economy dominated the discourse of having an education system that was administratively and organisationally effective and efficient (Dei and Karumanchery, 1999; Progressive Conservative Party of Ontario, 1994). Government rhetoric that Ontario's school systems were inefficient and ineffective was evident in government communications (Ontario. Office of the Premier of Ontario, 2002a, 2002b; 2001c; Ontario. Ministry of Education, 2001a, 2001b; Ontario. Ministry of Education and Training 1997e, 1997i, 1997k; Ontario. Management Board Secretariat, 1997d), in the Legislative Assembly justifying their education reforms (Ecker, 2001a, 2001b, 2001c, 2000a, 2000b, 2000c; Weston, 2001; Johnson, 1998; Snobelen, 1997a, 1997b, 1997c, 1996a, 1996b,1995a, 1995b; Harris, 1996; Jackman, 1995), and picked up by the media as evidenced by the headline in the *Globe and Mail*, 'Ontario spends too much on education and gets too little in return compared to the rest of Canada' (Lewington, 1996a, also see Gerard, 1997a, 1997c; Abraham, 1996; Dare, 1996; Wright, 1996b). Years of public dissatisfaction were sharpening the criticisms about the market value of education; a concern that the PCs also held even while in opposition as evidenced by the quote of their education critic Dianne Cunningham mentioned in the previous chapter.

Bill 160: The Education Quality Improvement Act (Ontario. Legislative Assembly, 1997a) was a comprehensive piece of legislation passed by the PCs that altered Ontario's education landscape (Gidney, 2002; Mackie and Lewington, 1997; Janigan and Wilson-Smith, 1997). It entrenched neoliberal policies to Ontario education (Greenberg, 2004). Funding became centralised to the government and the power of school boards to manipulate local property taxes to supplement government education grants was removed. Centralizing education funding to the government enabled them to increase their control over education. It gave the provincial cabinet unprecedented power over future education tax rate increases without requiring approval from the legislature (Walkom, 1997; O'Sullivan, 1999). Although the province assumed the costs of education through *Bill 160,* school boards continued to be the employer. This meant that the government did not have to assume both the economic and political costs, of being an employer. With the government controlling funding, school boards had little flexibility to bargain for higher salaries or increases to benefits (Kerr, 2006; Gidney, 2002). Teacher contracts were up for negotiations with individual school boards and teachers exercised their right to work-to-rule, cancelling any activities outside of classroom instruction. There were lockouts and strikes (Kerr, 2006; Clark, 2000; Gerretsen, 2000; Maves, 2000; Girard, 1998a, 1998b).

I underscore at this point, a characteristic of curriculum policy in that it is not developed in isolation of other education policies. Although *Bill 160* may seem to be outside the scope of this study and its research questions, as also noted previously, curriculum is a mechanism by which education policy is expressed within the practice of education (Ben-Peretz, 2009). In the case of *Bill 160,* its impact on teachers' working conditions, preparation time and length of school year is interconnected with curriculum policy, and with teachers' perceptions of the curriculum. Grant commented,

> The Harris years I mean it was just dark ages for educators. The bad mental, emotional, ongoing bashing, diminished the value of anything they did in education. The curriculum was regarded in a negative light just because of that. (Focus group 2. 18 March 2008)

His comment was also reflected by Adam, a secondary science teacher,

> And you see the Harris [PC] curriculum was dead in the water because of the politics. Like even those fumbling attempts of doing good stuff got caught in the politics of it. (Interview. 22 August 2006)

As well Uri, who was also a secondary science high school, commented on his attitude during the PCs reforms,

> I was furious at them. I was in a work-to-rule kind of mindset and am just coming out of that now. I think that there are an awful lot of people who just said to hell with it. We're not playing. Yeah. (Interview. 10 May 2007)

Ironically, teacher unions who had worked actively to defeat the NDP government and supported the election of the Harris PC government, ended up with a toxic relationship as the education system was overhauled and teaching was devalued as a profession (Levin, 2008; Sears, 2003; Sheppard, 1999). Educators saw the PC reforms as punitive, controversial and divisive (Levin, 2008). A negative relationship formed between the teachers and the government.

On October 27, 1997, Ontario's 126,000 teachers became politically active and staged a two-week illegal strike calling it a political protest to draw attention to their disagreement with *Bill 160*. Regardless, this massive protest did not steer the government from its course. Furthermore, the PCs were unhappy that principals and vice-principals had supported teachers during the strike, often joining them on the picket line (Bedard and Lawton, 1998). Accordingly, they made an amendment to *Bill 160* to remove these educators from teacher unions (Queen's Park Bureau, 1997). This amendment created a cultural shift in education that placed school administrators in a management role (Ontario. Legislative Assembly, 1997a; Roher, 2001). It altered the employment and professional relationships between classroom teachers and school administrators (Roher, 2001; Gidney, 2002; Sears, 2003). A consequence of removing school administrators from teacher unions also had a direct impact on reducing the coffers of the teachers unions (Raston and Reshef, 2003), thereby punishing teacher unions. When it came to curriculum policy, this change meant that school administrators were now responsible to ensure curriculum policy was implemented and they were to set the direction for its implementation in schools.

Almost one month after the end of the political protest, *Bill 160* received Royal Assent on December 8, 1997 and was in effect as of January 1998 (Ontario. Legislative Assembly, 1997a). One month later, the government quickly passed new legislation requiring school boards to compensate parents for up to $40 a day for the costs of child care services incurred during the teachers' political protest (Ontario. Legislative Assembly, 1997b). Applications were made directly to local school boards and not to the government. This reflected their view of education as a service organisation in that school administrators were managers to ensure the business of schooling was conducted to service its clients and customers. It was also punitive to the education system in that front-line providers (teachers) failed to deliver their services to their customers (parents), who were then accordingly compensated by school boards. This example was another means of the government increasing its power while school boards were to enact legislation in which they had no input. As school boards and Ontario educators were dealing with the massive restructuring related to new legislation, the government released its new elementary curriculum thereby imposing changes on what was to be taught in Ontario's classrooms.

The PCs education reforms would be led by an agency outside of their existing bureaucracy. In 1997, they passed *Bill 104: Fewer School Boards Act, 1997* (Ontario. Legislative Assembly, 1997c) creating a non-legislated government agency called the Education Improvement Commission (EIC). The EIC was to oversee the PCs restructuring of Ontario's education system (OECTA, 1997; Ontario. Legislative Assembly, 1997c; Ontario. Standing Committee on Social Development, 1997l). It had sweeping powers and was accountable only to the Minister of Education and to the government (McLeod, 1997; OECTA, 1997); not to the Ministry's bureaucracy. Opposition Liberal and NDP politicians and teachers' unions expressed concerns about the EIC's power and authority (McLeod, 1997; OECTA, 1997; Ontario. Standing Committee on Social Development, 1997l; Noel, 1997); however, their attempts for amendments and changes to legislation had little impact due to the PCs majority government. Within its four years of operation, the EIC exercised extensive managerial control by shifting power and control not only from the education bureaucracy but also from democratically elected school board trustees and school board administrators. Financial decisions made by school boards were subject to the EIC's approval and were binding (Education Improvement Commission, 1997b; OECTA, 1997).

Co-chaired by David Cooke, former NDP Minister of Education, and Ann Vanstone, an elected trustee and the chair of the former Metro Toronto School Board, the EIC positioned curriculum reform as part of the overall government strategy for provincial accountability to the people of Ontario (Education Improvement Commission, 2000b). It identified the Ministry of Education as being accountable to Ontarians for standards in student achievement and for the effective and efficient use of public funds. To that end the Ministry of Education was directed to establish a curriculum that specified what students should know at each level or grade (Education Improvement Commission, 2000b). A three-year timeline was proposed for the development of grade and course-specific curricula. Xia, a senior seconded Ministry bureaucrat at that time, commented:

> It was a political platform. This was my impression. They also wanted to make their mark and you know politics comes in four or five year slots. You've got your time and by the end of it you gotta have something to show**.** We had political urgency to do it. (Interview: 8 August 2007)

Although the EIC set the direction, Xia mentioned that politicos in the Education Minister and Premier's offices wielded a lot of power within the PC government. She recalled that although there were only about five or six people, they had a large influence to ensure the government's political mandate was met. Their role was to "protect" (her word) the Minister of Education and ensure the education bureaucracy was working on the government's agenda. In essence, using terms borrowed from Osborne and Gaebler (1992), politicos were steering on behalf of the government while the education bureaucrats were rowing. Terry, a career educator bureaucrat at that time, commented:

> Every one of the curriculum documents that rolled out to the system were at some stage in their approval process, actually taken to the provincial cabinet table with that sense of something between us as a government and our constituents. Uh (…) the public of Ontario. So it was a very definite shift upwards in terms of the stakes around curriculum in Ontario at that stage. (Interview. 18 April 2007)

With the elevated political importance of curriculum by the PCs, the government communications office became directly involved. Their presence was to ensure that the government's directives were being addressed. (Interviews. Terry, permanent staff bureaucrat, 18 April 2007; Xia, seconded bureaucrat, 8 August 2007).

7.4.2 Economy and the global marketplace

The discourse related to concerns about Ontario's competitiveness in a global marketplace that was evident during the Peterson Liberal governments and discussed in Chapter Five, increased in volume and intensity during the PC government. Education reforms were rationalized as a requirement if Ontario was to have a competitive edge in a global economy (Ward, 2012). This market-oriented ideology dominated the discourse of the PC's education reforms. Although the PCs asserted that education enabled students to contribute to society as responsible citizens, the data from PC documents, their members of parliament in legislative debates and comments in the news media indicates that an economic purpose of education received more emphasis and is discussed as follows.

Three years before they were elected, the PCs were explicit about their view of the link between education and the economy as evidenced in their election platform for education policies. This document was publicly accessible since 1992. They were transparent about their view of the place of education in a global economy:

> Education must be rewoven into the fabric of this province's strategic planning for the future. This means integrating education into a plan of economic renewal and integrating education as an essential component in a coordinated programme of community services. This will give us an education system with clear goals and measurable results (Ontario Progressive Conservative Caucus,1992, p.3).

Their 1995 *Common Sense* election platform reasserted this view that the reconstruction of Ontario's education system was necessary to ensure that Ontario would have a more skilled and competitive work force.

> Education reform is essential if Ontario's next generation is to find high-paying, productive jobs in increasingly competitive world markets (Progressive Conservative Party, 1994, p. 8).

Science curriculum was one component of this with its specificity as to what teachers should teach and students should learn.

As a government, their media releases and newspaper advertisements pledged their commitment that through their education reforms students would have the knowledge and skills to compete and succeed in Ontario and around the globe (Ontario. Ministry of Education and Training, 1996d, 1996e; also see Abraham, 1996). They used the media to tell the public that even though significant tax dollars were being spent on education, Ontario students were lagging behind that of two other Canadian provinces, Alberta and British Columbia (Ontario. Ministry of Education and Training, 1996e). Their political messaging contributed to an already negative public perception that Ontario's education system was inefficient and not effective in providing students with the knowledge and skills compared to their peers in other provinces. This is illustrative of a comment that Quincey had made about government using the media. Although she did not have experience with the Harris PC government, she is still a policy consultant and advises politicians to:

> Get a good media stench going on and see if we can get chief editors, chief reporters, outlets to know about a particular issue. And see if we can get them to advance the story a lot. (Interview, policy advisor during Peterson Liberal government, 4 November 2007)

Similar to the Peterson Liberal government, the PCs provided funding to elementary and secondary schools to purchase science equipment and materials to assist with the implementation of their new science curriculum. They considered school science to be as important as English and mathematics and should be taught at every grade from Kindergarten to Grade 12 (Ontario Progressive Conservative Caucus,1992). It is notable that both Peterson Liberals and the PCs viewed education as important to the economy and supported science education. The NDP had a different view as evidenced in *The Common Curriculum* where science was seen as both utilitarian and as having cultural and political significance. Their emphasis was on technology and its impacts on economic growth.

Although the PCs provided financial support for the implementation of the science curriculum, my recollection of the process was that it left much to be desired to make effective use of these funds. When this issue arose in the second focus group, Ian and Harriet, who were school board consultants at the time, described that as central board staff they had to coordinate and consolidate the requests of schools in their respective boards within a short window of opportunity. In the same focus group, Julia, who was a secondary school teacher at the time, commented that at her school deciding on what to purchase had to be made quickly before teachers had an opportunity to decide what they really needed (Focus group 2. 18 March 2008). Similarly, in the first focus group, Evelyn, who was also a secondary school teacher at the time, recalled a similar experience at her school. “We didn’t assess what we really needed. We just selected what we thought we needed from a list so that we could take advantage of the funds” (Focus group 1. 18 June 2007). In the *Ottawa Citizen* article ‘Tired of waiting’, elementary teacher Nancy Albota wrote about the hurried five-day deadline that she and her colleagues experienced to submit their school’s order only to be waiting eight months later with still no delivery (Albota, 1999). This rush to order could reflect the government’s lack of understanding the complexities of implementation but it also reflects their commitment to showcase their actions of support for their new curriculum to the electorate. In this case the government could show that they not only developed science curriculum but also provided funds to support its implementation, regardless of how effective or efficient that was.

7.4.3 Standards

The PC's commitment to standards was evident both in their own documents and as reported by the media (see for example, Abraham, 1997; Galt, 1997b; Small, 1997, 1996b; Ontario Progressive Conservative Caucus, 1992). One means by which the PC government chose to raise standards was through curriculum that they described as rigorous and relevant for all grades and subjects (Ontario. Ministry of Education and Training, 1997f, 1997j, 1996c; Snobelen, 1997a; Progressive Conservative Caucus, 1992).

The PCs intended to test students at regular intervals to ensure the standards were being met (Jackman, 1995; Progressive Conservative Party of Ontario, 1994; Progressive Conservative Caucus, 1992). This mandate interwove curriculum, in the form of content standards, with scrutinising the effectiveness of education, student achievement and teacher performance (Shore and Wright, 1999). The PCs view of education standards encompassed neoliberal tenets for increased accountability, surveillance and regulation and the EIC reinforced this by positioning curriculum as a component of the provincial framework for accountability (Education Improvement Commission, 2000b).

Writing curriculum as standards had implications regarding specificity. Second generation documents developed by school boards, which were common-place with the curricula of previous governments became less common. Curriculum was becoming a technical mechanism for educators who were expected to plan their programs directly from these documents. Expectations were deemed to be written in sufficient detail so that the development of school board second-generation resource documents were not necessary, and consequently the funds to develop them. I experienced this in my previous role as science program coordinator for a large school board; funds for writing resource documents were diminished and my team focused curriculum implementation plans on having teachers become familiar with using the curriculum to plan their own programs. In the focus groups, participants commented on having to plan programs directly from the curriculum. For example, Felicity commented on the experience in her school.

> In the first year of the Grade 10 implementation, we had to use the documents and I was confused. I think the way that they were laid out, you focused in on the specific expectations, especially the knowledge expectations because there were so many of them. I found it really hard to negotiate the inquiry portion in terms of exactly what labs do they want us to do. And it's only seven years later that I think we have a handle as a department and coming to a common understanding about what we have to teach. (Focus group 1. 18 June 2007)

Although teachers were expected to work directly with the curriculum documents, in practice, it was a challenge.

The PCs reforms resulted in standards for both students and teachers. For students, standards were in the form of new curricula providing both measureable statements of what students were expected to learn and performance indicators that described what successful achievement looked like. For teachers, a new agency, the Ontario College of Teachers, created standards that also took the form of measureable statements and performance indicators, and interacted with curriculum policy. This is outlined further in the following paragraph.

Standards for the teaching profession were written by the Ontario College of Teachers, a self-regulatory professional agency for certified elementary and secondary teachers that the PCs created through legislation (Ontario. Legislative Assembly, 1996b). The establishment of this agency led to a new set of relationships between the government and the Ministry of Education, teacher unions, school boards, faculties of education and teachers. Early in the College's mandate, they wrote the *Standards of Practice for the Teaching Profession* (Ontario College of Teachers, 2003a). Competency standards were developed in five domains: Commitment to pupils and pupil learning; Professional knowledge, the Ontario curriculum, and education-related legislation; Teaching practice; Leadership and community; and, Ongoing professional learning. Performance indicators were set for each standard. One of the domains related specifically to curriculum implementation. Teachers were to know the curriculum relevant to the subjects that they taught, to be familiar with the subject-matter, to know ways to connect curriculum expectations (content standards) to curriculum resources and technologies, and to assess and evaluate student achievement of curriculum expectations (Ontario College of Teachers, 2003b). In that sense the policies regulating the teaching profession interacted with curriculum policy and illustrate that curriculum policy does not exist in a vacuum but is interrelated with other government policies. Whereas curriculum implementation under previous governments was within the purview of teachers and their local school boards, the Ontario College standards and performance indicators that related to curriculum implementation were being centralised and used by school administrators as part of a teachers' performance appraisal.

7.4.4 Accountability measures

As noted in the previous section, the EIC developed a comprehensive accountability framework in which curriculum provided measureable standards. This section focuses on mechanisms for accountability and surveillance that involved science curricula while transforming Ontario's education system into an audit culture. It begins with a provincial testing program that still exists today, and then discusses Ontario's continued participation in international testing programs like TIMSS and PISA for science.

In 1996, the PCs passed into legislation the creation of a semi-independent agency from the government called the Education Quality and Accountability Office, or commonly referred to as EQAO (Ontario. Legislative Assembly, 1996a). Creating such an agency was one of the recommendations of the Royal Commission. As mentioned in the previous chapter, just prior to the 1995 general election, the NDP had announced its intention to create this agency but were unable to act on it having lost the election (Ontario. Ministry of Education and Training, 1995b). EQAO created and administered annual provincial tests of reading, writing and mathematics for students in Grades 3 and 6, and for mathematics for Grade 9. A mandatory Grade 10 reading and writing literacy test was added in 2001-2003. Successful completion of this test was, and still is, required for high school graduation. Individual school test results were published in local newspapers ranking schools in boards from highest student performance scores to lowest. This enabled the media and the public to compare schools and boards. Furthermore, this quantification of results was viewed as an indicator of successful teaching (Gerard, 1997b; Battagello, 2000). The establishment of EQAO gave the PCs an accountability mechanism to measure the effectiveness of how Ontario's students were achieving in their schools – but not for all subjects.

Although EQAO did not test for science, its emphasis on reading, writing and mathematics has marginalised other subject areas including science. I experienced this first-hand with the development of the school board improvement plans, and subsequence school improvement plans for the board in which I was a program consultant. The focus was on literacy and numeracy with an emphasis on reading, writing and mathematics. EQAO had, and continues to have, the authority to require schools and school districts to submit annual school improvement plans that take into account locally-generated school data to consider how a school compares to provincial results and its plans to improve (Education Quality and Accountability Office, 2005a, 2005b). Obviously with provincial tests focusing on reading, writing and mathematics, schools focused their efforts on improvements in these areas. In that sense, provincial policies for testing, do impact other subject areas like science, especially when the results of those tests are published in local media comparing schools and school boards. EQAO provided the government with a provincial surveillance mechanism that continued to transform Ontario's education system into an auditable commodity. In addition to its management of the administration and marking of provincial standardized tests, its mandate was, and still is, to develop systems to evaluate the quality and improvement of education, to collect information on assessing student academic achievement, and to report to the Ministry of Education and the public on provincial, national and international test results. One managerial role for school administrators introduced through the amendment to *Bill 160* was for each school to publish annual improvement plans using a process that involved parents (Education Improvement Commission, 2000a, p.40). This included reporting on how the school would improve its implementation of curricula. These plans were similar to business plans and annual reports that corporations prepare for their stakeholders. *Bill 160* introduced a managerial mechanism for curriculum implementation, including indicators to know whether they were successful when plans were reviewed.

Another accountability mechanism to measure the performance of Ontario students, and indirectly its teachers, was Ontario's continued participation in international and national tests. In 1996, TIMSS results were released for mathematics and science. Newspaper headlines reinforced the government's message that Ontario's school system needed reform, such as: 'Stronger curriculum called for in mathematics, science; Ontario students' poor results in international test prompt education agency to recommend that teacher training be improved' (Lewington, 1996b, also see Brennan, 1997; Galt, 1997a; Gerard, 1997a, 1997c; Ibbitson, 1997; Ontario. Ministry of Education and Training, 1997g; Haysom, 1996; Small, 1996a). A year later when the results of Canada's first national science testing programme, SAIP, was released, Ontario was ranked at the bottom of Canada's ten provinces (Gerard, 1997a). This ranking added to the public and government perceptions that Ontario's schools were not measuring up to that of other jurisdictions. Negative media headlines continued, such as: 'Why our kids are at bottom of the class in science; Probe urged into 'what's going on in the classroom'' (Gerard, 1997d); and, 'Ontario science education goes under microscope: Curriculum, teachers blamed for poor grades' (Gerard, 1997c). The quantification of results that ranked Ontario among that of other jurisdictions placed a judgement on the quality of Ontario's curriculum, its teachers and the effectiveness of its schools. Xia remarked that the PCs saw this public dissatisfaction as a political mandate to bring greater rigour to the school system through new curricula (Interview. seconded bureaucrat, 8 August 2007).

7.5 Section Two: Science curriculum origins, development processes and content

7.5.1 Origins

The new PC science curricula were a result of their overall restructuring of Ontario's education system. Senior level bureaucrat, Isabel commented,

> When the Conservative government came in, they came in on a platform, that was absolutely dedicated to changing all of that whatever the NDP curriculum reform was. They said was a dumbing down of the curriculum. I mean the Common Sense Revolution was predicated on a major, major educational reform that had to do with reform in curriculum, reform in governance, reform in financing, reforms in, you know, restructuring. So it wasn't just curriculum reform. (Interview. 5 January 2007)

Xia, also a senior level bureaucrat had similar recollections,

> Well we went from a left-wing government to the other end of the continuum. I mean a very conservative government and not. Not the kind of Bill Davis conservatism but a much more doctrinaire conservatism and they saw it [the election] as a political mandate to create a new curriculum that would bring greater rigor to the school system. (Interview 8 August 2007)

The government was clear that the NDP's *Common Curriculum* did not meet the expectations of the PCs education reform agenda. Van, who was a career bureaucrat at that time, said:

> We [Ministry of Education bureaucracy] had an advisory group and we were saying well there's some quite good stuff developed under the NDP. And they [PCs] said 'we're not throwing good money after bad so that's scrapped and we're moving on from there'. And so that was it. Nobody mentioned *The Common Curriculum* again. (Interview. 25 May 2007)

This went so far as removing the word outcome as used in *The Common Curriculum* and introducing a new term called expectations in the PCs curriculum. When I asked about the rationale behind changing this curriculum terminology, Xia explained that this was a decision by then Minister of Education John Snobelen who disliked the word outcomes.

> He [Snobelen] had little patience talking about the outcomes curriculum and what was different about a curriculum written as outcomes to a curriculum written as objectives except he hated the word outcomes for some reason that I was never quite clear about. And that's why we ended up saying expectations. (Interview. Xia, senior seconded bureaucrat, 8 August 2007)

His decision is an example of the power of one voice and the resulting consequences to a larger community. Through the NDP's *Common Curriculum,* Ontario's educators had become familiar with outcomes-based education (Small, 1997). As Xia mentioned, when the PC curricula was released there was confusion as educators tried to understand the significance and implications of what the term expectations meant, including myself.

7.5.2 Development processes

In the previous two chapters, the Ministry bureaucracy was not only leading the Peterson Liberal and NDP science curriculum processes but also actively involved in their content. This changed with the PC government who altered how its education bureaucracy did its work as outlined in this section. The PC's support of the marketplace extended to how curriculum policy would be developed.

When the PCs re-gained control of the government in 1995, they embraced a vision of New Public Management (NPM) (Cameron, Mulhern and White, 2003). The PCs had campaigned on having a bureaucracy that was smaller, more efficient, less expensive and more responsive to taxpayers (Janigan, 1996). Under their watch, they introduced a business culture into public administration, stating in their election platform that they ‘will demand that **government does business *like* a business**’ (Progressive Conservative Party of Ontario, 1994, p.16, bold and italics in original). This included how their curriculum was to be developed. Unlike the two previous governments’ curriculum processes, the education bureaucrats for the PC government required both managerial skills and political acumen. Subject expertise would be contracted and the construction of the science curriculum documents and their review involved actors outside of the education bureaucracy.

This section focuses on who was involved in the writing and construction of the elementary and secondary *Ontario Curriculum* science documents, and the processes. The data which informed this section were predominantly from transcribed interviews of participants in the PC curriculum reforms as well as my own experiences in the Assessment of Science and Technology Achievement Project (ASAP). As with the Peterson Liberals science curricula, the elementary and secondary processes were different and are presented in two separate sub-sections. It begins with a discussion about the Assessment of Science and Technology Achievement Project (ASAP). This project’s actors, and the ASAP final report, had a major role in the shaping of the PC’s elementary science and technology curriculum. As the research associate to this project, my personal experiences form part of the discussion. I draw upon these as well as that of other data sources from interviews and document analysis.

The Ontario Curriculum, Science and Technology, Grades 1 to 8

As mentioned in Chapter Six, in the absence of Ministry documents to clarify the science and technology MST outcomes of *The Common Curriculum,* the Assessment of Science and Technology Achievement Project (ASAP) had been developing standards for science and technology based on *The Common Curriculum* (Loree, 2003; Bloch and Orpwood, 1996). With the change in government from the NDP to the PCs, the work of ASAP evolved from being a project involving 17 boards of education and York University, to becoming the PCs elementary science curriculum.

ASAP was initiated and led by educators, and involved teachers in development and writing; however, once the ASAP document was purchased by the government, it became subject to the PCs approval process and no longer accessible to be reviewed by the education community. Other policy influencers like the government's communication office, parents, education bureaucrats and politicos became involved. As the content of the PCs elementary science curriculum was based on ASAP, I begin with an overview of who was involved in the *ASAP Framework* (Bloch and Orpwood, 1997) that was purchased by the government.

Two years prior to any government involvement, ASAP worked with over 300 teachers, school board science and technology consultants and science coordinators to develop an agreed upon set of science and technology standards for Grades 1 to 9 (Bloch and Orpwood, 1996). These were written for the end of Grade 3, Grade 6 and Grade 9 following the same structure as *The Common Curriculum,* as this was the official curriculum at that time. An iterative process involving the ASAP project team, including myself, the ASAP Advisory Panel, teachers and science consultants resulted in the publication of a draft *ASAP Framework* (Bloch and Orpwood, 1996). From 1996 to 1997, while the PCs were in office, this draft document was widely shared for further input, consultation and critiquing to continue the process of building consensus (York University, 1996). Teachers, whether or not they had participated in the project, were invited to use the draft *ASAP Framework* in their classrooms and provided feedback on how usable it was in practice. In May 1997, towards the end of this review period, ASAP hosted a forum on school science held at York University in Toronto to consolidate the *ASAP Framework.* This brought multiple stakeholder groups such as students, teachers, quality education (back-to-basic) groups, academics and business together for a comprehensive set of deliberations about the direction and content of the draft *ASAP Framework*. The Ministry of Education also sent a representative. The government was aware of the work of ASAP and had been following its progress. The PCs had not yet developed their new elementary science curricula. At the end of this review period, the *ASAP Framework* underwent further revisions (Bloch and Orpwood, 1997).

The government purchased the rights to the final *ASAP Framework* to use as the foundation for their elementary science and technology curriculum. During my interview with Terry, he noted that ASAP's successful outcome in becoming the elementary provincial curriculum for science and technology paved the way for the Ministry to use outside providers to develop the secondary curriculum.

> The science curriculum was a very interesting example from our perspective in terms of being able to have the actual curriculum development work done removed, so to speak from the Ministry process. (Interview. 18 April 2007)

This was the first time that the Ministry acquired a curriculum and constituted an unusual instance of having a process external to one led by Ministry bureaucrats. Unbeknownst to me at that time was that this project was being viewed as a trial for outsourcing curriculum as mentioned explicitly by Xia.

> ASAP was the first time the Ministry acquired a curriculum outside of its own development. There were mixed reactions about this within the Ministry but having done this with ASAP, it became a trial process for the RFPs that were announced for secondary curriculum development. (Interview. 8 August 2007)

These comments were a sobering indicator for me of unintended consequences in curriculum policy. The significance of this singular occurrence of the Ministry purchasing the rights to ASAP set the stage for contracting the writing of the PCs secondary curriculum for all school subjects as discussed later in the next section.

Once the *ASAP Framework* (Bloch and Orpwood, 1997) was purchased, it went into a period of revisions based on feedback from an influential government curriculum advisory panel. The contract for the Ministry to use the *ASAP Framework* required them to consult with ASAP project staff over any changes. This gave me an insider glimpse into this aspect of curriculum policy-making. My recollection of the panel's membership was that it included a representative of: the Ontario Parent Council; a member of the Quality Education Network - a public interest group sympathetic of a back-to-basics curriculum; the science teachers association; a politico from the Premier's office; a communications officer; several education bureaucrats; and, the ASAP project team lead. Although others may have been on the Panel, I have no recollection of them anymore and there is no official record of who was involved. When I had the opportunity to attend one of the advisory panel meetings, this experience heightened my awareness of the weighting of the voices of actors. Three separate incidents come to mind that I can personally recall: one using the term living things, one involving the inclusion of technology expectations and the other involving using the word environment. I can still recall these as they jolted my naiveté about curriculum decisions from an educator perspective to the power that select voices can have on curriculum content. They also raised my interest in how curriculum is developed, which as mentioned, led to this research study.

The first example about using the term 'living things' relates to the choice of vocabulary to make the curriculum documents understandable to parents and the general public. The communications department had edited the term living things to be plants, animals and people. When I expressed concern about this change, I was told that this was more understandable to the public. I pointed out that the revision was inaccurate as in science, people are part of the animal kingdom and distinguishing them separately perpetuates a misconception. My response was challenged by a communications officer. It was only when I commented that if the phrase remained, then they should be prepared for criticism in the public arena by those who understand science. It was this response that reversed the decision and the term living things was reinstated. I remembered being shocked that accuracy of the term was not the driver for change, but that the possibility of negative public criticism was. Even indirectly, their voice was powerful. As an aside, I recall being somewhat surprised that the communications officer did not think the public had the intelligence to understand the term living things!

The second incident involved the inclusion of technology expectations. As the *ASAP Framework* was a science and technology curriculum, the expectations related to technology were questioned by the same communications officer. She did not think they were appropriate as in her view technology was the traditional industrial arts and crafts program that used to be taught in Grades 7 and 8. These expectations had been developed through consultations and advice with an ASAP Technology Advisory Group. It was only when a member of the Quality Education Network, spoke in favour of keeping them that the communications officer removed her objection. This was another example about the power of voice. Without the support of this member, who belonged to a group sympathetic to the government's education reforms, the decision could easily have been to remove this content.

The third incident involved whether the term environment could be used in the curriculum. This incident was also raised by Xia who commented:

> I can remember them [politicos] blocking out the word environment. You know we're not a company of tree-huggers. There were these things like the environmental focus that simply weren't allowed. (Interview. 8 August 2007)

At an advisory panel meeting, Ministry bureaucrats raised the issue of whether or not the word environment could be used in the curriculum. They were looking to the panel for clarification as politicos had expressed concern to the bureaucrats and suggested removing it. When the representative of the Ontario Parent Council, another group sympathetic to the government's reforms in education, expressed that their group had no concerns about the word environment being in the curriculum or even having expectations related to the environment, the issue was resolved and environment was acceptable to use. He did mention that the Parent Council expected a balanced approach in that students were learning the science related to environmental issues and that the curriculum did not have expectations presenting a negative view of business and industry on environmental issues.

These examples exemplify that curriculum policy is more than the text of curriculum documents. Beyond the text, there are competing interests or differing beliefs. The final words can be a result of the power of certain voices over others. Of concern to me was how quickly curriculum content could be influenced by one voice with little substantive rationale or discussion. It made me wonder about processes other governments used to develop their science curricula, and influenced the choice of my research questions and how I designed this study. It is also a reason why I have given emphasis to understanding the political arena in examining science curriculum policy.

The Ontario Curriculum Science, Grades 9 to 10,* and *The Ontario Curriculum Science, Grades 11 and 12

The development of the secondary science curriculum was part of the PCs extensive secondary school reform plan. This included a public consultation involving the distribution of a series of discussion documents to Ontario households inviting responses and commissioning research papers to describe key issues in specific disciplines. Science education researchers, Chin, Munby and Krugly-Smolska (1997), at Queen's University wrote the backgrounder for science. Twenty-four subject panels were created to respond to the background papers and develop key directions for the government's secondary curriculum reform plans by providing subject-specific input. These so-called expert panels included representatives from subject-related teacher associations, universities and colleges and the community (Ontario. Ministry of Education and Training, 1997h). A team at the Ministry reviewed and analysed all expert panel papers and identified recurring themes which informed the changes to secondary school curriculum. The synthesis of these recommendations was published for anyone to read (Ontario. Ministry of Education and Training, 1997h).

Overall this process to re-image Ontario's secondary schools appeared to be transparent to the electorate and provided opportunities for input from multiple actors interested in education. What was not transparent were the decisions as to who was heard and who was not. One group that was heard was the Ontario Parent Council. Their Chair indicated that many of the recommendations made by the Council were incorporated into the final program (Ontario. Ministry of Education and Training, 1998a). The PCs looked towards what parents and its advisors were recommending for reform rather than the bureaucracy and educators (Interviews. Permanent staff bureaucrats, Terry, 18 April 2007; Van, 25 May 2007). Further indication that this was the case was provided by Floyd, who was a member of the science expert panel.

> When all was said and done, I don't know whether any of our recommendations made much impact in the curriculum that came out. Because there were other players like the back to basics movement. ... Our concern was not broader but deeper. But there were other forces that were trying to make us go broader and you know, more content and all of that, and so we're not sure how much impact we made. (Interview. 10 June 2006)

This illustrates the value-laden nature of curriculum policy. Value differences require political negotiation among those involved in curriculum policy (Cuban, 2008; Ungerleider, 2003) but the data indicated that whose voice was speaking carried the weight as to what decisions were made. As I analysed the data related to the different development processes, it was becoming clear that across governments curriculum policy-making each had different processes. I comment on this in the final chapter of this thesis presenting my conclusions.

Once the structure and organisation of Ontario's secondary schools were determined, construction of the curriculum development proceeded. As indicated earlier, the process to write all new secondary curricula was through competitive bids. Those outside of traditional education stakeholders were invited to bid for contracts. Requests-for-proposals were issued for all secondary subject disciplines in both English and in French with separate contracts required for each linguistic area. With the entire Grades 9 to 12 curricula undergoing simultaneous development, Ministry bureaucrats had to draw upon business practices to ensure deliverables were met. Xia commented that the government considered this business-model as a cost effective and efficient way of constructing curriculum within a short time period. She also noted that with the Ministry staff being downsized, they would not have been able to develop all required curriculum internally with the staff that they had (Interview. 8 August 2007). Ontario's teacher unions criticised the approach and felt that it would lead to Americans applying to develop Ontario curriculum (Ibbitson, 1998). This never transpired and Xia noted that Ministry bureaucrats never thought that it would:

> The specifications of the contract were such that it was not a money-making proposition. Costs would be covered by the successful bid but there was not room for profit making. (Interview. 8 August 2007)

Two proposals were submitted to develop the Grades 9 to 12 secondary science curricula. One was a joint submission of the science teachers' association and the school boards science consultants' association that would be managed through an Ontario school board. The other was a bid from a private consulting firm who hired a well known Ontario science educator as project manager to develop and lead the process. The role of the private consulting company and the Ontario school board was to act as legal entities for the bids. The proposal for science was awarded to the private consulting company.

An additional factor that Terry (Interview. 18 April 2007) mentioned contributing to the government decision to outsource the curriculum was the resistance of the Ontario Teachers' Federation (OTF) to work with a government that was continually criticising teacher professionalism. Previous governments had relied on the cooperation of OTF, its teacher union affiliations, and subject council affiliations in the development and implementation of curricula. Typically, OTF would be contacted by the Ministry and disseminate opportunities for its members and member associations to become involved in curriculum development, including writing. Outsourcing its new curriculum became a way that the government could circumvent working through OTF as curriculum project managers could chose their own teams. Matt and Pat mentioned that the only criterion was that the writing had to be done by teachers (Interviews. Curriculum developers, Martin, 1 February 2007, Pat, 21 March 2007). This criterion was no different than for the curricula for previous governments.

As mentioned earlier in the comments by Terry and Xia, coordinating a curriculum through an outsourced bidding process was new to Ministry bureaucrats. Martin commented that Ministry bureaucrats found themselves in a new role as a client to curriculum providers. This change was not without its challenges (Interview. Martin, curriculum developer, 1 February 2007). Terms of reference on signed contracts were changed, mostly on procedural issues, for example moving forward deadlines for a deliverable that had already been set. More significant was the lack of clarity by bureaucrats to project managers on differentiating between the new Grade 9 and 10 academic and applied courses. This created confusion for the science curriculum writers. Martin mentioned that when the initial drafts for these science courses were submitted to the Ministry, the feedback to the project manager was that the applied courses were more interesting than the academic courses. The Ministry's concern was that students comparing these two courses would prefer to take the applied courses (Interview. Martin, curriculum developer, 1 February 2007). Pat involved in assisting the coordination of the secondary curriculum, said that curriculum writers were instructed to increase the appeal of the academic course (Interview. Pat, curriculum developer, 21 March 2007). With the curriculum process happening behind closed doors, only those involved would have been privy to seeing the drafts that were developed; there was no opportunity for feedback from the broader education community. Control was centralised in the Ministry as the client and the project manager had to comply with their specifications.

Similar to the elementary document, the draft secondary science documents underwent an official review from an advisory panel. The issue of actors having differing values as to what should be taught in science was evident in the following two examples. This first example was the questioning by some panel members about the inclusion of Earth and space science in the curriculum. Pat described the discussion at one of these meetings that she attended:

> The quality education people and parents' groups were very concerned that space was fluff. And the actual words were. You know astronomy is fluff. And why should we be teaching our students this. It's all hypothetical. It's not real to our kids. They don't need to know about space. We were all just floored. They wanted it removed completely from the curriculum. And the Ministry held their ground on that and kept it. (Interview. 21 March 2007)

In this case, the voices of those that had the ear of the government and its politicos were overridden. One plausible reason I suggest is based on my personal experiences. The request to remove Earth and space science would have been contrary to the government directive to align Ontario curriculum with the *Pan Canadian* in which Earth and space science is a discipline from Kindergarten to Grade 12. Its removal would have put Ontario students at a disadvantage for any national testing related to this science discipline. Earth and space science remained in the Ontario curriculum but the final number of courses was reduced. I know this from personal knowledge as I had been asked to assist with a revision of the draft Grades 11 and 12 Earth and space science courses but when the final curriculum was released there was only one Grade 12 course.

The second example was mentioned independently by four participants. This was the addition of the concept of density in the Grade 9 academic curriculum. This recommendation did not come from the advisory panel and is an example where an actor, who was well-known to the government and external to the process, exerted his influence on the science content of the curriculum. Pat explained that the curriculum writers responsible for Grade 9 had removed this concept because it was expected to be taught at Grade 8 based on the *Pan Canadian* (Interview. Pat, curriculum developer, 21 March 2007). In Ontario, under *OS:IS Science*, density had been taught at Grade 9. When the draft Grade 9 science curriculum went to the Ministry for review, Van said,

> There was a certain person who wanted to add density [and] that had to be put in. That came down from the Minister's office (…) to put density in. So then we had this bloody Grade 9 with something sticking out like a sore thumb. (Interview. permanent staff bureaucrat, 25 May 2007)

This example also indicates the power of individual voices, in this case those who can circumvent established processes such as a curriculum review advisory panel. Xia referred to these as having “good political credentials” (Interview. 8 August 2007).

The final approval process to publicly release the document was described by Terry as being extraordinary. A briefing note to the Minister of Education was not sufficient as it was during the Peterson Liberal government nor was a presentation to the cabinet as during the NDP government. Lorraine, a senior seconded bureaucrat, explained that before the curricula could be publicly released, letters of authorisation were required from organisations such as the Quality Education Network and similar organisations that supported the government (Interview. Lorraine, 19 January 2007).

The PCs used a business model for the development of its science curricula. As with the NDP *Common Curriculum* the process involved the input of actors outside of education. In particular, the input of parents and their organisations. As with the curricula developed by the previous governments discussed in Chapters Five and Six, the PC development processes had no mechanism that enabled dialogue and discussion among multiple actors to come to consensus. Input from multiple actors remained as singular feedback from each group rather than across groups. Educators including practising teachers remained key actors in the writing of curricula. This did not change across all three governments discussed so far.

7.5.3 *The Ontario Curriculum* content

7.5.3.1 Economy and the global marketplace

The PC government stated that learning science was as important as literacy skills and mathematics (Ontario. Ministry of Education and Training, 1998a). They saw these as requirements for employment opportunities within Ontario, and that careers in national and global communities would be science and technology related (Ontario Progressive Conservative Caucus,1992; Ontario. Ministry of Education and Training, 1998b).

The introductory sections of both of the *Ontario Curriculum* secondary science documents stated that school science was not only preparation for becoming a science specialist but also to ‘thrive in a science-based world’ (Ontario. Ministry of Education, 2000, p.3; Ontario. Ministry of Education and Training, 1999, p.2). This reflects the long history of legitimately dual but often conflicting purposes in science education as discussed in Chapter Two: science for specialization in science- related careers; and science for all regardless of career or workplace specialization (Osborne, 2007; Roberts, 2007a, 2007b; Donnelly, 2005; Roscoe and Mrazek, 2005; Gilbert, 2004; Millar and Osborne, 1998; Fensham, 1993, 1988, 1985). The emphasis in the secondary science *Ontario Curriculum* was more reflective of science for specialisation, particularly in the organisation of courses based on post-secondary destinations of university, college, university and/or college, workplace. This required science curriculum writers to identify knowledge and skills relevant to the destinations for each of these courses – a challenging task! Furthermore, as early as Grade 8, students were required to make course selections depending on their post-secondary destination. This was quite unlike, *The Common*

Curriculum, and the recommendations by policy influencers during the Peterson Liberal and NDP governments, where Grade 9 was destreamed with a common curriculum for all students. In addition to organising secondary school around post-secondary destinations, all students were required to create personal annual education plans to help develop their 'interests and identify future educational and career opportunities' (Ontario. Ministry of Education and Training, 1998c, p.3). Ontario's students were being enculturated into education as being for training and employment.

Using the science literacy instrument mentioned in Chapter Four, *The Ontario Curriculum* for science is a combination of Roberts' (2011) two notions of scientific literacy. On one hand the science content was more like Roberts' (2011) notion of Vision I in that the science curriculum was emphasizing the science subject matter through expectations on specific science concepts. On the other hand, the science content also included STS-E as applications of science in technology, society and the environment. This is more like his notion of Vision II scientific literacy in that it situated science in life situations. For *The Ontario Curriculum*, the goal of school science encompassed both of these notions of scientific literacy but they were not equally represented. The majority of expectations related to science conceptual knowledge and less so on life situations. In addition, the curriculum continued to be organised around the traditional disciplines of science.

7.5.3.2 Specificity and standards

The Ontario Curriculum for science provided grade-by-grade standards in the form of curriculum expectations (content standards) and achievement charts (performance standards). This grade-by-grade organisation and specificity was a significant departure from the NDP *Common Curriculum's* (Ontario, Ministry of Education and Training, 1995f) organisation of outcomes into three divisions.

In the PC science curriculum content standards were written as expectations around three goals for science education: to understand the basic concepts of science; to develop the skills, habits of mind, and strategies related to inquiry in science and problem-solving in technology; and, to relate science to technology, to society and to the environment. These goals ran through every grade and strand. A strand was defined as a broad curriculum area within each course or grade (Ontario. Ministry of Education, 2000; Ontario. Ministry of Education and Training, 1999, 1998d). This is similar to the notion of a topic such as electricity in Grade 6 or weather in Grade 10. Each of Grades 1 to 8 had five strands; each of Grades 9 and 10 had four strands; and, each of the specialisation courses for Grades 11 and 12 had five strands. This is mentioned here as a point of reference as a change occurred with the next government and is discussed in the next chapter. Each overall expectation related to one of the goals of the science curriculum and was presented in the following order: knowledge, skills and STS-E. Again, this order is mentioned to compare it to changes that occurred with the next government, as well as their significance.

Performance standards were part of the curriculum documents in the form of an achievement chart. This chart was to be used to assess and evaluate students' achievement (Ontario. Ministry of Education, 2000; Ontario. Ministry of Education and Training, 1999, 1998d). Each achievement chart was – and still is - a matrix of four categories and four levels of achievement. Level Three is the provincial standard that students are expected to achieve. The science achievement charts reflected the three goals of the science curricula and included an additional category of communication. Students' achievement was to be based on how were they were performing in these categories. Xia commented that the achievement charts were contentious to include because politicians had difficulty understanding how these could become a mark.

> Politicians were mark oriented. Very mark oriented. And anything that didn't look like a mark had to be mushy in their eyes. ... And basically we went to the wall to keep that assessment chart in each curriculum. We simply said 'It can't go.' I mean I would have walked out. If we hadn't been able to make at least that ground on the curriculum because it just seemed to me such an important. I mean I don't know whether it was worth being passionate over but for me it was make or break. (Interview. 8 August 2007)

There are two points to bring forward with her comment. Firstly, politicians understood achievement to be represented as a quantitative mark. It is therefore not surprising that testing programs with quantified results on student achievement would receive their support. Secondly, her comment about bureaucrats "at least" being able to include the achievement charts reinforces that the voice of the bureaucracy still had a significant place in curriculum policy-making similar to previous governments, in spite of the development process discussed in this chapter.

The inclusion of the achievement chart in curriculum documents imposed a uniformity of assessment and evaluation practices when grading students. However, its implementation was not without confusion and resistance as noted by Julie, a secondary school science teacher in the second focus group. She recalled her frustration:

> Along with the changes in the subject curriculum piece there was that introduction of the achievement chart. So how does that work with my tests

> quizzes and labs and everything. ... It just became overwhelming, along with being bashed [by the government] in terms of you're not doing a good enough job. (Focus group 2. 18 March 2008)

Her comment also indicates that teachers were struggling to implement major curriculum changes within a hostile relationship with the government. Content standards may have provided consistency as to what students were to learn but the performance standards created inconsistency in determining student grades.

7.5.3.3 Accountability in the curriculum

As mentioned earlier, although science was one of three domains for national and international tests, the other two being reading and mathematics, it was not included in provincial tests. As mentioned earlier, by not having provincial tests in science, participants from school boards commented that school and board improvement plans shifted their focus on improving EQAO scores in reading, writing and mathematics. This is understandable as school results were – and still are - publicly posted. However, one consequence was that school administrators concerned themselves less with supporting science.

In the previous section about accountability, it was noted that the PCs wanted to see improved results in students' performance in national and international tests. When the results of the first 1996 SAIP science test were released, Ontario was ranked at the bottom of Canada's ten provinces (Gerard, 1997a). The PCs wanted a competitive edge for the 1999 SAIP science test. To that end, they required that the science content of *The Ontario Curriculum* for all grades be aligned to content of the *Pan Canadian* (CMEC, 1997). As mentioned in Chapter Two, the *Pan Canadian* was a national initiative coordinated by CMEC to provide a common set of science learning outcomes. The quantification of knowledge though SAIP results could be used to demonstrate a competitive advantage provided that the results show high achievement. On the other hand, poor results could be used as arguments to change curriculum or tighten accountability measures and teacher performance in curriculum implementation. Van commented that the PCs wanted a curriculum that was comparable to other national and international jurisdictions:

> Alberta was looked upon as the province of the world in curriculum and everything had to be compared to Alberta under the Tories [PCs]. I can remember when we were putting out the secondary school courses like chemistry and so on that we had to have comparisons to Alberta. Here's what they have. Here's what we have. This came about because of the *SAIP* testing. Alberta always seemed to be on top and Ontario would be on the bottom. (Interview. Van, permanent staff bureaucrat, 25 May 2007)

Van recalled that there was an assumption by the government that the Canadian science testing program SAIP would be aligned to the *Pan Canadian* but this did not happen. His comment illustrates that these testing programs exert an influence on local government curriculum, and in the case of *The Ontario Curriculum* for elementary and secondary science, it definitely did. The government wanted a better ranking of student performance and used curriculum as a means to improve this ranking. In that sense, *The Ontario Curriculum* became a competitive asset.

7.6 Chapter summary

The PC government was swept into office in June 1995 and with their two successive majority governments reinvented Ontario's education system. Their reforms to reduce governance, support market-based solutions and restructure education funding were intended to reduce the deficit and reduce taxes thereby providing conditions for faster economic growth. This growth would stimulate the economy to provide jobs for Ontarians. Education reforms were considered essential to their economic plan to ensure that Ontario's next generation had the knowledge and marketable skills to have high-paying and productive jobs that would contribute to Ontario being able to compete in world markets. Curriculum became a political tool of tangible evidence to demonstrate to the electorate that the government was taking action on the dissatisfaction that had been part of the Ontario discourse since the 1980s.

Curriculum was written as content standards, in the form of curriculum expectations, and represented what knowledge was valued. Performance standards were written in the form of the achievement charts and measured whether students met the provincial standard. This shift to a standards-based curriculum resulted in a prescriptive province-wide curriculum for all grades and all subjects. Science curriculum policy was part of this broader restructuring. It did have a notable role in being the first example of outsourcing curriculum rather than having it developed within the Ministry of Education as was done with previous governments. The PCs standards-based curriculum contributed to commoditisation of knowledge and became part of transforming Ontario into an auditable commodity. The seeds that were set with the previous Peterson Liberal and NDP government were propelled into maturity with the PCs neoliberal ideology.

The next chapter presents an analysis of the findings of science curriculum origins, processes and content for the McGuinty Liberal government. As this is the final government examined in this study, comparisons are made to the science curriculum policy and political arenas of the previous three governments when relevant.

Chapter 8 McGuinty Liberal government 2003 to 2008

8.1 Introduction

This, the last of the four findings chapters, presents an analysis of the data related to the McGuinty Liberal government. The previous three chapters have shown that since 1985, dominating discourses in the political arenas regarding education were demands for standards and accountability measures. Some of these measures included surveillance of how well curriculum was being implemented such as the OAC-TIP program and Program Reviews that were initiated by the Peterson Liberals but then discontinued by the NDP government. Instead, the NDP introduced provincial testing as part of their commitment to accountability, and this continued with the next PC government. As I have suggested, education and curriculum reforms over those past 18 years by three different governments transformed Ontario education into an auditable commodity. As discussed in this chapter, I argue that this was further shaped by the education priorities of the McGuinty Liberal government. Up to this point, science curriculum policy origins and processes were predominantly influenced by political arenas of education reform; however their content continued to be influenced by educators. As shown in this chapter, curriculum policy had less prominence for this government than the previous three governments, and science curriculum even less so. It should be noted that this study has only gathered and analysed data for this government up to the time the science curriculum documents were publicly released (2008). Since then there has been a change in the party leadership. In October 2012, a year after having a minority mandate to govern, McGuinty resigned stating that he wanted to spend more time with his family. At the same time he also prorogued parliament until a new Liberal leader was elected. On January 26, 2013, Kathleen Wynne, a former

Minister of Education in the McGuinty Liberal government was elected and parliament returned in February 2013. For this study, I continue to refer to the government as the McGuinty Liberals as he was the Premier and party leader for the time period of this study.

This chapter is organised with the same structure as the previous three findings chapters. Following the summary of the science curriculum policy documents developed by this government and a brief political orientation about the McGuinty Liberals, the remainder of this chapter is divided into two sections. The first section focuses on the political arena, in this case discussing the McGuinty Liberal education priorities and the implications of their enactment on school science and its curriculum. The second section focuses on the origins, processes and content of the McGuinty Liberal science curriculum policy documents. As with the previous three chapters each major section has three sub-sections of global marketplace, standards and accountability. This organisation enables a deeper discussion of these themes across all four governments as they related to science curriculum policy in the concluding chapter that follows this one.

Findings from this chapter were informed by participants in interviews and focus groups who had experiences with the McGuinty Liberal science curricula. Table 8-1 summarises their positions and the pseudonyms used in this chapter. The category of retired educators was added. These participants are still involved in Ontario education but their roles, like mine, for this government time period are outside of the formal education sector.

Table 8-1 Summary of participants with experiences related to the McGuinty Liberal science curriculum policy

Experiences/ Positions	Individual interviews	Focus group participants
Ministry of Education bureaucrat (seconded)	Andrew, Bailey, Cameron	
Ministry of Education bureaucrat (permanent staff)	Vincent	
Curriculum developer, elementary	Brittany, Sandra	
Curriculum developer, secondary	Olga, Ulrich, Walt	
Secondary science teacher	Peggy	Evelyn (FG-1) Felicia (FG-1)
School board science consultant	Fraser	Daniel (FG-1) Grant (FG-2) Harriet (FG-2) Ian (FG-2) Julia (FG-2)
Senior school board administrator	Loreen	
Resource developer	James, Ken, Nancy, Rick, Zack	
Retired educator	Haydon, Irene, Xavia	

Within the first year of the McGuinty Liberal government my own career in science education shifted from the formal education system, as coordinator of science and technology with the Toronto District School Board in Ontario, Canada's largest school board, to the informal education system with a Canadian non-profit organisation called Let's Talk Science. My new role required understanding what was happening within Canada's education systems, including any major reforms and particularly those that impacted on curriculum and school science. Unlike the previous three governments, my practitioner experiences with the McGuinty Liberal science curriculum were from this perspective as an outsider to the formal education system. As a researcher about Ontario science curriculum policy, this provided an added dimension as I was seeing relationships and events through an additional role (Bolton, 2010).

8.2 Overview: McGuinty Liberal science curriculum policy

When the McGuinty Liberals took office, they continued the curriculum review process which began by the former PC government, albeit renaming it from *Sustaining Quality Curriculum* to simply *Curriculum Review* (Ontario. Ministry of Education, 2005a). They described it as a staged process to review existing curriculum by discipline to build on the curriculum that was currently in place. This indicated their approval of the subject-specific and grade-specific curriculum that had been developed by the PCs. Their rationale for new curriculum was to ensure that it remained relevant and current (Ontario, Ministry of Education, 2005a). A seven-year curriculum review plan was published (Ontario, Ministry of Education, 2007d). The process for reviewing the science curriculum began in 2005 during the McGuinty Liberal's first term in office and the revised documents were publicly released during their second governing mandate.

The McGuinty Liberals released revisions of the three science curriculum documents of the previous PC government. These were T*he Ontario curriculum revised, science and technology, Grades 1 to 8* (Ontario. Ministry of Education and Training, 2007c); *The Ontario curriculum revised, science, Grades 9 and 10* (Ontario. Ministry of Education and Training, 2008b); and *The Ontario curriculum revised, science, Grades 11 and 12* (Ontario. Ministry of Education, 2008c). They are referred to as *The Ontario Curriculum Revised* in this thesis. As with the PC curriculum in the previous chapter, a descriptor is used to differentiate these three documents when needed such as *The Ontario Curriculum, Revised* for Grades 9 and 10 or the elementary *Ontario Curriculum, Revised*.

Although this study does not extend beyond the science curriculum that was released in 2008, it should be noted that the seven-year curriculum renewal cycle completed one full cycle and science was to undergo review again in 2012. At the time of this writing, this process has yet to begin. As this is outside the scope of the time period for my study, I can only make this observation and note that *The Ontario Curriculum Revised* is still the current science curriculum in Ontario schools in 2013.

8.3 Political orientation

By the time the McGuinty government was first elected, Ontario had had eight years of PC neoliberal policies. Towards the end of the PCs second term in office, they were experiencing backlash from Ontario voters and this helped put McGuinty into office in 2003 (Fanelli and Thomas, 2011; Schuetze *et al.*, 2011). Although both the Peterson Liberals and McGuinty Liberals are part of the Liberal Party of Ontario, their political orientations were quite different. As mentioned in Chapter Five, the Peterson Liberals were generally considered to be a centrist party, albeit slightly left of centre. The McGuinty Liberals, like the PCs that preceded them adopted neoliberal principles in their social and economic policies (Fanelli and Thomas, 2011). When first elected McGuinty positioned himself as a moderate but Fanelli and Thomas (2011, p. 151) stated that he is ‘a much more sophisticated and nuanced neoliberal than his predecessor’. As examples they cited his introduction of new public management techniques and the privatisation of services formerly covered under Ontario’s health insurance plan. Coulter (2009) suggested that the McGuinty Liberals represent a form of Third Way neoliberalism drawing from both the left and right to pursue their political agenda. She characterised the Third Way as a variant of neoliberalism when put into practice and cautioned that it is a ‘dangerous neoliberal shape-shifter’(Coulter, 2009, p. 206) as it actively fuses public and for-profit sectors.

8.4 Section One: Political arena

When the McGuinty Liberals took office, Ontario was in a state of upheaval from eight years of the PC neoliberal policies (Fanelli and Thomas, 2011). This section presents an analysis of the findings of the political arena surrounding the development of the McGuinty Liberal science curricula. Unlike the political arenas of the previous governments, public discourses and dissatisfaction with Ontario’s education system had diminished. Of significance to science curriculum policy was the education priorities of the McGuinty Liberal government that seemingly devalued school subjects like science. This may not have been intended but an analysis of the data indicates that it was a consequence. Data sources included government documents such as *Reach every student: Energizing Ontario education* (Ontario. Ministry of Education, 2008a) and participants in interviews and focus groups who were familiar with this government’s priorities and from government documents. The first section discusses the government’s priorities and education strategy and the three sub-sections that follow focus on these with respect to the global marketplace, standards and accountability.

8.4.1 Education and curriculum reforms

Prior to the 2003 provincial election, the McGuinty Liberals decided that education would become their central campaign issue (OECD, 2010; Levin, 2007; Ontario Liberal Party, 2003). As opposition leader, McGuinty had committed the Liberal party to a renewal of Ontario education and to address the reforms of the previous PC governments (Ontario Liberal Party, 2003). Among their commitments was a pledge to stop attacks on teachers and teacher unions, and treat teachers with professional respect (Levin, 2008; Ontario. Ministry of Education, 2004c; Ontario Liberal Party, 2003; p.16).

During the McGuinty Liberal's first term in office they established peace and stability to an education system that had been mired in strikes, lockouts and work stoppages under the PC governments (OECD, 2010; Ontario. Office of the Premier of Ontario, 2004f). In 2004, the McGuinty Liberals amended the *Ontario College of Teachers Act* (Ontario. Legislative Assembly, 1996b) to cancel the contentious Professional Learning Program that teachers were required to complete every five years for recertification (Ontario. Legislative Assembly, 2004a; Ontario. Ministry of Education, 2004d). During the McGuinty Liberal's second term of office, with less turmoil in labour relations, they focused on partnerships with teachers towards supporting the government's core priority of improving student achievement (Ontario. Ministry of Education, 2008a, p.13). Improving teacher relationships was part of the government's education strategy and stated by McGuinty as an important component for whole-system education reform: 'You won't get results unless teachers are onside' (McGuinty, 2009, cited in Fullan, 2010a, p.64; see also Ontario. Office of the Premier, 2009, 2010).

During the years for this study (until 2008), the relationships among the McGuinty Liberal government, Ontario teachers and their unions were dramatically different than the negative attacks on teachers and their unions by the PC government. After examining the political arenas for both governments, I suggest that both the PC and McGuinty Liberal governments used teachers and their unions for political gains – the PCs to further their education agenda by attacking teachers, the McGuinty Liberals to further their education agenda by creating positive relationships to gain support for their strategies to improve student achievement. That being said, since then, in late August 2012, this relationship has had a sudden and dramatic change (see Cohn, 2012; Brown, 2012; Gillis, 2012; Howlett, 2012a, 2012b; Howlett and Alphonso, 2012; Rushowy, 2012). I discuss this at the end of this section but first present the findings relevant to the time frame for this study. It should be noted that although the PC policies that related to improving teacher relationships were reversed, other PC neoliberal policies which led to re-inventing Ontario education remained in effect with the McGuinty Liberals such as governance and education funding policies (Schuetze *et al*., 2011).

McGuinty was called the 'education Premier' due to his strong support and sustained leadership to renew Ontario's public education system (Fullan, 2010a; OECD, 2010; Levin, 2008; Ontario. Office of the Premier, 2006b). He viewed publicly funded education as a cornerstone of democracy and a key to Ontario's future economic success (Ontario. Ministry of Education, 2008a, p.15). McGuinty was personally involved in shaping his government's education reforms. This was another key component that he stated as important to whole-system education reform: 'Education reform is not important to your government unless it's important to the head of your government' (McGuinty, 2009, cited in Fullan, 2010a, p.64; see also Ontario. Office of the Premier, 2009, 2010). McGuinty's political leadership

was cited as critical to the implementation of the education reforms instituted by his government (Fullan, 2010a; Radwanski, 2010; OECD, 2010; Levin, 2008).
Soon after forming his first government, McGuinty hired Michael Fullan to be his special advisor to education, and to also be an advisor to the Minister of Education (Fullan, 2010a, 2007; OECD, 2010; Boyle, 2004; Editorial, 2004; Mitchell, 2003). Fullan was the architect of McGuinty's education strategy (OECD, 2010) and was to assist in the development of a system-wide approach to improve reading, writing, and mathematics across Ontario (Fullan, 2007). The rationale being that if students did not have these foundational literacy and numeracy skills that it would be difficult to accomplish 'anything' (Fullan, 2007, p.141). A consequence of this approach was the marginalising of other subjects like science. Although reading and writing are part of any subject area, the implementation of this strategy kept it narrowly focused on language arts. Similarly, numeracy skills are important within science but the implementation of this strategy kept it narrowly focused on school mathematics. Evidence regarding this claim is presented in this section and in the sub-section about accountability.

Fullan devised a strategy for Ontario based on an evaluation of the U.K. literacy and numeracy strategy, which he led with a team from the Ontario Institute for Studies in Education (OISE). This evaluation was completed just prior to the 2003 Ontario election and, according to Fullan (2010c), he took the best of the English strategy, avoided the weak parts and built partnerships with Ontario's schools. Ball (2008) referred to Fullan as a policy entrepreneur in reculturing education and forming partnerships to influence school improvement and educational reform. As the architect of the McGuinty Liberal education strategy, Fullan's focus was on whole school/ school board reform, and in particular building capacity in the areas of supporting literacy and numeracy. He was a member of McGuinty's Premier's Education Results Team that met every two months to determine how to improve student achievement (Bloch, 2010; Ontario. Office of the Premier, 2010). Besides Fullan, members included the Premier, the Minister of Education, the Deputy Minister of Education. Its purpose was to provide direction on how to keep the government's education reforms moving forward including determining the funding and support that would be required (Ontario. Office of the Premier, 2010).

The McGuinty Liberal education strategy was to: create peace and stability in the education system; reduce class size; establish a Literacy and Numeracy Secretariat; establish negotiated targets, build capacity, enhance and target resources, create positive pressure; and reform whole schools/boards/systems (Fullan, 2007, p.141). All of these were done. Measureable targets were set for 75% of Ontario's 12-year-olds (Grade 6) to be at the provincial standard for reading, writing and mathematics, and for 85% of Ontario students to graduate from high school within five years. Setting provincial targets was unprecedented as were government funds dedicated to support meeting these targets. Funds were not allocated to specific subject areas like science. When it came to other subject areas, the government stated:

> We are not ignoring the other specific areas of the curriculum, such as science, technology, or history. These subjects are taught in their own right as schools go about implementing the provincial curriculum. All subjects improve when literacy across the curriculum is a priority (Ontario. Ministry of Education, 2008a, p.11).

By setting targets for literacy, numeracy and high school graduation, and the surveillance and accountability mechanisms to measure their success, Ontario education became an auditable commodity. It has been used by OECD as an example of effective whole-system reform (OECD, 2010). What this statement by the government did not convey were the consequences on other subjects when funding is focused to school boards on the government's education priorities. School science consultant Daniel commented on having funds to implement the new science curriculum,

> There is a huge discrepancy in the amount of time and resources that have been spent on the development of the curriculum versus the development of the implementation process there's a huge discrepancy. With science not being a government priority, they don't give time, they don't give money. It goes nowhere. (Focus group 1. 18 June 2007)

Similarly Ian, also a school board science consultant noted,

> I think this time round, with the current climate of literacy and numeracy being very prominent in school districts and provincially, I think a lot more principals and superintendents are in tune to see those goals supported. (Focus group 2. 18 March 2008)

The government did not allocate any dedicated funds for science for this implementation unlike the Peterson Liberal and PC governments.

The government focused their support and funds on what Fullan (2010b) called 'Raise the bar, close the gap'. This reflects another component that McGuinty stated as an important lesson to implement whole-system reform: 'If you want to achieve your goals, you need to keep up the pressure all the time' (McGuinty, 2009, cited in Fullan, 2010a, p.64; see also Ontario. Office of the Premier, 2009, 2010). This also had consequences for other subjects like science. I suggest that an emphasis on performativity to meet set targets contributed to marginalise the value of school science by school administrators and teachers due to the surveillance and accountability measures that the government created for their core priorities.

Fraser’s comment below supports this claim:

> It [science] isn’t one of the priorities of the government. Not science. It's not a priority compared to literacy (…) compared to numeracy. Compared to keep kids in school until they're 18. Compared to student success. (Interview. secondary school science consultant, 10 June 2006)

This is addressed further in the sub-section about accountability and curriculum policy.

One group of actors that needs to be mentioned is parents as in the previous government they had an active role in curriculum policy. This changed with the McGuinty Liberals and is raised here so that there is not an assumption when comparing the role of parents in science curriculum policy across governments that parents had the same role or influence with this government. When the McGuinty Liberals took office in 2003, newly appointed Education Minister, Gerard Kennedy appointed twenty parent leaders from across Ontario to advise the government on how to create an independent, representative province-wide parent voice that was accountable to parents (Ontario. Parent Voice in Education Project, 2005c). This committee reported that they wanted a voice at the provincial level that was accountable to parents and not a tool of the provincial government. They recommended a provincial parent board that would provide the government ‘***advice*** on parent involvement ***only*** and not education policy in general’ (Interim Parent Involvement Advisory Board, 2006, bold and italics in original). This was a departure from the intent of the Ontario Parent Council under the previous PC government where the Council was actively involved in their education reform plans including having a representative as part of the government curriculum advisory panel. This was discussed in the previous chapter.

At the beginning of this section, it was mentioned that the relationship between teachers and the government had changed dramatically since 2008. This past year teacher contracts were up for renewal and the government attacked teacher unions that had not settled their contracts by September 2012, using the media to suggest that the new school year may start with a strike. No unions had suggested this; nevertheless, the McGuinty Liberals passed legislation, *Bill 115: Putting Students First Act* (Ontario. Legislative Assembly, 2012) giving them the power to impose a contract on the unions and take away their right to strike. Teachers, through their unions, responded by started rotating one-day strikes and withheld extracurricular activities. The political climate became more reminiscent of the relationship with the teachers and former PC government. In January 2013 the Liberals retracted *Bill 115* but unions and their teachers continued to withdraw extracurricular activities although they discontinued the rotating strikes. In February 2013, the Liberals elected their new leader Kathleen Wynne, who stated her commitment to work on rebuilding the relationship with teachers and their unions (Ontario Liberal Party, 2013). At the time of this writing, she has begun a series of dialogues with union leaders and since then teachers have returned to full services. It remains to be seen what the long-term effects will be among the Wynne Liberal government, Ontario teachers and their unions.

8.4.2 Economy and the global marketplace

When the McGuinty Liberals took office, a supposedly balanced budget by the previous PC government had a hidden deficit of over $5.6 billion dollars (Morse, 2007). This deficit did not deter the new government from investing significant funds into education illustrating their commitment to education as a government priority (Levin, 2008; Ontario. Office of the Premier of Ontario, 2004e). I suggest that it also helped to build goodwill in an education system weary of the PC reforms. As noted in the previous section, improving relationships between the government and educators was a component of the McGuinty Liberal education strategy for whole-system reform. The government committed an investment of $2.6 billion over their first four-year mandate thereby reinvesting public education to the levels recommended in the *Rozanski Report* (Ontario. Office of the Premier of Ontario, 2004e; Rozanski, 2002). This report was from an independent task force that the PC government commissioned towards the end of their term in office to review education funding (Bartleman, 2002). At that time, there were increasing concerns by parents, educators and the public that education was adequately funded. The *Rozanski Report* confirmed this, estimating that updating the benchmarks for all components of the funding formula to August 2003 would require $1.08 billion to the education system, excluding salaries and benefits (Rozanski, 2002). During the McGuinty Liberals term in office, a global economic crisis emerged. Although the provincial debt had grown and policies were developed to control government spending, the government continued to fund their education priorities to maintain high standards and set targets for accountability. These were one way of building public confidence in public education so that government could continue spending in education (Levin, 2008; Ontario. Ministry of Education, 2008a).

The McGuinty Liberal government viewed their education priorities as a means to ensure Ontarians had a skilled workforce that could compete in a global economy. This was not unlike the view of the previous PC government. The McGuinty Liberals had a focused agenda on accountability, surveillance and regulation to prepare students for a global marketplace (Ontario. Ministry of Education, 2004e). Their target to have an 85% high school graduation rate within five years resulted in a new initiative, called Student Success (Ontario. Office of the Premier, 2005). This was a government priority from an economic perspective. The McGuinty Liberals viewed the issue of students not graduating from high school as a limiting option for their future employment opportunities. Then Education Minister Dombrowsky stated in a television interview, 'So it's really about building good workers for the jobs of tomorrow. That's why we are so driven to ensure that our students have everything available to them to be successful.' (Dombrowsky, 2010, 3:38-3:50). To support their Student Success initiative, the government funded a 'student success officer' in each high school and created programs of 'credit recovery' through which students could make up the parts of the courses that they had failed (OECD, 2010). Funds were also provided for student success school board leaders to meet and share strategies.

The issue of high school students not graduating has been an area of concern with previous governments, most notably the Peterson Liberals who had commissioned the *Radwanski Report* (Radwanski, 1987). As Ontario's elementary and secondary education became accessible for all, its education system had been challenged to provide curriculum and programs for students for whom traditional academic pursuits were not motivating and for students who were not interested in pursuing post-secondary education (Maharaj, Levin & Segedin, 2012). To address this concern, the McGuinty Liberal government bureaucracy created a new high school program called the Specialist High Skills Major (SHSM) program (Ontario.

Ministry of Education, 2013)as an initiative to support increasing the graduation rate by 2011.

Without the government needing to create new curriculum, SHSM programs integrated existing curriculum with work experiences and industry sector certifications. Students would select a SHSM program with a focus on a future career area such as biotechnology, agriculture, aviation and aerospace, manufacturing, mining and some 14 other programs. SHSMs required students to complete a set of eight to ten courses that related to the selected career interest. Students as early as Grade 9 or 10 could focus on a potential career that matched their skills and interests. Students who completed this program received a special designation on their high school diploma. This program targeted students who might otherwise not achieve high school graduation. On first glance, this program purported to enable students to pursue their own unique interests, goals and strengths; however, driving the actions of this initiative was the government target to reduce graduation rates and to be able to show measureable decrease in the high school drop-out rate.

8.4.3 Standards

The McGuinty Liberal government set three major education priorities: high levels of student achievement; reducing gaps in students' achievement; and, increasing public confidence in publicly funded education (Ontario. Ministry of Education, 2008a, p.4 and p.15). Their strategy focused on teaching and learning practices rather than new curriculum. Ben Levin (2008, p.100), who was a former Ontario Deputy Minister of Education from 2004 to 2007 and again from 2008 to 2009, stated, ‘Writing new curricula or writing performance objectives is not a good way to use teachers’ time in comparison with improving daily student assessment practices or learning new pedagogical practices’. This perspective aligned with the McGuinty Liberal direction of less emphasis on standards and new curriculum, and more emphasis on supporting schools to meeting targets to improve Grade 6 students’ literacy rates and to improve high school graduation rates. The PC curriculum already provided grade-by-grade content standards and performance standards in the form of an achievement chart in each curriculum document. The *Curriculum Review* process by the McGuinty Liberals was not intended to restructure curriculum but rather ensure that it remained relevant and current. By continuing with the same curriculum structure and format as the PC curriculum the McGuinty Liberals were indicating that these standards-based, subject-specific and grade-specific curriculum were satisfactory.

8.4.4 Accountability measures

As discussed in previous sections in this chapter, the McGuinty Liberal political arena related to education was less connected to curriculum policy and more to having accountability measures and surveillance mechanisms to support their education priorities for whole-system reform. As their priorities were in the areas of literacy, numeracy and improving high school graduation rates, government funds and support were directed to these areas. In a television interview, Fullan (2010b) commented on the government’s education strategy staying: ‘To reach set targets, the government’s role was to monitor the system’. This statement is a clear reflection of neoliberal tenets in education for increased accountability and surveillance. Considering that Fullan was the architect of the Ontario education strategy, it should not be surprising from his quote that mechanisms to monitor progress were put in place. I suggest that one outcome of this was minimising the importance of school science, particularly in elementary schools where there was intense surveillance to improve student achievement in literacy and numeracy. To illustrate this point, it is first important to understand the intensity of this surveillance.

During the McGuinty Liberal government, an accountability measure used to demonstrate the target of 75% of Grade 6 students reaching the provincial standard in literacy were the results of EQAO reading and writing tests. Former Education Minister Kathleen Wynne (2009) stated that these EQAO tests were used as diagnostic tools and were indicators of achievement. School administrators were to develop annual school improvement plans using the data from this provincial testing and demonstrate how they were working towards meeting government targets. Since provincial testing was only done in reading, writing and mathematics, it is not surprising that these improvement plans focused on these areas. EQAO provided resources to assist with the development of these plans at the local level.

An agency that played a key role in surveillance was the Literacy and Numeracy Secretariat. This new arm of the government was created in 2004, as part of the McGuinty Liberals education strategy. Its purpose was to improve achievement in reading, writing and mathematics through effective teaching (Ontario. Ministry of Education, 2010b; Ontario. Office of the Premier, 2009). The Chair reported directly to the Deputy Minister of Education (Ontario. Ministry of Education, 2006a). If EQAO results were low, intervention teams were mobilised to schools and/or school boards that were not meeting the government's targets (Costante, 2010; Fullan, 2010c; Wynne, 2006; Alphonso, 2004) At the government level, EQAO data was used to help determine resources and funding. As part of the funding schools received to improve their test scores, school boards needed to report on the funding that they had received, and on the effectiveness of the strategies and lessons learned so that adjustments could be made to the initiatives (Costante, 2010). Progress was monitored with a balance of pressure and support (Ontario. Office of the Premier, 2010, 2009; Fullan, 2007). In the same television interview Fullan (2010b) described the government strategy to be 'light on judgement and heavy on capacity building'.

Whole-system reform focusing on data and results created an audit culture in Ontario education. Fullan (2010b) stated that the test results of EQAO were providing data to be used as a strategy for improvement but the focus remained narrowly within language arts and mathematics. The strategy did not embrace a cross-curricula approach of improvement in reading, writing and mathematics. Staying within this narrow focus at the exclusion of other subjects may have also been due to the continued publication of EQAO results in the media ranking schools according to their performance on the tests. Then Minister of Education Dombrowsky (2010) justified this stating that these results would be accessible in any case through the freedom of information and that having the results publicly released was a form of transparency to the electorate. The following quote by Harriet illustrates that whole-system reform was not as much whole-system but narrowly within literacy and numeracy:

> I mean we offer AQ [additional qualifications] courses in science and [elementary] teachers taking it tell us they are taking this because it's of interest to them but they have almost a guilty feeling that they're taking a science AQ instead of a literacy or numeracy AQ. (Focus group 2. Harriet, school board consultant, 18 March 2008)

In science, the government supported Ontario's continued participation in testing at the international and national levels. Ontario's students performed among the top three and within the national average (Wynne, 2007). One would think that this good news would receive media attention, particularly after years of Ontario students performing below their peers in Canada in TIMSS and SAIP but this was not the case. A government media release (Ontario. Ministry of Education, 2007a) was not picked up by the media and did not result in headlines (Ontario. Ministry of Education, 2007a). Minister of Education Wynne did mention the Ontario results in the Legislative Assembly but within a broader political statement staying on message about the government's progress on student achievement (Wynne, 2007). In analysing the data about government's surveillance mechanisms to meet their targets, it is interesting to note that Ontario students performed well in science without the accountability measures, surveillance and the capacity building that has been the strategy for this government.

8.5 Section Two: Science curriculum origins, development processes and content

8.5.1 Origins

The origins of *The Ontario Curriculum, Revised* differed from the curricula of the previous three governments in that it was part of a review cycle for all curricula and its origins were not part of any initiative related to restructuring as had been the case with *OS:IS*, *The Common Curriculum* and the PCs *Ontario Curriculum*. The McGuinty Liberal education priorities were focused on system-wide improvement of student achievement through teaching and learning as discussed in Section One. There was less emphasis on new curriculum and more emphasis on supporting schools to meet targets.

8.5.2 Development processes

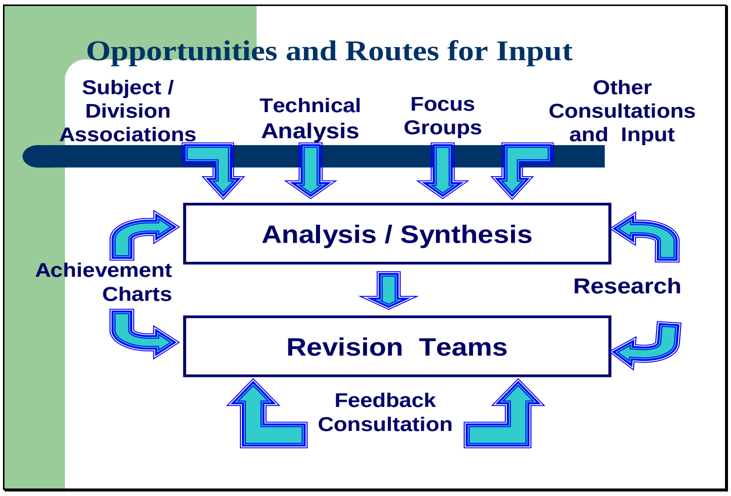
This section is informed by data analysed predominantly from transcribed interviews of participants who were involved in constructing the McGuinty science curricula (Interviews. seconded bureaucrats, Andrew, 1 April 2008; Bailey, 23 April 2008, Cameron, 8 June 2008; permanent staff bureaucrat, Vincent, 25 May 2007, Curriculum developers, Brittany, 18 October 2006, Sandra, 16 April 2007, Olga, 19 February 2007, Ulrich 10 May 2007, Walt, 16 July 2007). The McGuinty Liberal science curriculum documents returned control back to Ministry bureaucrats. Two project managers were seconded from their respective school boards to lead the science curriculum review, one for elementary science and one for secondary science. By this time, few career bureaucrats remained in the curriculum branch of the Ministry. Over the course of the previous governments, their bureaucracies were downsized and seconded staff was hired to manage and work on specific projects. A shift back from seconded staff to permanent staff occurred during the second term of the McGuinty Liberals and they began to hire permanent staff. This was related to the government addressing concerns of the public service union about the continued practice of hiring seconded staff and renewing their contracts rather than hiring permanent staff. The lack of permanent staff over the years created challenges for new staff as Bailey explained,

> Everything gets passed on by word of mouth. There was nothing written down that says this is what the curriculum process looks like and in year one you should be thinking about these things at this time of the year. And sometimes (…) word of mouth doesn't work really well. People that are there assume you know. They know you don't but they assume you do. And they don't think that if you're new you don't know what to ask. (Interview. seconded bureaucrat, 23 April 2008)

As shown in the previous three chapters, each government curriculum had a different process for its construction. The development processes of the last two governments show that the political arena can influence the process of how curriculum is constructed.

In the case of the McGuinty Liberal government, staff created a common process for the development of both the elementary and secondary science curriculum as shown in Figure 8A. This is already a difference from the previous PC government where there was one process for the elementary science curriculum using the ASAP Framework and a competitive bid process for the secondary science curriculum. Figure 8A diagram was widely used by Ministry staff to explain and communicate how the review would be conducted.

Figure 8A Ministry of Education curriculum development process (Ontario. Ministry of Education, 2005b)



An earlier stage not shown on Figure 8A and mentioned by Cameron was the Ministry commissioning a report on key issues in science education (Interview. seconded bureaucrat, 8 June 2008). This step was similar to one taken by the PC government which provided information to their expert panels as discussed in the previous chapter. This report was publicly available on their web site for anyone to read. The report for the McGuinty Liberals did not have this transparency and remained internal to the Ministry. Another report was that of an outside agency which was paid to examine the science learning requirements of five countries and/or provinces that the Ministry identified. These jurisdictions were selected according to who was performing better and worse than Ontario in PISA 2006 Science. This reinforces earlier claims that curriculum becomes a competitive asset and good performances on tests provide evidence of the market value of education. The commissioned report compared learner requirements with Ontario's PC curriculum and identified similarities and differences. Cameron commented that this report was also internal to the Ministry and not publicly accessible; there was no explanation why this was so. In my interview with Walter, who was involved in the technical analysis phase of constructing curriculum, I mentioned this report wondering if this team would have had access to it but he was not aware of it (Interview. 16 July 2007). The Ministry may have been open in sharing the process shown in Figure 8A but they were controlling what information they would share. The lack of public access may have had a political reason or it may have been an oversight and just not considered. There was no data from this study to suggest the reason. The lack of public availability to read these documents makes it difficult to determine their influence.

Referring to Figure 8A, Cameron, a seconded education bureaucrat, described an opportunity for input into the curriculum-making process was by subject or division associations (Interview. 8 June 2008). Early in the process before any analysis or writing was done, presidents of subject or division associations and representatives for Ontario school boards were invited to an information meeting at the Ministry. The Ministry shared the process as shown in Figure 8A and identified where they would be asking these associations for their input. This was for participation in focus groups, for the technical analysis and for the summer writing teams. Associations were informed that the Ministry would be requesting them to submit names of who they considered to be expert teachers. The Ministry chose the final participants to ensure that there was a balanced representation accounting for different geographical regions, rural/urban, public/Catholic, balanced gender representation, an identified area of expertise and range of experiences. The interview with Bailey, who was also a seconded education bureaucrat, affirmed Cameron's description of this process.

One criterion was that those nominated had to be practicing teachers in Ontario school boards as the Ministry considered practicing teachers to be experts in the field. Bailey said:

> They should be the ones who know the curriculum the best. Who have the best ear to the teachers in the classroom? What are they liking? What are they really concerned about? What's an issue for them that we need to be addressing through this [curriculum revision]? (Interview, 23 April 2008)

This seems idealistic and limiting in a stage of the process that seeks input from multiple perspectives. As shown in previous chapters, curriculum policy is value-laden and the so-called experts bring their own agendas to the process (Fensham, 2012). Furthermore there is an assumption by the Ministry that these representatives of associations were expressing the views of their members, but the comments by participants showed otherwise. For example Brittany recalled,

> So I was part of technical analysis because there wasn't anybody else on the [association name] who was involved with science and tech. ... How do you bring in an association perspective when others had really no opinion other than well I think I heard somebody say that they didn't like this. (Interview. 18 October 2006)

Her comment of others having "no opinion" sounds harsh and dismissive of colleagues but it raises a point as to what happens if you are the only one in an association who is interested in participating. Are you still representing the associations' view or your own? These questions are not insignificant when the Ministry lists associations that it has consulted as part of the process. The name of an association implies there is more than one voice being represented.

Although it was well known within the science education community that the elementary and secondary science documents would undergo revisions beginning in 2005, not all associations prepared or actively engaged their membership in a discussion about curriculum. For example Walter submitted his name for the technical analysis through his association and commented that there was no effort by the organisation to prepare a position about the curriculum. He said, "So we ended up being there just as individuals.". When probed further as to whether there was time for the organisation to coordinate a response, he remarked:

> It wasn't done at all. I mean I believe that [name of professional organisation] knew at least a year ahead of time that this review was coming. And that they would be asked to have representatives in the review; so one would expect that they would have gotten together a group and done a review to prepare ahead of time. But they didn't. Or failing that, once people were actually selected by the Ministry that small group would have gotten together ahead of time. (Interview. 16 July 2007)

One notable exception was the school board science consultants' organisation, SCCAO, who engaged their membership for over a year in a series of meetings, to reach consensus as to the changes that they would like to see in a revised curriculum (SCCAO, 2005a, 2005b; 2004a, 2004b; Interview. Olga, curriculum developer, 19 February 2007). Consultations involving actors outside of school educators occurred simultaneously while school board focus groups and the technical analysis of the PC curriculum were being conducted. A survey with three general questions was sent to government ministries whose mandates were related to science such as environment, health and energy. Universities and colleges submitted reports as well as various other actors that were on a Ministry list of education stakeholders. This included parent organisations and some non-government organisations. This broad consultation of actors was not unlike those which had occurred during the NDP and even more so during the PC governments. The "closed shop" of the Peterson Liberal process ended with the NDP government. This enabled multiple actors within and outside of the education sector to give their input. Although there may be conflicting or competing values, ultimately the curriculum is a public policy document as it defines what students are to learn in schools.

Regardless of multiple actors having input, power and control of information remained with Ministry staff. They synthesised the documentation from the input stage into a recommendations report. This report required approval by senior administration before any writing proceeded. Writing teams met for several weeks in the summer. Olga (Interview. 19 February 2007), Ulrich (Interview. 10 May 2007), and Sandra (Interview. 16 April 2007), who were all involved in the writing process and had varied experiences. The process was not as much writing as making selections. Writing teams had to work from a database of expectations of the current PC curriculum. They were to input their rationale as to why an existing expectation should be deleted, rewritten, remain as is, combined with another expectation, or moved. This made the writing process a technical exercise. How smoothly this process went depended on the dynamic interactions of the teams. The beliefs and values of participants about science teaching and learning varied based on the recollections of participants interviewed.

An added complexity was that both English and French science curricula were developed simultaneously with both linguistic groups working in the same room and on parallel teams. Comparable teams (for example, English senior chemistry and French senior chemistry) were to come to consensus with the changes they were making to the database. In addition to the values and beliefs that individuals brought to the process, having both linguistic groups work together had language challenges. For example, Olga mentioned, "When we talked STS-E to the French writers they were talking careers whereas we were talking analysis. Decision-making." (Interview. 19 February 2007). Conflicts among teams and across teams were to be resolved through discussion. However, if there was no resolution, writers were to record the disagreement and continue with their work. Olga commented that, "the English language Ministry person just said to document any unresolved conflicts in her book and she will look at them the following week and so we did.". Disagreements were to be resolved by Ministry project staff through internal discussions with the Ministry's French and English language curriculum branches. Ulrich found the process frustrating commenting, "I've never spent 20 days in conflict like that before where the conflicts centered on pedagogy and remained unresolved." (Interview. 10 May 2007).

Once Ministry project managers had reviewed the work of the writers, the draft curricula were posted for review on a secured website. School boards and stakeholder groups were provided with a password. Stakeholder groups were limited to those who were on an approved Ministry list developed by staff and the Minister's office. It remains unclear as to how this list was constructed and who was involved; however, it is clear from one participant who was interviewed that there was a list and it is those who were on the list who were included in the process. This person had requested for the recording to be stopped and did not want to be identified. This is an example of difficulty in putting aside information that is spoken regardless of whether or not it is taped (Marshall and Rossman, 2011; Walford, 2005; Kvale, 1996).

While the curriculum was being constructed, politics intervened. In 2006, the environment had become an area of media attention and public interest. The Curriculum Council, an advisory group of community leaders and education experts created by the McGuinty Liberal government, convened a working group to examine environmental education in curriculum. Their subsequent report had a series of recommendations to strengthen environmental education in Ontario's schools (Ontario. Ministry of Education, 2007b, pp.12-15). The government supported all of its recommendations some of which would impact on the science curriculum. The Council recommended that in addition to an environmental education focus across all compulsory courses, that there would be an additional course option available to students in Grade 11. This resulted in a revision of the draft Grade 11 science university/college course and workplace course. Both of these were rewritten in a second summer writing session as environmental science courses. Political interest in environmental education led to a stronger emphasis regarding environmental stewardship across all subject areas. This is an example of government influence being itself influenced by the public and the media. In spite of the lessened role of curriculum policy with the McGuinty Liberal government, when there was media interest, like other governments, they took action.

As with the PC government, interviews with participants in this study confirmed that the government communications department continued to have a role in the final documents. They would edit them to ensure the text would not conflict with government priorities. The introductory sections in *The Ontario Curriculum, Revised* for both elementary and secondary science is an example. Embedded into the text are the government's priorities towards literacy, the environment and supporting student success (Ontario. Ministry of Education, 2008b, 2008c, 2007c). Final approval to publicly release the curriculum documents followed the protocols that were in place prior to the NDP government; a briefing note was sent to the Minister of Education to approve the completed document for public release. The document was then posted on the Ministry website followed by print copies sent to school boards. By posting the document on the web site, the curriculum continued to be accessible to the general public and parents. Cabinet approval was not required indicating that curriculum did not have the same political priority as with the previous two governments which did require cabinet approval.

8.5.3 *The Ontario Curriculum, Revised* content

8.5.3.1 Economy and the global marketplace

As mentioned in Section One, the McGuinty Liberals viewed their education priorities as a means to create a skilled workforce that would compete in the global economy. This view is not reflected in *The Ontario Curriculum, Revised*. It may have been the focus underpinning their education strategy, but the text of the curriculum does not reflect this. *The Ontario Curriculum, Revised*, both elementary and secondary, describes the importance of school science for developing scientific literacy. It supports the view of scientific literacy for citizenship and that scientific literacy is important for all (Ontario. Ministry of Education, 2008b, 2008c,2007c). Science for specialisation is not emphasised and the secondary science curriculum states that scientific literacy is not the same as becoming a scientist (Ontario. Ministry of Education, 2008c, p.3). *The Ontario Curriculum, Revised* is oriented more towards Roberts' notion of Vision II scientific literacy with a focus on situations. Although the documents continued to be organised around the traditional disciplines of science, the emphasis on STS-E makes it more like Vision II.

8.5.3.2 Specificity and standards

The Ontario Curriculum, *Revised* continued having a standards-based, subject-specific and grade-specific curriculum. Second generation documents that were the norm during the Peterson Liberal and NDP government time periods were no longer developed. Teachers had become used to working with the curriculum documents directly, or through resources developed for the curriculum like curriculum-aligned textbooks. That may be due to greater specificity in the documents but it could also be due to school boards no longer having the number of central staff and a budget to continue developing their own documents.

There were three major changes to *The Ontario Curriculum, Revised* that are worth noting for this curricula. One is related to the number of expectations (content standard), the second to the order of the overall expectations, and the third is the change to the achievement chart (performance standard). Reducing the number of expectations was a directive by the government. Andrew, a seconded bureaucrat, recalled:

> The Deputy Minister came down and said. Well I'm responsible for this. I hope you're paying close attention to the fact that we put far too much stuff in this [the PC] curriculum and you gotta do something about it. (Interview. 1 April 2008)

He mentioned that this directive was in agreement with what was heard during focus groups of elementary teachers during the input stage of the development process.

An analysis of the *The Ontario Curriculum, Revised* policy text for elementary science and technology shows that the five strands that were in the PC curriculum were reduced to four. There is also a reduction in the number of curriculum expectations; however, this does not mean that the required learning has been reduced. A quantitative approach to reducing the number of expectations is misleading. Visually it appears as a reduction but the learning within an expectation can still be substantial. For example, in the new Grade 8 curriculum there is a new learning expectation 'understand and use the formula work = force x distance (W = F x d) to establish the relationship between work, force, and distance moved parallel to the force in simple systems' (Ontario. Ministry of Education, 2007c, p.145). This singular expectation requires significant time to teach as it involves understanding several concepts. Similarly combining expectations into a singular one does not reduce the required learning. As an example, in the PC elementary science curriculum, two learning expectations for Grade 1, ‘identify major parts of the human body and describe their functions’ and ‘identify the location and function of each sense organ’ (Ontario. Ministry of Education and Training, 1998d, p.15) were combined in *The Ontario Curriculum, Revised* as ‘identify the location and function of major parts of the human body, including sense organs’(Ontario. Ministry of Education, 2007c, p.46). The number of expectations may have been reduced but this did not lead to a reduction in what was to be taught and learned, and therefore not addressing the major concern teachers were expressing at the focus groups.

Secondly, *The Ontario Curriculum, Revised* science policy texts for both elementary and secondary show that the order of the goals, overall expectations, and organisation of the specific expectations is in reverse order with the first being STS-E related, the second skills-related and the third knowledge-related. This new order is a significant change and the implementation message to curriculum users is that STS-E has been deliberately placed at the beginning to provide the context for developing the related skills and knowledge (Ontario. Ministry of Education, 2008b, 2008c). It is also within the STS-E expectations that environmental education has been included. The inclusion of environmental education was a political influence on science curriculum as discussed in the earlier section on the development process.

Thirdly, the achievement charts in *The Ontario Curriculum, Revised*, are no longer subject-specific and the four categories are now the same for Grades 1 to 12 for all disciplines. This had resulted in the Achievement Chart not aligning to the implementation message about STS-E in the science curriculum. In the PC science curriculum, the achievement chart was specific to the discipline of science and STS-E was a category onto itself called Making Connections. The revised McGuinty Liberal achievement chart has reduced making connections to a criterion within the new category called Applications. The significance of this is that the revised Achievement Chart undermines the emphasis of STS-E in the curriculum text.

8.5.3.3 Accountability in the curriculum

The emphasis in *The Ontario Curriculum, Revised*, is on classroom assessment and evaluation and on considerations for program planning (Ontario. Ministry of Education, 2008b, 2008c,2007c). This was expected as curriculum is enacted locally within the classroom.

There have been changes in *The Ontario Curriculum, Revised* regarding when certain topics are to be taught. This has shifted the Ontario curriculum away from its alignment with the *Pan Canadian*. However, these changes occurred in the secondary science curricula and therefore should not impact on curriculum congruency for national testing in science as this occurs in Grade 8. The elementary curriculum remains aligned to the *Pan Canadian* which is used to develop assessment items for the *Pan Canadian Assessment Program* (see Chapter Two for more information about this assessment program).

8.6 Chapter summary

Unlike the science curriculum of previous governments, the McGuinty Liberal curriculum was part of a cyclical review and not developed within larger education reforms that reconceptualised or restructured Ontario education. This did not mean that this government was not interested in reinventing Ontario education, but their focus on whole-system reform was specifically aimed at literacy, numeracy and improving high school graduation rates. Measureable targets were set for 75% of Ontario's 12-year-olds (Grade 6) to be at the provincial standard for reading, writing and mathematics, and 85% of Ontario students would graduate from high school within five years. It was these areas that received the attention and funding of school boards. Subject-specific subjects like science were marginalised with this singular focus on meeting these targets.

The shift towards accountability measures and surveillance mechanisms that had begun under previous governments reached new heights with the McGuinty Liberal government. Neoliberal policy technologies of creating high performance and building capacity contributed to transforming Ontario's education system into an auditable commodity. Curriculum continued to have a role as a form of measureable standards that could hold educators (usually teachers) accountable.

This is the last of four chapters presenting an analysis of my findings. Each chapter discussed the political arena for each government as it related to education. It is within that political arena that each government decided whether or not to have new curriculum. Each chapter also discussed the science curriculum policy documents, their development processes, and their content as they related to themes of global marketplace, standards and accountability. The concluding chapter discusses trends and patterns in science curriculum policy across all governments to identify influences on curriculum policy-making. This includes commenting on the curriculum policy characteristics that were outlined in Chapter Three after having conducted this study.

Chapter 9 Conclusion

9.1 Introduction

This chapter draws together the findings of this study. Coincidently, in 23 years, the education reform policies of Ontario’s four governments have resulted in 23 science curriculum policy documents, albeit 15 of these were for the Peterson Liberal government *OS:IS Science* curriculum. In addition, there were six different development processes for these science curricula across these four governments. The influences that contributed to Ontario’s science curriculum origins, processes and content are summarised in this chapter. Over the course of the time period for this study, Ontario’s education reforms encompassed neoliberal trends for standards and accountability measures. This has transformed its education system into an auditable commodity. The science curriculum policy documents are one component and reflect these reforms. Science curriculum policy was not immune from the demands for standards and accountability that began with the Peterson Liberals, increased during the NDP, enacted with whole-scale reform by the Harris PCs and intensified to a system focused on performativity with the McGuinty Liberals. This chapter begins with a summary of major findings. This is followed by revisiting the characteristics of curriculum policy that were discussed in Chapter Three. Having concluded this study, I modify the descriptors for each based on what my study has uncovered about curriculum policy characteristics that I was unaware of when I began this research. The remaining sections of this chapter discuss possibilities for further research and limitations of this study. As this thesis reaches completion, my personal reflections about this research journey are presented at the end of the chapter along with concluding comments.

9.2 Summary of major findings

As shown with this study, curriculum policy is an expression of political intention involving a course of action that is shaped by political acts, events and interactions among actors resulting in a product in the form of government-developed curriculum documents. These documents are products of compromises, influences and agendas among a variety of actors. Discourses related to curriculum reform and curriculum policy occur within broader political agendas. In this study, three of the four governments (Peterson Liberals, NDP and PCs), considered curriculum policy as essential for having a common set of standards for all students to learn whereas the McGuinty Liberal government did not place the same importance on curriculum; however by then there was a standards-based curriculum. Their education reforms emphasised teacher practice that would result in higher student achievement. As they set targets in literacy and graduation rates, subjects like science were marginalised. Regardless of whether or not a government had interests in a particular subject area, their education reforms had an impact on all subjects. Examining the curriculum policy of a specific subject, as was done in this study, is illustrative of how these reforms influence curriculum documents. They have become a public record of standards to which students and teachers are held accountable. In that sense they contribute to Ontario's transformation of its education system to an auditable commodity where the performance of students and teachers has become an indication of how efficient and effective schools are operating.

This section presents a summary of major findings looking at patterns and trends across all four governments. This includes the ideological, economic and political conditions during the times when the science curricula were developed; as well as the processes involving development and content of the curricula.

9.2.1 Arena for education reform: ideological, economic and political conditions

Although it is entirely appropriate that curriculum should undergo revisions to be kept current, the demands of the public, politicians, business and industry for efficiency and effectiveness from Ontario schools, were significant factors influencing why governments chose to undertake curriculum reform. I draw upon the summary of influences shown in Table 9-1 to discuss the ideological, economic and political conditions for education reform for the four governments examined in this study. Included are actors who were influencing how these governments acted, which subsequently also influenced their curriculum policy.

Table 9-1 Summary of influences on the education reform arena for all four governments from 1985 to 2008

Influences	Peterson Liberals 1985-1990	NDP 1990-1995	PC 1995-2003	McGuinty Liberal 2003-2008 (+)
Ideology	Centrist	Social democrat then shifted towards right	Neoliberal (re-invent education system)	Third Wave neoliberalism
Economy	Education for workplace emphasis	Deep recession (dominated early agenda) Keynesian approach Social Contract/Rae Days	Rationalised economy as purpose for education reforms	Purpose of education – economic emphasis SHSMs Global economic crisis emerging in 2007-2008
Global marketplace	Concerned about global economic competitiveness	Concerns towards latter half of governing period	Concerned about global competitiveness	Concerned about global competitiveness
Market value of education	Emerging	Emerging	Explicit	Explicit
Accountability measures	SiSS (international) Began Provincial	TIMSS SAIP OAC-TIP- discontinued in	TIMSS results PISA SAIP Established	PISA SAIP PCAP EQAO (as for

	Review Program OAC-TIP	1993 Program Review discontinued Introduce EQAO and provincial testing Continue Program Reviews	EQAO Provincial testing at Grades 3, 6 (reading , writing, mathematics); Grade 9 math; Grade 10 literacy – needed pass to graduate College of Teacher PLP and preservice test	PC) Set literacy target for Grade 6; set high school graduation rate target; marginalises science
Electorate/ (Public/ Business/ Industry	Public confidence decreasing	Public confidence decreasing; want provincial testing	Initially supportive; towards end of second mandate were concerned	Premier viewed as friendly to education and acting on their concerns through setting targets
Parents	Dissatisfied with education; decreasing confidence in public education	Increasing voice of parents; established Parent Council and school councils	Increased role and parent input into curriculum	Changed role; less policy-driven
Media	Negative articles about education and economic preparedness	Negative articles about the curriculum draft and lack of accountability	Poor results in science testing	Articles less negative about education policies
Government and bureaucrats	Looked to policy influencers outside bureaucracy: Radwanski, Premier’s Council, Select Committee; large bureaucracy with subject expertise	Beginning of downsising of bureaucracy; Involved multiple stakeholders outside of bureaucracy for input into reforms; Policy influencer: Royal Commission	Major shift from career bureaucrats to seconded staff Policy influencers other agencies (e.g., EIC, OPC), Embraced NPM	Continuation of seconded staff; (some hiring after 2008); strategy design and led by Fullan and Literacy and Numeracy Secretariat; reforms driven by strategy and not bureaucracy
Educators	Concerned about calls to review and change *OS:IS* curricula Unhappy with Peterson, campaigned against the gov. in election	Unions unhappy about Rae Days and destreaming; also about vagueness of *TCC*; unions campaigned in support for Harris PCs	Changed working conditions of teachers and school administrators; 1996 political protest Unions (and teachers) unhappy, campaigned for Liberals	Rebuilt positive relationship with teachers (this changed dramatically in 2012)

Since 1985, the ideologies of the political parties that have governed Ontario have varied from centrist (Peterson Liberal) to neoliberal (PCs and McGuinty Liberal). In-between these two extremes, Ontarians elected a social democratic party (NDP) that, during their time in power, shifted their policies to the right. Although the ideologies of these parties are reflected in their reforms and ways of governing, it should be remembered that as pointed out in Chapter One, the changes in governments were less a reflection of the policies of a government and more a reflection as to whether Ontario voters perceived a government and its leadership to be managing the affairs of the province competently and in a fair manner. In essence, the Ontario electorate rewards a government's managerial skills. Nevertheless, although governments change, the impact of their policies continues. Levin (2008) suggested that the high political visibility of education that has developed over the years has made governments feel compelled to act. Given Ontario's political culture, it is no wonder that all four political parties wanted to be seen as being responsive to the electorate. Ontarians expected governments to be responsive to their concerns; politicians are interested in being elected; and, political parties are interested in forming governments.

Findings from this study showed that from the Peterson Liberal governments to the PC government, business, industry, the media and the public were vocal about their dissatisfaction with Ontario's education system. Concerns were centred on a decrease in public confidence as to whether the system was addressing having a workforce that would contribute to having Ontario be competitive in the global marketplace. Related to this were the demands for standards and accountability measures, thereby illustrating the increasing interplay of the economy, a competitive marketplace, and the requirements for a skilled and competitive workforce (DeBoer, 2011a; Carter, 2005a; Astiz, Wiseman and Baker, 2002). One way in which Ontario governments acted to these concerns was through education reforms. Developing new curriculum was an action within these reforms that governments undertook to demonstrate to the electorate that they were addressing their concerns. This was the case for both the NDP and PC governments. The Peterson Liberals acted by announcing new reforms while the curriculum that was being developed during their mandate was just released for implementation. The McGuinty Liberals showed their response, not through curriculum, but through a strategy that set quantitative targets that the education system needed to reach. With these targets set in reading, writing and improved graduation rates, subjects like science were marginalised in the attention they received for funding and implementation support.

When an electorate is dissatisfied with education, public confidence decreases. This brings forward the issue of voters questioning the value-for-money that they are receiving through their taxes. With education being a major fiscal responsibility for education, it is within governments' interests to have the electorate satisfied with its education system. One discourse related to this was the demand for standards and accountability measures. The action for standards is discussed in the section summarising the content changes to the curricula; however, the actions related to accountability measures is addressed here.

As shown in Table 9-1, accountability measures in Ontario education have increased significantly since 1985. This has transformed Ontario's education system into an auditable commodity. It has been a gradual increase beginning with the curriculum-oriented Program Reviews and OAC-TIP programs initiated by the Peterson Liberals to standardised testing first at the international level during the Peterson Liberal governments, students participated in SISS (see Chapter Five). This evolved across the other three governments to a system of multiple large-scale testing programs provincially, nationally and internationally. The national and international tests included science. The Ontario provincial tests were – and still are - only in the areas of reading, writing and mathematics. These were introduced in the new reforms announced by the NDP government but enacted by the PCs and continue with the McGuinty Liberals. Although this may seemingly be unrelated to a study about science curriculum, there are consequences to school science with the provincial focus on literacy and numeracy , particularly with the McGuinty Liberals. With this government, school administrators were required to prepare and submit annual school improvement plans to indicate how they were working to meet the governments' targets. To inform their plans they were expected to use the data from their schools' results of these provincial tests. These school improvement plans were more than an accountability mechanism; they were an auditing mechanism for the government to determine how to focus funds and support to ensure its targets would be met. This singular focus marginalised attention to other subjects like science.

Another outcome of public and media dissatisfaction with the education system was that curriculum documents were no longer for educator consumption only but have become policy documents accessible to anyone interested in reading them. This began when the NDP government released their curriculum after the vociferous debates of public dissatisfaction in education in the media in the late 1980s. This curriculum was intended to address the public mood for accountability and standards in what was being taught in Ontario schools. *The Common Curriculum* (Ontario. Ministry of Education and Training, 1995f) was vilified in the press and by other education stakeholders as not reflecting their concerns. It was considered vague and offered choice and flexibility for teachers in planning their courses of study rather than specific standards for each grade and in each subject. Following this negative response, the PC government used curriculum documents as a form of political communication to the electorate. Curricula were to be written in plain language so that they were understandable to all Ontarians and not only to those in education.

Education is a political process (Ball, 2003, 1990a). There is educator naïveté in thinking that educator expertise would be given preference in matters involving education over public opinion. Levin (2008, p.145) commented that the judgement of experts is often overridden by public opinion that may or may not be well informed but has its own reasons. From the discussions in this section, the findings from my study support his comment.

9.2.2 Science curriculum policy development processes

After analysing the development processes of curriculum policy-making across the four governments in this study, a striking, revelation came forward. There were six development processes for four governments! Each government's process was different and within the Peterson Liberal and PC governments, the development processes were also different for their elementary and their secondary documents. A summary is presented in Table 9-2. This also contains the ideology of the four governments as a reminder of the political orientation of each political party at the time.

Processes to construct curriculum documents from 1985 evolved from involving only educators to one involving increasingly more actors. Politicians and politicos became involved when political stakes were high as was the case with the NDP government which renewed their interest in education reform after *The Common Curriculum* was negatively received by the public, and by the PC government.

Table 9-2 Science curriculum development across four governments from 1985 to 2008

<table>
<tr><th>Influences</th><th>Peterson Liberals 1985-1990</th><th>NDP 1990-1995</th><th>PC 1995-2003</th><th>McGuinty Liberal 2003-2008 (+)</th></tr>
<tr><td>Ideology</td><td>Centrist (slightly left)</td><td>Social democrat then shifted towards right</td><td>Neoliberal (re-invent education system)</td><td>Third Wave neoliberalism</td></tr>
<tr><td rowspan="2">Process</td><td>Elementary: educator committee-style; generalists “closed shop” – non-educators not involved</td><td rowspan="2">Multiple stakeholder committees under Learning Program Secretariat</td><td>Elementary: purchased</td><td rowspan="2">Process silo-ed among actor groups</td></tr>
<tr><td>Secondary: writing teams for difference courses closed shop” – non-educators not involved</td><td>Secondary: outsourced</td></tr>
<tr><td rowspan="2">Who led and wrote</td><td>Elementary: Educator / bureaucrat led Educators wrote</td><td rowspan="2">Bureaucrats wrote discussion papers for committees, led and wrote outcomes</td><td>Elementary: Bureaucrats as managers; ASAP wrote based on work with 17 boards</td><td rowspan="2">Educator led (bureaucracy) Educators wrote Simultaneous English-French development</td></tr>
<tr><td>Secondary: Educator / bureaucrat led Educators wrote</td><td>Secondary: Bureaucrats as managers; Educators wrote</td></tr>
</table>

Influencing actors	policy advisor Radwanski Premier's Council Science Council of Canada report Science education reforms (SL/ emphases)	Public, business, industry, media, politicians for consultative draft response; outcomes-based education	Parents, those sympathetic to gov.; gov communications ; politicos; Curriculum Advisory Panels; *Pan Canadian*	Communications office Curriculum Council Media (environment)
Approval process	Briefing note for Minister approval	Approval by cabinet committee	Approval by cabinet	Briefing note to Minister approval

Major actors determining what students should learn were educators, predominantly those involved in science education although not exclusively. Fensham (2002) suggested that academic scientists and elite science teachers are the principal 'drivers' of school science curriculum-making. Findings from this study indicate this was not the case for the Ontario curriculum. Ministry of Education bureaucrats relied on professional educator organisations to provide them with the names of teachers for writers and reviewers. These organisations were not limited to science teacher organisations as there are also generalist primary and junior teacher organisations.

The findings from this study indicate that although practising teachers and consultants are key actors in constructing school science curriculum documents, this did not necessarily mean that they were 'elite science teachers' as mentioned by Fensham (2002). Rather they were teachers who had expressed interest in reviewing, writing or responding to draft curricula. They often had personal agendas such as using the experience as a professional development opportunity and wanting to influence science curriculum according to their personal views.

Since the 1980s, governments significantly downsized the education bureaucracy. During the Peterson Liberal governments there were career bureaucrats with subject expertise in both the central and regional Ministry offices. They led curriculum development, typically seconding teachers and consultants from school boards to assist in this process. Curriculum development during that time remained within and among educators. With subsequent governments, there was an emphasis on efficiency and cutting costs, and career education bureaucrats were replaced by seconded teachers from Ontario school boards. These seconded bureaucrats were hired to lead projects such as constructing curriculum. As the PC government reinvented Ontario's education system, New Public Management (NPM) manifested itself bringing practices from the private sector into traditional practices of bureaucratic central control. An extraordinary example was their outsourcing of the development of the secondary curriculum through a business practice involving a request-for-proposal process. With the McGuinty Liberal government, curriculum development returned to a process that was more similar to the Peterson Liberal government in that it was less political and the leadership was back to central bureaucratic control, albeit with bureaucrats still in seconded positions.

Governments exerted influence through their choice of who sits on advisory panels and being responsive to actors sympathetic to their policies. As curriculum documents gained political currency, the government communications office which was responsible for editing these documents was a gatekeeper to ensure the intent of the documents reflected the government's priorities; for example, the McGuinty Liberal *Ontario Curriculum, Revised,* expanded the introductory pages of this curriculum to refer to the importance of environmental education, student achievement, and significance of literacy and numeracy. All of these were important priorities for the McGuinty Liberal government.

Traditionally, public release of curriculum documents underwent a routine process of bureaucrats submitting a briefing note to the Minister of Education. When political stakes were high the process involved presenting the documents to the cabinet for approval before they could be publicly released such as the curriculum documents developed during the PC government's mandate. All of their curriculum documents required full cabinet approval before they could be released. Curriculum was part of the PCs government reforms to reinvent how government works and subsequently how education in Ontario works.

After examining the development processes for these four governments, one commonality is the different beliefs and values of actors who influenced science curriculum. This is not surprising as policy-making is a human activity and actors involved in the processes bring their understandings to the role that they play. Although this study did not set about to propose a process for making curriculum policy, the analysis of the development processes for the curricula in this study indicate that there was a lack of actors being able to hear each others' agendas. This led me to examine an approach that enables multiple actors to openly express their views within a common forum. I suggest that this deliberative inquiry approach is a way of engaging multiple actors who influence curriculum policy-making. I draw upon the literature related to this field to support this suggestion. First, an orientation about what is meant by deliberative inquiry.

Deliberative inquiry

Reid (1982) coined the term 'deliberative inquiry' (cited in Harris, 1999, p.287) and viewed deliberation in terms of practical reasoning (Harris, 1999). Based upon the work of Schwab, in a deliberative inquiry, curriculum issues are set among wider practical problems and resolved through a structured results-focussed process that allows for arguments for and against issues (Christodoulou, 2010; Henderson, 2001; Harris, 1999; Reid, 1999). Actors share their reasons, rationale or logic of their opinions to establish where mutual understandings exist (Christodoulou, 2010; Kanuka, 2010; Henderson, 2001; Orpwood, 1981). The aim is to make choices based on thoughtful examination of alternatives among decisions such as what should be taught and to whom should it be taught (Christodoulou, 2010; Harris, 1999; Orpwood, 1981). An assumption of deliberative inquiry is that decisions are socially constructed and built upon discussions with others (Kanuka, 2010). Furthermore the process of deliberative inquiry is informed by asking and answering ancillary questions that can be researched through inquiry processes (Christodoulou, 2010; Harris, 1999). If moderated effectively by an experienced facilitator, the group determines whether consensus can be reached.

Deliberative inquiry was the process used for setting forward the series of recommendations in the Science Council of Canada report (Canada, 1984). As mentioned in Chapter Two, this process engaged multiple actors in dialogues about school science education in a series of 'deliberative conferences' (Orpwood and Souque,1985, p.625). Each two-day conference included high school students, elementary and secondary teachers, parents, trustees (elected school officials), the scientific community, university science educators and representatives from business and labour communities (Aikenhead, 2006; Orpwood and Souque, 1985). Thereby, multiple actors could present their agenda as well as hear that of others who also had interest in education (Ivany, Sherwood and Wideen, 1997). In essence, it is a way of developing and refining ideas (Fischer, 2007).

Orpwood (1981) argued that curriculum reform is a political process. Similarly, Hart (1989) suggested that central to the activity of constructing curriculum are policy debates. The process of deliberative inquiry can be a means to engage multiple actors from diverse groups who bring competing agendas to make decisions. Their views can affect understandings of other actors, either confirming or reshaping them. These collaborated views can then be brought to other stages and further refined and reshaped. Deliberative inquiry explores multiple points of view, is sensitive to the perspectives shared by groups of people, and demonstrates respect for those who may have different viewpoints about an issue under investigation and discussion (Christodoulou, 2010; Kanuka, 2010; Aikenhead, 2006). Given that curriculum is political, this approach has merit for consideration.

9.2.3 Science curriculum content

Increasingly since the 1990s, political agendas demanded accountability measures from the education system. Standards were a means to centralise control as to what students should learn. The increasing demand for standards influenced the specificity of the curriculum documents since 1985 as shown in Table 9-3. The flexibility that both the Peterson Liberal and NDP curricula enabled for interpretation and implementation was removed with the standards-based curricula of the PCs. This is still the case with the McGuinty Liberal science curricula.

Table 9-3 Structure and specificity of science curriculum from 1985 to 2008

Influences	Peterson Liberals 1985-1990	NDP 1990-1995	PC 1995-2003	McGuinty Liberal 2003-2008 (+)
Ideology	Centrist (slightly left)	Social democrat then shifted towards right	Neoliberal (re-invent education system)	Third Wave neoliberalism
Standards	Demand for standards	Demand for standards; Language and Math standards developed	Standards for students (curriculum) Standards for teachers	Standards for students (curriculum) Standards for teachers
Structure and format	Elementary: Flexibility in what can be taught Organised by grade grouping (end of 3, end of 6)	Emphasis on integrated approach; science not separate subject Three versions released: working draft, parent copy, final copy Flexibility – organised by grade grouping (end of 3, 6, 9) Oriented to Vision II SL	Elementary: Content standards (expectations) Performance standards (achievement chart)	Reduce expectations Same structure and format as PC curriculum,
	Secondary: 15 documents; written as objectives; include STS, Oriented to Vision I SL Flexibility in choice of units; grade and course specific Streamed: advanced, basic, general		Secondary: Orientation towards both Vision I and Vision II SL with leaning to Vision I Expectations ordered: Knowledge, skills, STS-E	Oriented to Vision II SL Reordering expectations from PC: STS-E, skills, knowledge

With years of political and public rhetoric about needing to reform curricula, and in spite of the funds that governments spent on reforming curriculum, the knowledge and skills students were expected to learn did not undergo radical changes. The content to be learned is reflective of Cuban's (1992, p.223) notion of the 'historical curriculum' in that each curriculum continues to exert influence on successive curricula thereby highlighting a tendency to continue with the traditional. The traditional in this case being what students were required to know about fundamental science concepts and skills, and to understand how science impacts on their lives and on the environment. Ulrich, one of the curriculum writers for the

McGuinty Liberal government characterised curriculum content as being like “a number of tiles that could easily be moved around on a board”. Reconceptualising a new way of thinking about how to incorporate new science understandings and discoveries, how to reflect the increasing influence of technology on science and society, and how to incorporate current science education research to engage students and provide relevant programs of study was not central to creating new science curriculum policy. Given the political rhetoric of accountability to taxpayers to spend their money more efficiently and effectively, the above are more compelling reasons for spending government funds to revise a curriculum than appeasing an electorate. Science content continued to be a repackaging of the traditional.

9.3 Revisiting curriculum policy characteristics

In Chapter Three I presented eight characteristics of curriculum policy based on the summary by Naidu (2003) of the policy characteristics outlined by Taylor *et al.* (1997). I described how these characteristics also applied to my understanding about curriculum policy based on the literature that I had reviewed. Throughout the findings chapters I have made references to these characteristics and return to them upon completion of this study to reflect how they applied to this study about curriculum policy. To begin, I would say that all eight characteristics were reflected in this curriculum policy study and through an analysis of my data, illustrate that curriculum policy is indeed complex, interactive and multilayered.

Curriculum policy is more than the text

Findings from this study indicate that to analyse curriculum policy only by the written text of the curriculum documents that are a product of this policy overlooks the contexts that gave the text its meaning and significance. Basing an analysis solely on these documents does not shed light on the context, struggles, conflict and competing interests related to their origins and development. Gathering data from sources that represent what actors are saying at the time about a government's education reforms provided insights into the political arena within which science curriculum policy was formulated, generated and enacted.

Curriculum policy is multi-dimensional

Curriculum policy is situated within a political arena that involves multiple actors and their agendas. The science curriculum policy examined in this study was indeed multi-dimensional. It was situated within broader education reforms with actors who had multiple agendas such as the public demanding standards and accountability measures; politicians, business and industry wanting a skilled workforce that could compete in the global economy; and educators writing curriculum with their own views about the purpose of school science. Curriculum policy represents the dynamic and interactive political compromises among these diverse groups of actors. The resulting policy documents once publicly released adds another dimension as actors have their own perception of what they expected these documents to be. Furthermore, the political climate-of-the-times within which they were released can influence the reception of these documents.

Curriculum policy is value-laden

As noted in Chapter Two science curriculum has a long history of legitimately dual but often conflicting purposes: science for specialisation in science-related careers;

and, science for all regardless of career or workplace specialisation. My findings indicate that values in curriculum policy are inherent to both policy process and policy product. Values related to this were educators who were influential in determining what content should be taught in school science curriculum through their role as curriculum writers. Also contributing to curriculum policy are the values of multiple actors outside of the education system who exerted their influence through roles on advisory committees, writing reports that influenced government policies, expressing their dissatisfaction with what students were learning through the media or directly to politicians. Curriculum policy is also influenced by the values inherent in the education reforms that a government undertakes. For example, reforms that reflected valuing standards resulted in science curriculum documents that had a high degree of specificity like those developed by the PC government.

Curriculum policies exist in context

Curriculum policy does exist in context and as the findings for this study show, this context is shaped by the government (state), the economy, global trends of increased accountability, surveillance and regulation in education, and by the public wanting government to be responsive to their dissatisfaction with education. In that sense curriculum policy is situated within both local and global contexts.

Curriculum policy making is a state activity

As stated in Chapter Three, the definition of curriculum policy for this study explicitly identifies resulting curriculum documents as those mandated and released by the state. The nature of this definition illustrates that curriculum policy is a state activity. The origins of the science curriculum policy examined in this study were all government decisions. The making of curriculum policy was also a government activity. This was also the case with the PC government in spite of outsourcing curriculum development. Even here, curriculum could not be publicly released until it had the approval of the cabinet. Findings from this study have shown that curriculum policy documents can become a political tool for a government to further its own education reform agenda.

Curriculum policy interacts with policies in other fields

This characteristic of curriculum policy was evident through the findings of this study. The comment by Ben-Peretz (2009) about curriculum being a major element by which education policy is expressed within the practice of education was often cited in the findings chapters. This was purposeful as it situates curriculum policy within education reforms that governments undertook to restructure education. In that sense, curriculum policy is inevitably also interconnected with other policies. Curriculum policy determines what is taught in schools. Other policies can impact on curriculum implementation and on the public reception of a curriculum document. For example, in Chapter Seven, I discussed *Bill 160* and the negative relationship that developed among teacher unions and the PC government. One outcome was the outsourcing of secondary science curriculum, by-passing the traditional involvement of unions in choosing representatives to be part of curriculum policy-making.

Curriculum policy implementation is never straightforward

This study did not examine curriculum policy implementation in any great depth. It did examine perception and reception of the curriculum policy documents once publicly released. The findings indicate that curriculum policy documents are open to interpretation and thereby never straightforward. A government decree that these are policy and therefore need to be implemented as intended ignores the multi-dimensional and value-laden characteristics of policy which involves interactions with diverse groups of actors. Furthermore, findings indicate that governments showed little understanding of the time and resources required to implement curriculum policy. Curriculum policy documents were sufficient for them to use as evidence that they were addressing public dissatisfaction with education. These could be completed within an election cycle whereas implementation can not.

Curriculum policy results in unintended as well as intended consequences

As mentioned above curriculum policy is value-laden and is also typically situated within larger contexts of government education reforms. Findings indicate that these two characteristics are interconnected with this one. An example of an unintended consequence occurred with the NDP *Common Curriculum*. This curriculum involved multiple actors bringing their own agendas through a process that the government expected would result in a product to address public dissatisfaction with education in Ontario. As discussed in Chapter Six, although the policy text stated the importance of having clear outcomes and accountability, the public reaction to this policy was negative and resulted in a renewed focus by the NDP government on education. This further resulted in new reforms introducing accountability measures in the form of provincial tests.

9.4 Future research possibilities

The findings for this study have opened up a range of future research possibilities. I discuss four of these as follows. The first one considers a set of research questions posed by Fensham (2009, p.1081) related to policy as values for policy studies in science education. His question about ‘Whose values about science education are favoured by a curriculum policy document?’ relates to the characteristic that curriculum policy is value laden. This study identified actors who were involved in curriculum policy and further study could be undertaken to examine the values that these actors have about science education. This can be compared to the values expressed in the policy text. This should include actors in political arenas who, through this study, have been shown to influence curriculum such as politicos, government communications officers, those who participated in curriculum advisory panels, those who wrote reports that governments acted on, and politicians. This study only examined the orientation of scientific literacy in the curriculum documents. This was compared to the views about the purpose(s) of education in the political arena – which in this study was typically an economic argument.

Weaver-Hightower’s (2008) policy ecology approach presents another research possibility. The strength of this approach is that it illustrates the fluidity of curriculum policy and its interactions with environments, actions and events. When I first read about this approach and saw an example of what a policy ecology map might look (see Weaver-Hightower, 2008, p.159). I felt this approach would be too challenging for a novice researcher like myself. Furthermore with few studies about science curriculum policy, the components that constitute the policy ecology are still emerging. Findings from this study have begun to identify these such as political party ideologies, public concerns, previous policies, the economy, teachers, parents, politicians, the media, politicos and policy entrepreneurs. Further research would add to understanding the intricacies and complex interactions among these components and begin to map them into a curriculum policy ecology.

As already mentioned in Chapter Four, I am interested in using the data from the Science Content Analytical Instrument to compare and examine the science content of the curriculum documents in more depth. The significance would be to examine whether new reforms reconceptualise science content or whether it is repackaged curriculum that only looks new. Flora’s comment raised this question at a focus group meeting. She was a secondary science consultant and had experience with all of the secondary science curricula examined in this study. In the focus group she wondered why mitosis is taught in Grade 11 in one curriculum, Grade 10 in another and Grade 9 in yet another. Why indeed! Related to this would be a question asking what should a science curriculum look like?

A fourth area for further research is to focus on a specific actor or similar groups of actors and examine their particular influence on science curriculum policy in more depth. Findings have shown that actors with a vested interest in education such as the media, business and industry, and parents have an influence on curriculum policy. Further studies about the influence of these actors on science curricula policy would add to a deeper understanding about the complex relationships and how they are interconnected to science curriculum policy.

9.5 Limitations

Studies have limitations and this one is no exception. The scope of this study in spanning more than 23 years of four government time periods, and multiple science curricula, was ambitious especially for a novice researcher. This was particularly heightened because there is little tradition in the literature on the intersection of policy, curriculum studies and science education. Therefore the approach that I used was my interpretation of researching science curriculum policy. Using a policy cycle approach could be considered a limitation due to the criticisms that were mentioned in Chapter Four. Having conducted this study using this approach, I would argue that it served its purpose and was effective as it enabled me to answer my research questions as evidenced in the above summary. One of the criticisms of a policy cycle approach is that it is messy and inadequate to characterise the nature of complex and contradictory relationships among the contexts of the policy cycle (Power *et al*., 2004). I would argue that using the word messy conveys a negative connotation of this approach and suggest that the word complex is better suited to my experience. Structuring each context into macro, meso and micro levels enabled me to organise data and identify actors and trends as evidenced in the findings chapters and in the summary in this chapter. A policy cycle approach is also criticised in that it focuses on a micro level of policy at the expense of a bigger picture of power (Hatcher and Troyna, 1994; Troyna, 1994; Dale, 1992). In that sense it differs from a state-centred approach (macro-oriented) where the state is central to understanding any education policy-making (Dale, 1992). Findings from this study, as shown in the previous four chapters, indicate that although the state makes the decisions as to whether or not new curriculum is created, other actors had power over other aspects of curriculum policy-making, such as educators who wrote the content of the documents, and parents who were vocal about their dissatisfaction with Ontario education and caused governments to respond. The approach that I used for this study for data collection and analysis provided findings that are suitably captured by Leonie Daws' quote which was mentioned in Chapter Three and relevant to repeat here:

> At each point policy is a response to complex and diverse elements, including a range of constraints imposed by other levels of public and educational policy, different administrative contexts, varying ideologies and the personal idiosyncrasies of the people involved. (Daws, 1995, p.129)

My findings support her characterisation of policy as also being relevant to curriculum policy.

Coincidentally, when I began this study, the current McGuinty Liberal government was just beginning to revise the science curricula. The process which began in September 2005 would have been completed within the time frame of my research. It offered an excellent opportunity for a real-time case study of science curriculum policy. It was not to be. Requests to conduct this research which required interviews with developers at strategic times were denied by the Ministry of Education. I could interview staff about previous curricula but not about the curricula under development. Restricting access by senior government officials is a significant limitation when undertaking a study to examine curriculum policy (Walford, 1994; Ball, 1990b). For my study, participants agreed to be interviewed once this curriculum was released. It is interesting to note that two non-government participants first checked for approval with the Ministry of Education before agreeing to be interviewed. This was not the case for other non-government participants.

As a practitioner undertaking research in an area in which I have had and still have experiences could raise concerns about biases in conducting and analysing this study. (Robson, 2002; Cohen, Manion and Morrison, 2000). A different researcher with different relationships, responding differently, asking different questions and prompting different replies may unfold a different story. This does not mean that the study cannot be credible and the results dependable under other circumstances (Ball, 1990b). Not all biases can be completely avoided. Reflexive accounts helped to raise awareness when these occurred and were integral to addressing this issue (Marshall and Rossman, 2011; Mason, 2005; Robson, 2002; Ball, 1990b).

9.6 My journey as a novice researcher

Undertaking this study has been a personal journey where I have learned as much about myself as I have about my research. In reflecting on my first years as a researcher, I was naïve about conducting academic research. Initially I thought the emphasis was on the topic of the study and its findings. Although this is still essential, what I have learned since then is that the process of how those findings are uncovered is also essential knowledge that is being constructed. A doctoral study is just the beginning of understanding what it means to be a researcher. As my own study progressed, I remained interested in the findings and answers to the research questions but I also became equally interested in the research process and its limitations. This was particularly heightened because of the nature of the study that I have chosen and how interconnected it is to my own career experiences. This added a layer of complexity as I explored and reflected on whether I am a researcher conducting ‘research as an insider’ or ‘research as an outsider’.

As mentioned in Chapter Four, when I began my study, I felt my direct involvement with the research setting and community made me an insider (Robson, 2002). As I learned more about the role of the researcher, I realised that this is not a simple either/or issue and that there is a duality of these roles throughout the study. I still have these dual roles as the findings of my study have influenced my thoughts about science education not only from a research perspective but also in my contined practitioner work. I presently work in a non-profit science education outreach organisation that works with teachers, school boards and different jurisdictions in the area of science education, and I cannot ignore the findings of this study. A lens has emerged where I have become aware of the pressures on an education system that has become oriented around performativity and its resulting accountability measures.

Learning about oneself as a learner and learning to manage time, finances, information and data all contribute to the knowledge that ultimately impacts on the tangible products of the research. With the completion of this thesis the journey is not over. It has just begun. I have discovered how much more there is to know and have a better understanding of what I do not know. Reading the literature opened my eyes to other ideas, many of which can now be revisited as possibilities for personal interest if not further study. What I have learned through the findings of my study is that science curriculum policy is indeed messy and complex but it can be researched and indeed needs further research. On a practical side, I have learned more about the workings of politics, curriculum and education. This is causing me to re-examine my values and beliefs about school science and about the political arena surrounding science curriculum policy.

9.7 Concluding comments

The focus of this research was to examine Ontario science curriculum policy. Curriculum policy documents have a wide-ranging influence on what students learn and the resources that are created to support teaching. They inform teacher-developed courses of study, lesson plans, assessment and evaluation both of students and of teachers, and resources such as textbooks to support curriculum implementation. Because of their far-reaching impacts, these policy documents are significant, and more research needs to be conducted on the influences and political arenas that inform their development. The processes that determine what teachers are expected to teach, what they should teach and who decides are important questions for science curriculum studies. This study contributes to that field.

Appendix A Research design summary chart

<table>
<tr><th colspan="3">Primary research question</th></tr>
<tr><td colspan="3">What influences contributed to the origins, processes and content of making Ontario science curriculum policy since 1985?</td></tr>
<tr><td colspan="3">Why change? What’s changed? How did it get changed? What was the perception of the change?</td></tr>
<tr><th>Restatements</th><th>Methods and sources of evidence</th><th>Purpose</th></tr>
<tr><td>RQ1: What influenced curriculum policy changes for each Ontario government since 1985?</td><td>Document analysis
• election platform documents
• Ontario legislature debates
• government reports
• government science curriculum documents
• government media releases & events
• media clippings
• professional organization reports
• personal files
• reflexive notes

Interviews
• government officials
• science curriculum developers
• resource developers</td><td rowspan="4">Document analysis
• exploring factors that influenced decisions to develop science curriculum
• exploring influences and how they impacted on development
• exploring curriculum development processes
• exploring changes in science curriculum content
• exploring users perceptions of science curriculum documents

Interviews
• exploring curriculum development experiences of participant
• exploring factors that influenced decisions to develop science curriculum
• exploring influences and how they impacted on development
• exploring curriculum development processes
• exploring changes in science curriculum content
• direct experiences and assumptions

Focus groups
• exploring participants experiences with the science curriculum documents
• exploring perceptions of the users
• exploring changes in science curriculum content
• exploring influences on science curriculum development
• exploring science</td></tr>
<tr><td>RQ2: What processes were involved in making science curriculum policy since 1985? Who was or was not involved?</td><td>Document analysis
• election platform documents
• Ontario legislature debates
• government reports
• government science curriculum documents
• government media releases & events
• media clippings
• professional organization reports
• personal files
• reflexive notes

Interviews
• government officials
• science curriculum developers
• resource developers</td></tr>
<tr><td>RQ3: What were the changes to policy text in each government’s science curriculum documents since 1985?</td><td>Document analysis
• election platform documents
• Ontario legislature debates
• government reports
• government science curriculum documents
• government media releases & events
• media clippings
• professional organization reports
• personal files
• reflexive notes

Interviews
• government officials
• science curriculum developers
• resource developers</td></tr>
<tr><td>RQ4: What were the perceptions of these documents once they were publicly released?</td><td><u>Document analysis</u>
• Internet
• library
• personal files</td></tr>
</table>

	• professional organizations • individual contributions • reflexive notes <u>Interviews</u> • science consultants and/or coordinators • resource developers <u>Focus Groups</u> • teachers - elementary teachers - secondary science teachers • science consultants and/or coordinators - elementary science curriculum responsibility - secondary science curriculum responsibility	curriculum development process • direct experiences and assumptions

Ethical protocols (Approved by Roehampton Ethics Board)

Informed consent
- participants informed in advance about the purpose, aims and expected benefits of the study
- participants informed of interview/focus group procedures and understand they are free to withdraw consent and discontinue participation in the research at any time without prejudice
- written consent form signed by participants
- secured storage of communication with participants including signed consent forms and any recordings

Respect for individuals
- plan for least disruption to participants (e.g., time and location)
- honour requests by participants who may request to view a copy of their transcript or wish to verify statements used in the thesis
- during the course on an interview, honour requests by participants who provide information but request it not be used in the study
- no participant will be coerced into participating and have the right to withdraw at any time
- cancel any interviews or focus groups if there may be harm to the participants (e.g., inclement weather making it hazardous to travel)

Confidentiality
- treat all information from participants with the strictest confidentiality
- make every attempt to prevent data from being linked to specific individuals
- code participants roles or use pseudonyms rather than use personal names

Bias and validity
- ensure professional relationships with participants are not biased by my presence or my different role as a researcher
- be conscious of ways that I could bias the data
- keep reflexive notes that can be scrutinized throughout the research process for any contaminating effects on the research
- have multiple methods of data gathering from a variety of sources
- use verbatim transcripts to analyse data
- avoid leading questions that do not permit participants to reveal their own perspectives
- use an iterative process to rigorously examine all data during analysis and conclusions

Storage of data
- raw and processed data to be stored in clearly marked files in a secure place with access only by myself

Appendix B Primary source document selections

Timeframe: 1985-1990 Liberal Party of Ontario (Premier: David Peterson) **Ministers of Education: 1985 - 1987 Sean Conway; 1987-1989 Chris Ward; 1989-1990 Sean Conway**					
Political parties	**Ontario government**	**Professional organizations**	**National and International Reports**	**Newspaper articles**	**Other**
Hansard Accord 33rd parliament, 1st session: 38 debates 2nd session: 16 debates 3rd session: 18 debates Majority 34th parliament, 1st session: 48 debates 2nd session: 42 debates	<u>Government</u> 1988 *Competing in the new global economy, Volumes 1 to 3* (Premier's Council) 1990 Premier's Council Report: *People and Skills in the New Global Economy* (Premier's Council) <u>Ministry of Education</u> 1983 & 1989 Revised, *Ontario schools: Intermediate and senior* – OS:IS policy Reports of the Minister of Education: 1985 – 1986, 1986-1987, 1987-1988, 1989-1990 1986 *Science in primary and junior education: A statement of direction* 1987 *Ontario study of the relevance of education and the issue of dropouts* (George Radwanski) 1987 *Intermediate/senior division science guideline, incorporation of Part 1 features: Checklists* 1987 *Implementation profile: Science intermediate and senior divisions Part 1: Program outline and policy* 1987 *Intermediate and senior division science curriculum instructional/ resource guide in-service manual for Board writing teams* (MEd Central Regional office) 1987 *Research brief: Ontario science education report card – Canadian national comparisons*, F. Michael Connelly 1987-1989 *Ontario schools: Intermediate and senior divisions* science curriculum documents (15 documents) 1987-1988 *Curriculum management questionnaire: Physics advanced Level Senior Division* 1987-1988 School Year 1987-1988 *Teacher practices questionnaire: Physics advanced level senior division 1987-1988 school year* 1988 *Science is happening here: A policy statement for science in the primary and junior divisions* 1988 *Curriculum management resource guide* 1989 *Senior division advanced-level chemistry: A report card for Ontario* 1989 *Senior division advanced-level physics: A report card for Ontario* 1991 MEd memo: *Examination reviews in OAC Chemistry and OAC Physics* 1991 *Science in primary and junior education: A report of progress* 1993 *Provincial Report OAC Chemistry Examination Review* 1993 *Provincial report OAC Physics Examination Review* Undated: *Senior division advanced level chemistry and physics 1987-1988 provincial review: Guide to interpretation of school results* Undated: Teacher practices questionnaire: Physics advanced level senior division 1987-1988 school year Undated: OAC TIP chemistry final examination review; school report survey Undated: OAC TIP physics final examination review; school report survey Undated OAC TIP Examination preparation matrix	1985 STAO Science curriculum policy paper; A Rationale for quality science education in the schools of Ontario OSSTF newspaper ad (pre-election period)	IEA SiSS results *The IEA Study of Science I* (Eds. Rosier & Keeves) *The IEA Study of Science II* (Eds. Postlethwaite & Wiley)	<u>1985</u> Toronto Star 4 Globe and Mail 2 <u>1986</u> Toronto Star 6 Ottawa Citizen 4 Whig-Standard 1 Globe and Mail 2 *(Montreal Gazette 1)* <u>1987</u> Toronto Star 21 Ottawa Citizen 2 Windsor Star 5 Globe and Mail 13 *(Vancouver Sun 1 Montreal Gazette 2 Winnipeg Free Press 1)* <u>1988</u> Toronto Star 53 Ottawa Citizen 13 Whig-Standard 8 Windsor Star 9 Globe and Mail 19 *(Vancouver Sun 1 Montreal Gazette 1)* <u>1989</u> Toronto Star 17 Ottawa Citizen 3 Windsor Star 10 Globe and Mail 2 <u>1990</u> Toronto Star 9 Ottawa Citizen 3 Whig-Standard 1 Windsor Star 1 Globe and Mail 7	OISE-UT Survey of *Public Attitudes Towards Education in Ontario*, 1986, 1988, 1990

Timeframe: 1990-1995 New Democratic Party (Premier: Bob Rae) **Ministers of Education: 1990 - 1991 Marion Boyd; 1991-1993 Tony Silipo; 1993-1995 Dave Cooke**					
Political parties	**Ontario government**	**Professional organizations**	**National and International**	**Newspaper articles**	**Other**
Hansard Majority 35th parliament 1st session: 44 debates 2nd session: 40 debates 3rd session: 16 debates Election platforms *New Directions Volume 2: Blueprint for Learning in Ontario* (PC) *The Common Sense Revolution* (PC) *The Right Choice for Ontario* (NDP re-election) *The Ontario Liberal Plan* (Liberal)	Government 1995 *Royal Commission on Learning Background Papers* (Volume I and Volume II) 1995 *For the Love of Learning Report* (Volumes I to IV) 1995 *New Foundations for Ontario Education: A Summary* Ministry of Education Ontario Parent Council Annual Reports: 1993-1994, 1994-1995 Reports of the Minister of Education: 1989 – 1990, 1990-1991, 1991-1992, 1992-1992, 1993-1994 1990-1994 Ministry of Education Action Plan: Restructuring the education system 1991 *Science in primary and junior education: A report of progress* 1991 *The specialization years: Guide to discussion and response* 1991 *Strategic directions* 1991-1992 *Transition years pilot projects: Year two reports* 1993 *The Common Curriculum Grades 1 – 9, Working Document* 1993 *The Common Curriculum Grades 1-9, Version for Parents and the General Public* 1993 *Provincial Report OAC Chemistry Examination Review* 1993 *Provincial report OAC Physics Examination Review* 1993 *Years of transition: Times for change, Volume one* 1995 *The Common Curriculum: Policies and Outcomes Grades 1 – 9* 1995 *The Common Curriculum Grades 1-9: Provincial Standards, Language* 1995 *The Common Curriculum Grades 1-9: Provincial Standards, Mathematics* Policy/ program memorandum #122: School board policies on school councils	1994 (April) SCCAO response to *The Common Curriculum* 1995 (April 30) *Draft Discussion Paper: Science and Technology Provincial Standards Project*	1990 – 1991 *International Assessment of Educational Progress: Detailed Results for Ontario Age 13 Science*, February 1992 *Learning science* (report #22-CAEP-02) International Assessment of Educational Progress (IAEP) July 1992 *Performance assessment: An international experiment* (report#22- CAEP-06) International Assessment of Educational Progress (IAEP)	1991 Toronto Star 8 Ottawa Citizen 4 Whig-Standard 2 Globe and Mail 3 1992 Toronto Star 13 Ottawa Citizen 7 Whig-Standard 2 Windsor Star 6 Globe and Mail 9 1993 Toronto Star 28 Ottawa Citizen 16 Windsor Star 21 Globe and Mail 19 1994 Toronto Star 9 Ottawa Citizen 4 Whig-Standard 4 Windsor Star 2 Globe and Mail 10 1995 Toronto Star 13 Ottawa Citizen 8 Whig-Standard 4 Windsor Star 8 Globe and Mail 9	OISE-UT Survey of *Public Attitudes Towards Education in Ontario*, 1992, 1994

Timeframe: 1995-2003 Progressive Conservative Party of Ontario (Premier: Mike Harris until 2002; Ernie Eves for 2002 to 2003) Ministers of Education: 1995 - 1997 John Snobelen; 1997-1999 Dave Johnson; 1999-2002 Janet Ecker; 2002-2003 Elizabeth Witmer					
Political parties	**Ontario government**	**Professional organizations**	**National and International Reports**	**Newspaper articles**	**Other**
Hansard Majority 36th parliament, 1st session: 70 debates 2nd session: 28 debates 3rd session: 10 debates Majority 37th parliament, 1st session: 37 debates 2nd session: 29 debates 3rd session: 27 debates 4th session: 12 debates Election platforms 1995 ON Liberal election brochure Ontario Liberal Plan 1999 20/20 Plan – A clear vision for Ontario's Future (Liberal(	Government Jul 26, 1996 News release – New secondary program to start in Sept 1998 Sept 20, 1996 News release – Focus on excellence in high schools Nov 25, 1996 News release – new date for submission on high school reform Jan 23, 1997 News release – Announcement of commission to implement reforms Aug 29, 1997 News release – New report card to measure achievement Sept 9, 1997 Backgrounder – Students come first Sept 10, 1997 News release – Gov update on educator stakeholder discussions 1997 *Education Improvement Commission – The Road Ahead* Jan 22, 2003 News release – Harris launches Task Force on Effective Schools Feb 2, 2003 News release – Harris predicts bright future for education system Mar 15, 2003 Backgrounder – government's record Mar 29, 2003 News release – quality reforms will continue Apr 8, 2003 News release – ON students excel internationally with new curriculum Apr 26, 2003 News release – Government's 21 step action plan May 27, 2003 News release – ON students top of call, curriculum is working Sept 4, 2003 News Release – Continue focus on improved student learning 2000 Education Improvement Commission: School Improvement Planning Ministry of Education and Training 1996 (Feb) Foundation requirements (internal discussion paper) 1996 *Curriculum for Ontario Secondary Schools*: Discussion Paper 1996 Background paper: A study on costs Jan 13, 1997 Minister speaking notes: restructuring announcement 1997 Excellence in Education: Ontario's plan for reform 1997 Excellence in Education: Student-focused funding 1997 Newspaper flyer: Ontario's plan for education reform 1997 Key directions in secondary curriculum: Expert panels 1997 Synthesis of Recommendations of Expert panels Jan 9, 1998 Minister speaking notes: high school reform 1998 Fact sheet: High school reform 1998 Stepping Up! – guide for new high school standards 1998 OSS – detailed discussion document 1998 *The Ontario Curriculum, Science and Technology, Grades 1-8* 1998 Implementation Planning Guide Binder 1999 (Fall) Curriculum Update Issue 2: Implementation 1999 *The Ontario Curriculum, Science, Grades 9-10* 2000 *The Ontario Curriculum, Science, Grades 11 -12* Ontario Parent Council Annual Reports: 1995-1996, 1996-1997, 1997-1998, 1999-2000, 2001-2002 Minister's Advisory Council on Special Education Annual Reports: 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003 2002 *Rozanski report: Investing in public education*	OSSTF Sept 1999 Monograph #17 OECTA Oct 1997 *Brief to the Standing Committee on Administration of Justice re: Bill 160, The Education Quality Improvement Act, 1997* March 1998 *Secondary School Reform Process* February 2000 *A vision for successful school councils* June 2000 *Brief to the Standing Committee on Justice and Social Policy on Bill 74, The Education Accountability Act,2000* 2001 *Brief to the Minister of Education's Task Force on Effective Schools* *March 2002 Ontario's double cohort: A government's experiment in education* March 2002 *Weighing in: A discussion paper on provincial assessment policy* March 2003 *Three Strikes and You're Out* STAO/ SCCAO 1997 Input to science background paper 1997 STAO/SCCAO Response to the Pan Canadian	1995 TIMSS ON reports 1996 SAIP science 1999 SAIP science 2000 TIMSS R ON report 2000 SAIP ON report 2001 PISA ON report	1995 Toronto Star 3 Globe and Mail 4 1996 Toronto Star 8 Ottawa Citizen 4 Windsor Star 3 Globe and Mail 5 1997 Toronto Star 14 Ottawa Citizen 9 Windsor Star 4 Globe and Mail 10 Whig-Standard 8 1998 Toronto Star 12 Ottawa Citizen 6 Whig-Standard 4 Windsor Star 3 Globe and Mail 3 1999 Toronto Star 5 Ottawa Citizen 3 Globe and Mail 2 2000 Toronto Star 6 Ottawa Citizen 4 Whig-Standard 1 Windsor Star 3 Globe and Mail 2 2001 Toronto Star 1 2002 Toronto Star 1 Ottawa Citizen 1	OISE-UT Survey of *Public Attitudes Towards Education in Ontario*, 1996, 1998, 2000, 2002 Apr 4, 1995 Draft YorkU Provincial Standards-Science and technology, response to the Ministry of Education and Training Personal Summary of tasks for stages of development of grades 1-8 science and technology curriculum August 23, 1997 – MEd memo re: structure and format Sept 25, 1997 – MEd memo re: notes from Advisory Committee on The Ontario Curriculum: Grades 1-8, Science and Technology 1997 – handwritten notes re: MoE advisory committee participants (Premier's office representative: "consistency with math and language; understandable to parents; useful to teachers; most rigorous in all Canada")

Timeframe: 2003 -present Liberal Party of Ontario (Premier: Dalton McGuinty)
Ministers of Education: 2003 - 2006 Gerard Kennedy; 2006-2006 Sandra Pupatello; 2006- 2010 Kathleen Wynne; 2010 – 2011 Leona Dombrowsky

Political parties	Ontario government	Professional organizations	National and International Reports	Newspaper articles	Other
Hansard Majority 38th parliament, 1st session: 52 debates 2nd session: 42 debates Majority 39th parliament, 1st session: 49 debates 2nd session: 24 debates (to December 2010) <u>Election Platforms</u> *Publicpower: Practical solutions for Ontario* (NDP) 2007 Moving forward together (Liberal) For a better Ontario: Leadership matters (PC) Fair deal for today's working families (NDP) Meeting our green obligations (Green Party)	<u>Government</u> Apr 22, 2004 News release – McGuinty commits to excellence for students Dec 28, ?? News release – McGuinty celebrates progress by education sector Apr 2, ?? News release – Gov launches new youth science and technology outreach program <u>Ministry of Education</u> The Curriculum Review Cycle – 7 year summary chart Minister's Advisory Council on Special Education Annual Reports: 2003-2004, 2004-2005, 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010 [no date] Discussion paper: Renewing Ontario's Schools (Kennedy) Apr 18, 2004 Mini-discussion paper: Revitalizing OCT Apr 29, 2004 Mini-discussion paper: Student achievement Aug 16, 2004 Mini-discussion paper: Unlocking student potential March 2005 *Parent Voice in Education Project Report* Dec 1, 2005 Mini-discussion paper: Developing partners in education 2005 Curriculum Review Cycle – Sustaining Quality Curriculum July 2006 *Report to the Minister of Education: Parent Involvement* Nov 9, 2006 MEd Curriculum review feedback (Session handouts) Nov 2006 *The Ontario Curriculum, Science, Grades 9-10 revised - DRAFT* 2006 Development of new provincial parent board (web site) 2006 Status of the curriculum review (McGowan in Crucible) 2006- 2011 Parents Reaching Out Grants 2006-2011 Parents Reaching Out grants for Regional/Provincial Projects Memo to Directors: Sept 7 2006 Student Success Strategy 2006-2007 Jun 12, 2006 Release of K curriculum Oct 6, 2006 Curriculum review feedback consultations 2006 draft curriculum 2007 *The Ontario Curriculum, Science and Technology, Grades 1-8 Revised* 2007 *Shaping our Schools, Shaping our Future* April 24, 2007 Evaluation of MEd's Student Success/ Learning to 18 strategy Oct 5, 2007 Timelines for curriculum review process Nov 19, 2007 OSSD requirements and curriculum policy revisions Dec. 19, 2007 Release of Grades 1-8 science and technology curriculum document 2008 *Reaching every student, Energizing Ontario Education* 2008 *The Ontario Curriculum, Science, Grades 9-10 Revised* 2008 *The Ontario Curriculum, Science, Grades 11 -12 Revised* April 18, 2008 Release of grades 1-8 science and technology curriculum June 23, 2008 Policy focus for 2008-2009 Dec 5, 2008 Release of grades 9-10 science curriculum Dec 24, 2008 Training Sessions for Grades 9-12 science curriculum Jan 2, 2009 Release of Grades 11-12 science curriculum Apr 8, 2009 Working group on Elementary Curriculum Aug 17 2009 Working group on elementary curriculum consultations Oct 2, 2009 Status of curriculum review process Oct 27, 2009 EY – K curriculum revisions	<u>OSSTF</u> Dec. 6, 2004 Update: Ministry consultation for curriculum review – too little, too late? April 12, 2006 Update: A changing of the guard <u>STAO/SCCAO</u> 2005 Summary of STAO secondary science survey 2006 STAO/SCCAO nature of science position paper 2006 personal emails re: SCCAO review <u>Ontario Science and Innovation Council</u> 2002 Index – Executive summary 2002 Index – full report <u>ETFO</u> Voice Fall 2003- Ontario's new head master (profile of Fullan) <u>OCT</u> June 2009 – The Greening of Ontario's Curriculum	2003 TIMSS ON report 2003 PISA ON report 2004 SAIP science 2006 PISA ON report 2007 PCAP_13 2007 PCAP-13 ON report 2007 TIMSS ON report 2009 PISA ON report	<u>2003</u> Globe and Mail 1 Toronto Star 1 <u>2004</u> Toronto Star 3 Ottawa Citizen 1 Globe and Mail 1 <u>2005</u> Toronto Star 3 Ottawa Citizen 2 Windsor Star 2 <u>2006</u> Toronto Star 3 Ottawa Citizen 1 <u>2007</u> Toronto Star 4 Ottawa Citizen 2 Windsor Star 1 Globe and Mail 1 <u>2008</u> Toronto Star 5 Ottawa Citizen 2 Whig-Standard 1 Windsor Star 2 Globe and Mail 2 <u>2009</u> Toronto Star 10 Ottawa Citizen 4 Windsor Star 2 Whig-Standard 1 <u>2010</u> Toronto Star 3 Ottawa Citizen 1 Windsor Star 1 Globe and Mail 1	OISE-UT Survey of *Public Attitudes Towards Education in Ontario*, 2004, 2006, 2008, 2010 People for Education: *Measuring success* (2008)

	Memo to Deans of Education Jan 8, 2008 Release of grades 1-8 science and technology curriculum Dec. 2, 2008 Release of 9-10 science curriculum Memo to Key Stakeholders Jan 6, 2009 Training session for Grades 9-12 science curriculum Letters – Minister or DM Feb 8, 2007 Parent Involvement Committee Chair Mar 29, 2007 Directors Mar 6, 2009 (internal circulation) Sept 23, 2009 Directors of Education Presentations STAO 2005 Curriculum review process (PPT) STAO 2006 Curriculum review status report (PPT) STAO 2007 Curriculum status report (PPT)				

Appendix C Science curriculum document components and guiding questions

Components	Guiding questions
Target Audience	Who is the target audience? How is the document to be used? Does the curriculum address the roles of groups for implementation?
Acknowledgements	Who is involved/ acknowledged in the development of the document? Is there a reference to the development process?
Goals, Purposes	What are the goals to be met? What is the purpose of the document? These are defined as the "anticipated or actual outcomes of learning – the results which are expected and worked for or which come about as a result of engaging in purposeful learning activities." (Klein, 1991a, p.33)
Format, structure	How is the content organized? What are the components of the document? What are the suggested time requirements?
Content	What are the facts, ideas and concepts that students are expected to learn? What are the skills that students are expected to develop? What are the attitudes that students are expected to develop?
Language	The actual words chosen in the final curriculum documents communicate key messages and intent. How are the revisions described? What is the reference to government initiatives? What references are used or cited? How is diversity recognized? What is the view of the learners?
Values, attitudes and beliefs	Is there a philosophy stated? Is there a vision of learning stated? Is there a discussion about the nature of science? How is the philosophy reflected in the curriculum content?
Strategies	Are there selected teaching strategies? How is the learning to be assessed and evaluated? Are there suggested grading requirements?

Appendix D *Science is Happening Here* (Ontario. Ministry of Education, 1988i) curriculum component matrix

	Science is Happening Here, 1988
Target Audience Who is the target audience?	educators (indirectly - resource developers)
How is the document to be used?	- to be used by school boards in developing local programs "At this level, science is seen, not as a separate subject, but as one component of a balanced and integrated program." (p. 33) Mention made that at the Intermediate level, "science emerges as a distinct subject..." and that further science subdivision into courses of various science disciplines occurs at the Senior Division. (p. 33)
Does the curriculum address the roles of groups for implementation?	Section on Responsibility for Implementation (p. 37-38) - shared responsibilities The Ministry of Education responsibilities - establish common framework of goals and aims for education - develop and articulate curriculum policy - initiate the delivery of the policy - review the policy and its implementation School Board Officials responsibilities (includes supervisory officers and consultative staff) - leadership in various aspects of implementation process, including curriculum and PD - provide opportunities for cooperative planning - programs congruent with ministry policy - resources, including appropriate facilities - "For many school boards, an effective means of sharing resources is through the establishment of a kit loan program." (p. 12) Principals - Assist in the provision of materials, facilities, and human resources - Encourage shared management of implementation so that all staff have input into, and a sense of ownership of, the process - Monitor implementation - Provide opportunities for, and participate in, cooperative planning Teachers (p. 11 and p. 38) - Cooperate with other staff members in planning a program that implements policies - Enlist support of teacher-librarians - Ensure the program is in keeping with children's needs and abilities - Identify and use appropriate resources (people, places, and materials) - Model inquiry as an active participant and demonstrate a willingness to learn with and from children - "Encourage free exploration of science materials and concepts within a carefully managed environment" (p. 11) - "...provide a sensitive, supportive environment in which creativity is encouraged" (p. 11) Suggestions for types of questions for teachers to use in to help implement SIHH is provided in Appendix A - (e.g., show respect and support for the children?; achieve a balance between child-initiated and teacher-initiated activities, etc.) (p. 41) School librarians - School library and school librarian "play key roles in providing print and non-print resources to support hands-on experiences" (p. 12)

Development process Who is involved/ acknowledged in development?	Acknowledgements section (p. 45-46): All listed by name and orgainzation MoE Project Managers (permanent staff) MoE Project Leader (seconded staff) Writing Committee: 9 members (various Boards and one University member) Advisory Committee, 30 members listed: - MOE (7) - STAO (1) - OTF (4) - COEO (1) - OSTC (1) - OSLA (1) - OAEAO (1) - SCCAO (1) - CAPE (1) - OSC (1) - TVO (1) - OISE (1) Other; various Boards (9)
Is there reference to the development process?	appreciation is expresses to "all the boards, schools, and individual educators who contributed sage advice an dideas at the validation stage" (p. 45)
Goals/Purpose What are the goals to be met?	Ontario's 13 goals of education aims for science in the environmental studies section of The Formative Years Outlines "involvement" in the s&t program will help and encourage children to develop (more attitudinal – see page 6)
What is the purpose of the document?	to be used by school boards in developing local programs
Format/Structure What are the components of the document?	10 sections – 46 pages (includes science and technology for grades 1 to 6) JK-SK? Many pictures of children actively engaging in science activities Lots of "white space" Includes large graphics (balloon with different images on it representing the three different areas of science) Preface – includes 13 goals of education Introduction The Learner and the Learning Environment Attitudes, Skills, and Knowledge Learning Opportunities: Life science, Earth and space science, Physical science Science from Junior Kindergarten to OACs Assessment and Evaluation Responsibility for Implementation Appendixes Acknowledgements

How is the science content organized?	Attitude, Skills, knowledge Attitudes – develop personal attitudes about themselves and their environment, reference to widely shared attitudes of which “some are conducive to scientific inquiry” (p. 17) Skills - Importance of skills to gather and apply information, and use in a reasoned and intuitive way. Process skills identified are: observing, classifying, seriating, communicating, measuring, inferring, predicting, hypothesizing, experimenting, interpreting, making models. I (p. 18) in addition, developing physical skills in using scientific equipment. (p. 19) Knowledge - Emphasis is on having students learn about themselves and their immediate environment. Broad concepts identified are: energy, space, time matter, community, life, change, growth, interrelationships, technology, conservation. (p. 19) no emphasis on teaching conceptual knowledge “Although the choice of appropriate learning opportunities for children in the Primary and Junior Divisions is based on broad concepts, it is important that the experiences grow from the perspectives of the children rather than from the concepts themselves. Opportunities involving wind-up toys, flashlights, or magnets, for instance, will contribute to a growing concept of energy without requiring a precise definition for the concept. Learning opportunities Should help children to develop the “appropriate” attitudes, skills, knowledge. Written as “kinds of experiences that children should have, rather than specific learning outcomes.” (p. 21) 7 general learnings that experiences in the three areas of science should provide opportunities for. These are overarching and not division specific or content specific (p. 21) “Children shall have opportunities to” Primary Division opportunities Junior Division opportunities Life science Earth and Space science Physical science Technology opportunities within all three sections are italicized Learning opportunities include examples.
What are the suggested time requirements?	none
Language How are the revisions described?	MoE “policy for the development of the science component of the curriculum for the Primary and Junior Divisions” (p. 3) Supports and extends the aims for science in The Formative Years environmental studies section.
What is the reference to government initiatives?	none explicit
What references are used or cited?	Ontario’s 13 goals of education (p. 3) MoE & MoCU (1980). *Issues and Directions: the response to the Final Report of the Commission on Declining School Enrolments in Ontario* “an active participant in education who gains satisfaction from the dynamics of learning” and “a self-motivated, self-directed problem-solver...deriving a sense of self-worth and confidence from a variety of accomplishments” (p.2) MoE publications for special needs: *Children with Physical Handicaps and Health Impairments* (1978)

What references are used or cited? (continued)	*Vision* (1987) *Children with Communication Exceptionalities* (1979) *Children with Mild Intellectual Handicaps* (1979) *Children with Moderate and Severe Intellectual Handicaps* (1981) *Learning Disabilities* (1987) *Programming for the Gifted* (1985) *Behaviour* (1986) Other MoE publications: *Personal and Societal values:A Resource Guide for the Primary and Junior Divisions* (1983) *Shared Discovery: Teaching and Learning in the Primary Years* (1985) *Science in the Primary and Junior Divisions* (1983) *The Complexities of Childhood* resource chart (no date) *The Formative Years* (1975) *Partners in Action: The Library Resource Centre in the School Curriculum* (1982)
How is diversity recognized?	Three subsections in the Learner and the Learning Environment devoted to each of: Special Needs - Emphasis on adaptation (learning environment, teaching strategies, evaluation to accommodate intellectual, emotional and physical requirements of children) (p. 9) Multiculturalism - "learning environment that celebrates cultural, linguistic, racial, and religious diversity" to help children "develop an understanding of interrelationships and an open-minded attitude" (p. 10) Sex Equity - "essential that girls and boys participate equally in science" (p. 10) - "A conscious effort must be made to involve and encourage all children in the full range of learning opportunities, roles and activities in science" (p.10) - "All resources (human, print, audio-visual) chosen for use in the classroom should be bias-free and support all children's involvement in science" (p. 10) - "...help children to view science as a field of interest and endeaviour appropriate for everyone" (p. 10) "Science is important for all learners, but the uniqueness of each learner must be acknowledged. Varied backgrounds and special learning needs affect the ways in which children will participate in science." (p. 9)
What is the view of the learners?	Whole section dedicated to the Learner including diversity (as above) Image of the learner as"an active, enthusiastic, and unique participant in the learning process" (p. 10)
Values, attitudes, beliefs Is there a vision of learning stated?	Learning actively through and about science and technology "to encourage children to explore their environment, ask questions, generate and test ideas, evaluate and create" Belief that exercising these skills will strengthen and deepen reasoning abilities for children "to become self-motivated, independent learners and active, concerned participants in society" "For children, play is a natural way of learning. ... Play contributes to the development of the attitudes, skills, and knowledge prescribed in this document" (p. 15) "Whether children are exploring freely or participating in a more structured experience, opportunities for meaningful interaction with their teacher are vital to the learning process." (p. 15) "Problem solving is embodied in play and facilitated by questions such as 'What do we want to know?' and 'How can we find out?'" (p. 15)

Is there a philosophy stated?	Experiences of children in PJ must be relevant to them on an immediate and personal level. Encourage a practical approach of developing attitudes, skills and knowledge that children can use today and in the future. Practical approach provides rationale for including the “world of technology”
Is there a discussion about the nature of science?	utilitarian view of science implicit in the document language (e.g., “appreciate the scientific and technological contributions of Canadians” and “feel competent, and therefore self-confident, in a society that uses and is influenced by science and technology”) (p. 6) Learning opportunities should provide “insight” into the nature of science by: - The various skills used in science - The equipment appropriate to science activities - The vocabulary and terminology associated with first-hand science experiences - Safety procedures and equipment - The roles of the various skills in scientific problem solving - The potential and limitations of science and technology
How is the philosophy reflected in the curriculum content?	In the Introduction by stating 7 ways how students can learn about “their physical and natural environments”: - Play and explore - Investigate, experiment, and discover - Ask question and seek solutions - Look for applications of science - Create, invent, and construct - Explore and use technology - Relate science to their own and others’ need Emphasis in three areas of learning opportunities is phrased as “doing” reflecting exploration and discovery. Nature of science not embedded in learning opportunities – up to teachers to incorporate in planning.
Strategies Are there selected teaching strategies?	Opportunity to “interact with materials, people, places, and the outdoor environment” (p.12) “The learning environment must extend beyond the classroom and the school.” (p. 12) Computers and developing computer skills as “...useful in providing extensions of and support for science learning.” (p. 12) Computers not to “...be regarded as a primary means of delivering science education or as a replacement for the direct investigation of natural and physical phenomena.” (p. 12) Provides 7 aspects of what is included in a well-balanced program based on “...what the teacher judges to be the needs, abilities, and interests of the children.” (p. 13) Support for integration and that “...science provides the starting point for integrated learning.” (p. 14) Provide learning opportunities “...that encourage children to talk about science observations and discoveries in their own words, as well as in scientific language, help them to acquire a variety of expressive language skills.” (p. 14) A problem-solving model is provided in Appendix C as a sample reference. It includes: 8 Stages such as Exploring, Inquiring, Predicting Mapped to 8 descriptions of each stage Mapped to an example of a facilitating question for each stage (e.g, Exploring; Children learn by using their senses to explore materials and events. As they do so, they identify interests and formulate questions; What do we see/ What do we hear? What is happening? (p. 43)

How is the learning to be assessed and evaluated?	Measure of learning success is "the learner's own sense of achievement". Section on assessment and evaluation (p. 35) - Assessment emphasis is on the teacher evaluating the effectiveness of the program and its suitability to the needs and abilities of the children - Mention of assessment to monitor children's growth in skills, knowledge and attitudes as information to share with children, parents and the teacher - Observation as "essential" for making judgements about children's learning (p. 35) - Self-assessment by students mentioned as well as peer assessment - Suggestion to maintain a record of assessment along with some examples (e.g., rating scales, profiles, anecdotal comments, file of student sample work, etc.) - Mention of Junior OAIP to "assist in the development of a balanced approach to assessment. It will assist in the development of a balanced approach to assessment. Items in the pool will support observational techniques and assessment of oral and written responses. In addition, the pool will serve as a source of practical science activities that can be incorporated into the classroom program." (p. 35)

Appendix E Scientific literacy Vision I and Vision II data chart summary

Doc #	Excel workbooks	Excel worksheets per workbook
1-SL	Peterson Lib Elementary VI-VII	Gr.3 VI, Gr.3 VII, Gr.6 VI, Gr. 6 VII, Gr. 7 VI, Gr. 8 VII
2-SL	Peterson Lib OSIS Grade 9 VI-VII	Gr.9A VI, Gr.9A VII, Gr.9G VI, Gr. 9G VII, Gr. 9B VI, Gr.9B VII
3-SL	Peterson Lib OSIS Grade 10 VI-VII	Gr.10A VI, Gr.10A VII, Gr.10G VI, Gr. 10G VII, Gr. 10B VI, Gr.10B VII
4-SL	Peterson Lib OSIS Sr Bio VI-VII	BIO 11A VI, BIO 11A VII, BIO OAC VI, BIO OAC VII, ApBIO 11G VI, ApBIO 11G VII
5-SL	Peterson Lib OSIS Sr Chem VI-VII	CHEM11A VI, CHEM 11A VII, CHEM OAC VI, CHEM OAC VII, ApCHEM 11G VI, ApCHEM 11G VII
6-SL	Peterson Lib OSIS Sr ESS VI-VII	ESS 12G VI, ESS 12G VII, ESS 12A VI, ESS 12A VII
7-SL	Peterson Lib OSIS Sr Physics VI-VII	PHYS 12A VI, PHYS 12A VII, PHYS OAC VI, PHYS OAC VII, ApPHYS 12G VI, ApPHYS 12G VII, TechSci 12G VI, TechSci 12G VII
8-SL	Peterson Lib OSIS Sr Science VI-VII	Gr.11 SciB VI, Gr. 11 SciB VII, Gr. 12 SciB VI, Gr. 12 SciB VII, SiS OAC VI, SiS OAC VII
9-SL	Peterson Lib OSIS EnvSci VI-VII	EnvSci 10G VI, EnvSci 10G VII, EnvSci 11G VI, EnvSci 11G VII, EnvSci 12G VI, EnvSci 12G VII, EnvSci 10A VI, EnvSci 10A VII, EnvSci 12A VI, EnvSci 12A VII
10-SL	NDP CC-MST 3-6-9 VI-VII	Gr.3 VI, Gr.3 VII, Gr.6 VI, Gr. 6 VII, Gr. 9 VI, Gr. 9 VII
11-SL	PC Elementary VI-VII	Gr.1 VI, Gr.1 VII, Gr.2 VI, Gr. 2 VII, Gr. 3 VI, Gr. 3 VII, Gr.4 VI, Gr.4 VII, Gr.5 VI, Gr. 5 VII, Gr. 6 VI, Gr. 6 VII, Gr.7 VI, Gr.7 VII, Gr.8 VI, Gr. 8 VII
12-SL	PC Grade 9 VI-VII	Gr.9Ac VI, Gr.9Ac VII, Gr.9App VI, Gr.9App VII
13-SL	PC Grade 10 VI-VII	Gr.10Ac VI, Gr.10Ac VII, Gr.10App VI, Gr.10App VII
14-SL	PC Sr Bio VI-VII	BIO 11U VI, BIO 11U VII, BIO 11C VI, BIO 11C VII, BIO 12U VI, BIO 12U VII
15-SL	PC Sr Chem VI-VII	CHEM 11U VI, CHEM 11U VII, CHEM 12C VI, CHEM 12C VII, CHEM 12U VI, CHEM 12U VII
16-SL	PC Sr ESS VI-VII	ESS 12U VI, ESS 12U VII
17-SL	PC Sr Physics VI-VII	PHYS 11U VI, PHYS 11U VII, PHYS 12C VI, PHYS 12C VII, PHYS 12U VI, PHYS 12U VII
18-SL	PC Sr Science VI-VII	SCI 11U/C VI, SCI 11U/C VII, SCI 12U/C VI, SCI 12U/C VII, SCI 11W VI, SCI 11W VII, SCI 12W VI, SCI 12W VII
19-SL	McGuinty Lib Elementary VI-VII	Gr.1 VI, Gr.1 VII, Gr.2 VI, Gr. 2 VII, Gr. 3 VI, Gr. 3 VII, Gr.4 VI, Gr.4 VII, Gr.5 VI, Gr. 5 VII, Gr. 6 VI, Gr. 6 VII, Gr.7 VI, Gr.7 VII, Gr.8 VI, Gr. 8 VII
20-SL	McGuinty Lib Grade 9 VI-VII	Gr.9Ac VI, Gr.9Ac VII, Gr.9App VI, Gr.9App VII
21-SL	McGuinty Lib Grade 10 VI-VII	Gr.10Ac VI, Gr.10Ac VII, Gr.10App VI, Gr.10App VII
22-SL	McGuinty Lib Sr Bio VI-VII	BIO 11U VI, BIO 11U VII, BIO 11C VI, BIO 11C VII, BIO 12U VI, BIO 12U VII
23-SL	McGuinty Lib Sr Chem VI-VII	CHEM 11U VI, CHEM 11U VII, CHEM 12C VI, CHEM 12C VII, CHEM 12U VI, CHEM 12U VII
24-SL	McGuinty Lib Sr ESS VI-VII	ESS 12U VI, ESS 12U VII
25-SL	McGuinty Lib Sr Physics VI-VII	PHYS 11U VI, PHYS 11U VII, PHYS 12C VI, PHYS 12C VII, PHYS 12U VI, PHYS 12U VII
26-SL	McGuinty Lib Sr EnvSci VI-VII	EnvSci 11U/C VI, EnvSci 11U/C VII, EnvSci 11W VI, EnvSci 11W VII
27-SL	McGuinty Lib Sr Science VI-VII	SCI 12U/C VI, SCI 12U/C VII, SCI 12W VI, SCI 12W VII

Appendix F Science content analytical tool

Topic: Earth and Space Science	
General categories	**Specific categories**
Earth features	• **composition** - Earth's crust, mantle, core • **landforms** - mountains, valleys, continents • **bodies of water** - oceans, lakes, ponds, bottom of ocean, rivers, aquifers - potable water supplies - watershed - states of water on Earth's surface • **atmosphere** - layers of atmosphere - greenhouse atmospheric gases • **rocks and minerals** - classes of rocks and their characteristics - physical properties of rocks and minerals • **soil** - weathered rocks and decomposed organic material - soil types, soil formation, pH - soil composition (natural; human additives) • **ice forms** - glaciers, icebergs, polar ice caps
Earth processes	• **weather** - day to day changes - recording and predicting weather changes - global patterns of atmospheric movement may influence local weather - weather forecasts • **climate** - dynamic processes - systems that influence climate • **physical cycles** - internal and external sources of energy - Sun is a major external source of energy (e.g., heat, light) - water/ hydrological cycle - carbon cycle - rock cycle • **building and breaking** - tectonics, erosion, mountain building, volcanoes, landslides, earthquakes • **Earth's history** - formation of fossils, geological time scale
Astronomy	• **Earth in the solar system** - Earth/sun/moon system, night/day. Tides, north/south hemisphere, seasons • **objects in the solar system** - planetary motion • **objects beyond the solar system** • **evolution of the universe** - origin/ history/ future of the universe
Topic: Life science	
General categories	**Specific categories**
Structures and functions of living things	• **plants, fungi** - types of plants, fungi - characteristics of plants, fungi - classification systems • **animals** - types of animals - characteristics of animals - classification systems • **microorganisms** - types of microorganisms - classification systems • **tissues, organs, organ systems** - plant and animal organs - plant and animal organ systems - systems for movement • **cells** - parts of cell - cell theory

Life processes and systems enabling life functions	• **energy handling** - energy capture, storage, transformation, photosynthesis, respiration, biosynthesis • **sensing and responding** - biofeedback in systems, homeostasis, sensory systems, responses to stimuli - passive transport (osmosis, diffusion) • **biochemical processes in cells** - regulation of cell functions, translation, protein synthesis, enzymes • **reproduction** - animal and plant reproduction - asexual and sexual reproduction
Changes in living things	• **heredity** - genetics - inheritance - genomics • **life cycles** - life cycles of plants and animals - cell division - cell differentiation - dispersal • **evolution** - evidence for evolution - processes of evolution (adaptation, natural selection)
Interactions of living things	• **biomes and ecosystems** - biotic and abiotic factors - habitats and niches • **interdependence of life** - food webs/ chains, symbiotic relationships - food energy sources • **animal behaviour** - migration, social groupings of animals,
Human biology and health	• **anatomy** • **wellness** - nutrition - fitness • **disease**
Topic: Chemistry	
General categories	**Specific categories**
Matter	• **classification of matter** - solids, liquids, gases - homogeneous and heterogeneous materials - elements, compounds, mixtures, solutions - types of acid/base (Arrhenius, Bronsted-Lowry, Lewis) - organic (hydrocarbons, functional groups) • **physical and chemical properties** - of elements & compounds (density, boiling pt. Etc.) - of gases (gas laws, kinetic theory) - of solutions (types, concentration, acid/base) • **periodic table** - periodic trends
Structure of matter	• **atoms, ions, molecules** - as basis for different substances - isotopes, average atomic mass • **crystals and molecular shape** - crystal types (ionic, covalent, metallic, macromolecular - VSEPR theory, bonding theory - polymers, shape/ function of biological molecules, • **subatomic particles** - electrons, protons, neutrons - quantum mechanical theory
Physical transformations	• **physical changes** - temperature, changes in states of matter, mixing • **explanation of physical changes** - general explanations for boiling, freezing, dissolving, etc. • **kinetic molecular theory (gases); particle theory of matter**
Chemical transformations	• **chemical changes** - definition of chemical change - types of reactions (displacement, acid-base, oxidation-reduction, etc.) - predicting chemical changes • **explanations of chemical changes** - ionic/covalent bonding - electron configurations • **rate of reaction**

	- collision theory - factors affecting rate - activation theory - rate law - reaction mechanism • **equilibrium** - LeChatelier’s Principle - solution equilibria - acid-base equilibria - entropy • **energy and chemical change** - exothermic and endothermic reactions - thermal energy, calorimetry, Hess’ Law • **electrochemistry** - electrochemical cells/ batteries - electrolysis - oxidation-reduction reactions
Organic chemistry	• **organic compounds** - structure & properties of hydrocarbons - structure & properties of functional group compounds • **organic reactions** • **biochemistry**
Topic: Physics	
General categories	**Specific categories**
Energy types, sources, conversions	• **types of energy** - potential and kinetic energy - electrical • **sources of energy** - solar, wind, renewable/ 356on-renewable, etc. • **transformation of energy** • **heat and temperature** - conduction, convection, radiation, thermodynamics, thermal energy, measurement, thermometers • **conservation of energy**
Force	• **types of forces** - magnetism, gravitational, electric • **fluid behaviour** - buoyancy, hydraulics, Bernoulli’s principle, pneumatics • **structural forces** - tension, compression, torque, torsion, shear, stability, strength • **properties of forces/fields** - magnetic - electric - gravitational
Motion	• **laws of motion** - relative motion - Newton’s laws - movement - conservation of momentum • **inertia/ mass** - balanced and unbalanced forces - action/ reaction - momentum and collisions - friction • **types of motion** - free fall, circular, projectile, rotation - velocity - acceleration • **work** - simple machines - mechanical advantage - W=Fxd
Electricity	• **static electricity** - electric charges - electric field • **electrical and magnetic fields** - electromagnetism, induction, motor principle, transformers • **electrical currents (AC/DC)** • **electrical power generation** • **circuits** - switches, bulbs, parallel, series • **electrical properties** - conductors, insulators, semiconductors

<table>
<tr><td>Waves</td><td>

- **electromagnetic radiation**
  - sources of light
  - properties of light (refraction, reflection, interaction of light and matter-rays, prisms, lenses, mirrors)
  - electromagnetic spectrum
  - wavelength, amplitude, frequency, colour
- **sounds**
  - sources of sound (vibrations)
  - properties of sound
  - wavelength, amplitude, frequency, pitch, loudness, transmission, resonance, Doppler effect
- **wave phenomena**
  - wave properties
  - types of waves
  - wave interactions, superposition, constructive/destructive interference
  - physical optics (diffraction, interference)

</td></tr>
<tr><td>Modern physics</td><td>

- **relativity theory**
  - general relativity
  - special relativity
- **quantum theory**
  - quantum nature of light
  - photoelectric effect
- **fundamental particles**
  - Standard Model
  - quarks, bosons, etc.
- **fundamental forces**
  - strong interaction, electromagnetic, weak fore, gravitational force

</td></tr>
<tr><td colspan="2">Topic: Technology</td></tr>
<tr><td>General categories</td><td>Specific categories</td></tr>
<tr><td>Physical systems</td><td>

- **structures**
  - types of structures
  - structural failure (static and dynamic forces)
  - stability
- **materials**
- **mechanisms (device which changes an input motion and force into a desired output motion and force)**
  - types of motion
  - transmission of force
  - velocity ratio and mechanical advantage

</td></tr>
<tr><td>Function</td><td>

- **aesthetics**
  - elements of visual design: line, shape and form, texture, colour
  - principles of visual design: proportion, balance, pattern,
- **ergonomics**
  - designing for people (taking into account use of the product by the person)

</td></tr>
<tr><td>Control</td><td>

- **systems**
  - input, output, feedback loops
- **power sources**
  - sources for energy (e.g., electrical, pneumatic, hydraulic, etc.)

</td></tr>
<tr><td>Risk management</td><td>

- appropriate use of materials
- heath and safety protocols
- assess and manage potential dangers and apply safety procedures

</td></tr>
<tr><td colspan="2">Topic: Science as a discipline</td></tr>
<tr><td>General categories</td><td>Specific categories</td></tr>
<tr><td>Nature of science</td><td>

- **nature of scientific knowledge**
  - science as a human endeavour
- **the scientific enterprise**
  - recognize key features of scientific research
- **different worldviews**

</td></tr>
<tr><td>Nature of technology</td><td>

- **nature of technological knowledge**
  - creates products, applications and processes to meet a human need or want
- **technological enterprise**
  - application, products, processes

</td></tr>
<tr><td>History of science and technology</td><td>

- **history of science**
- **history of technology**

</td></tr>
<tr><td>Science-technology-society-environment (STSE)</td><td>

- **influence of science and technology on each other**
- **influence of science and technology in society**
- **human use of science and technology in society**
  - life style, quality of life, daily living, sustainability issues as related to society
  - the designed world (e.g., medical/ health technologies, biotechnology, ICT, transportation, manufacturing, construction)

</td></tr>
</table>

	• **influence of science in the environment** • **human use of science and technology in the environment** - engaging with Earth's physical and biological systems o engaging in authentic learning situations and interactions in their local environment o exploring and appreciating the outdoors to help develop their understanding of the local environment - understanding dependence on Earth's physical and biological systems o understanding the kinds of interactions that occur within and between human and natural systems - environmental issues o (e.g., pollution, world population, impact of natural disasters, climate change, conservation) • **influence of science and technology in the economy** • **human use of science and technology in the economy** - industry, jobs, currency, innovation for economic growth, economic sustainability
Topic: Skills	
General categories	**Specific categories**
Inquiry	• **identifying questions to investigate scientifically** • **planning investigations** • **conducting investigations** • **gathering data** • **organizing and representing data** • **interpreting and analysing data** • **formulating conclusions based on data**
Scientific problem solving	• **applying scientific principles to solve quantitative problems** • **constructing, interpreting, and applying models to understand scientific principles**
Technological problem solving	• **identifying a problem/need** • **creating ideas** - designing • **choosing options** - establishing criteria • **assessing materials for a specific design purpose** • **fabricating materials, mechanisms (devices) and structures** - constructing - building • **evaluating technological products, processes and applications** - testing - assess societal and environmental implications • **modifying technological products, processes and applications**
Making decisions	• **identifying science-related issues** • **interpreting scientific evidence** • **formulating a position based on evidence** • **assessing implications of their position**
Using tools and processes	• **using apparatus, machinery, equipment and computers** • **Safety: using tools, apparatus, materials and equipment safely** • **using senses to observe, classify, seriate**
Communication	• **using appropriate science and technology vocabulary** • **using variety of media forms (includes drawing and layout)** • **sharing information (includes presentations)** • **developing teamwork skills** - working collaboratively - developing interpersonal responsibility, an openness to diversity, respect for multiple perspectives, and an appreciation of the efforts and contributions of others
Topic: Attitudes	
General categories	**Specific categories**
Appreciation of science	• **appreciating the role and contributions of science in their lives** • **encouraged in examining how science has an impact daily and over the long term on themselves and on the lives of others** • **appreciating science's potential significance for their own lives** • **appreciating the dynamic interactions between human-created and natural systems and the positive and negative consequences** • **considering issues related to sustainability from a variety of perspectives**
Interest in science	• **encouraged in developing enthusiasm and continuing interest in the study of science** • **awareness of science-related careers**
Habits of Mind	• **open-mindedness and flexibility** • **critical-mindedness**

	• **respect for evidence** • **initiative and perseverance** • **creativity and inventiveness**
Stewardship	• **demonstrating environmental stewardship by thinking globally and acting locally** • **understand the behaviours, practices and approaches that promote sustainability in various areas of human activity** • **implement plans to support sustainability** • **encouraging responsible action towards living things and the environment**

Appendix G Record of interview and focus group dates

Code
E-Educator
MEd – Ministry of Education bureaucrat
Ed-Dev – Ontario science educator (development role)
RD – Resource developer
Ed-U – Ontario teachers and consultants (implementation role)
FG-1 – Focus Group 1
FG-2 – Focus Group 2

Interviews			
Who	**Date**	**Length**	**Status**
1E	22-08-2006	1:20:43	Ed-U
2E	05-09-2006	1:45:43	MEd
3E	19-09-2006	1:33:57	MEd
4E	26-09-2006	1:31:14	Ed-U
5E	26-09-2006	1:31:14	Ed-U
6E	10-06-2006	59:57	Ed-Dev
7E	18-10-2006	1:05:00	Ed-Dev
8E	16-11-2006	2:22:55	Ed-Dev
9E	05-01-2007	42:15	MEd
10E	19-01-2007	41:19	MEd
11E	01-02-2007	1:32:45	Ed-Dev
12E	19-02-2007	1:29:51	Ed-Dev
13E	21-03-2007	1:09:51	Ed-Dev
14E	04-11-2007	1:30:27	MEd
15E	16-04-2007	47:15	Ed-Dev
16E	18-04-2007	1:38:42	MEd
17E	10-05-2007	2:07:79	Ed-Dev
18E	25-05-2007	1:16:40	MEd
19E	16-07-2007	2:07:58	Ed-Dev
20E	08-08-2007	24:02	MEd
21E	21-08-2007	1:24:39	MEd
22E	01-04-2008	1:10:29	MEd
23E	23-04-2008	1:28:18	MEd
24E	08-06-2009	2:00:50	MEd
25RD	08-01-2007	1:24:59	RD
26RD	12-01-2007	27:04	RD
27RD	13-02-2007	2:08:12	RD
28RD	13-04-2007	1:24:06	RD
29RD	22-08-2007	1:38:46	RD

Focus Groups			
Who	**Date**	**Length**	**Status**
FG-1 a	18-06-2007	1:42:07	Ed-U
FG-1 b	18-06-2007	1:42:07	Ed-U
FG-1 c	18-06-2007	1:42:07	Ed-U
FG-2 d	18-03-2008	1:29:52	Ed-U
FG-2 e	18-03-2008	1:29:52	Ed-U
FG-2 f	18-03-2008	1:29:52	Ed-U
FG-2 g	18-03-2008	1:29:52	Ed-U

Appendix H A qualitative study examining Ontario science curriculum policy-making from 1985 to 2008

Research Summary

Ontario is one of Canada's ten provinces and home to almost one third of all Canadians. Ontario provincial governments, under the direction of the Ministry of Education, have developed curriculum documents that are considered mandatory policy for teachers and school administrators to implement. These documents have a wide-ranging influence on what students learn and the resources that are created to support teaching. They are used to inform teacher-developed courses of study, lesson plans, assessment and evaluation both of students and of teachers, and resources such as textbooks to support curriculum implementation. Because of the far-reaching implications of these curricula, their content is significant, yet there is little in the literature on processes, decision-making influences and political contexts that inform their development.

The primary purpose of this qualitative study is to explore the development and decision-making processes in Ontario science curriculum policy-making from 1985 to 2008. Central to the data gathering for this thesis is identification of factors that influenced these processes and how they had an impact on final versions of the science curriculum documents. This study also examines perceptions of the curriculum documents once they were released for implementation. It is anticipated that this research will contribute to understanding the development and decision-making processes of Ontario science curriculum policy-making. This study is situated in policy studies and draws upon research related to curriculum studies and science education.

Aims and Objectives

- to explore the origins of the various Ontario science curriculum policy documents developed by successive governments from 1985 to 2008
- to identify factors that influenced development and decision-making processes in these science curriculum policy documents
- to examine what students are expected to know and do across science curriculum documents from 1985 to 2008
- to collate and analyse the documentation and commentary related to the origins, processes and perceptions of Ontario science curriculum policy documents from 1985 to 2008
- to analyse the perceptions of users of Ontario science curriculum policy documents
- to contribute to the literature of policy research in science curriculum policy-making

Research Questions

What influences contributed to the origins, processes and content of making Ontario science curriculum policy since 1985?

policy origins/sources, development processes,

What influences initiated curriculum policy changes by each Ontario government since 1985?	What processes were involved in making science curriculum policy since 1985? Who was or was not involved?	What were the changes to policy text in each government's science curriculum documents since 1985?	What were the perceptions of these documents once they were publicly released?

Appendix I Participant interview consent form

Roehampton University

ETHICS BOARD

RESEARCH PARTICIPANT CONSENT FORM

You are being asked to participate in an interview for the following research project. Your participation in the study is voluntary. Before agreeing to be part of this study, please read the following information carefully. Feel free to ask any questions you may have.

Title of the Research Project
A study about the development of Ontario's Ministry of Education science curriculum policy documents from 1985 to 2008.

Brief description
The purpose of this study is to explore politics and processes involved in developing and implementing science curriculum policy in Ontario. This study is situated in policy studies and draws upon research related to curriculum studies and science education.

It is anticipated that this research will contribute to understanding the politics and processes of developing science curriculum in Ontario and the direct impact these policy documents have on what science is to be taught to students. By examining the complexities of science curriculum policy, this study can be a platform for further research on how science education research can inform curriculum policy development and implementation issues.

Participation
If you participate in this study, you will be asked to participate in a series of questions in an interview. The interview will take place on [ ] at [ ] at [ ] in Toronto, Ontario.

Your privacy will be protected at all times. You will not be identified individually in any way as a result of your participation in this research. The data collected however, may be used as part of publications and papers related to politics and processes involved in developing and implementing science curriculum policy in Ontario

Your participation in this study is entirely voluntary. If any questions make you feel uncomfortable, you can do any of the following: you can choose not to answer certain questions, you can take a break and continue later, you can choose to stop the interview. You may refuse to participate in this research. Such refusal will not have any negative consequences for you. If you begin to participate in the research, you may at any time, for any reason, discontinue your participation without any negative consequences.

Name and status of Investigator:
Marietta (Mars) Bloch is the Director, Early Years and Schools for a charitable not-for-profit organization called Let's Talk Science. She is a Ph.D student at Roehampton University, London, U.K. working on her doctoral research.

Consent Statement:
I agree to take part in this research, and am aware that I am free to withdraw at any point. I understand that the information I provide will be treated in confidence by the researcher and that my identity will be protected in the publication of any findings.

Name

Signature ……………………………… Date ……………………………………

Please note: If you have a concern or question about any aspect of your participation, please raise this with the investigator, Marietta (Mars) Bloch, 79 Ramblewood Lane, Thornhill, ON L4J 6R9, Tel 905 886-1742, e-mail mbloch@edu.yorku.ca or please contact her Director of Studies Professor Pat Mahony, Education Studies, Roehampton University, Roehampton Lane, London SW15 5PJ, UK, Tel 44 (0)20 8392 3172, e-mailP.Mahony@roehampton.ac.uk .

Appendix J Semi-structured interview guide

Question	Prompts and probes	Relevance
Can you please tell me about your involvement in the development of science curriculum policy in Ontario, including how you got involved? ***RQ1***	Introductory question • participants describe what their experiences related to the theme of the study (science curriculum development) Follow-up prompts • Can you say something more about that? • Do you have any further examples?	• Exploring curriculum development experiences of participant
How would you describe the intended purpose of your role and how it contributed to the development process? ***RQ2***	Follow-up prompts • **What other development processes were there that you were not involved with and what were their purposes?** • Can you explain this further? • Can you give examples of what you mean?	• Exploring curriculum development processes • Direct experiences and assumptions
Who, beside yourself, do you recall was also involved and could you describe what the expectations were of their involvement? ***RQ2***	Follow-up prompts • Do you think others should have been involved? If so, whom, if not, why not? • Can you explain this further?	• Exploring curriculum development processes • Direct experiences and assumptions
How would you describe the decision-making processes used during your involvement and what influenced these decisions? ***RQ2*** ***RQ3***	Follow-up prompts • Can you describe this in more detail? • Can you give examples of what you mean from your experiences?	• Exploring curriculum development processes • Exploring influences on science curriculum development • Direct experiences and assumptions
How would you describe the process that was used for determining the actual content of what students were expected to learn in science, including how these decisions were made? ***RQ1*** ***RQ3***	Follow-up prompts • What do you think influenced this content? • Do you have any examples based on your experiences?	• Exploring changes in science curriculum content • Exploring influences that affect science curriculum content • Direct experiences and assumptions
What would you consider influenced decisions to develop new science curriculum in Ontario during the [80's, 90's, recently]? ***RQ1*** ***RQ2*** ***RQ3***	Follow-up prompts • How did 'climate of the times' impact on the development? • Who was involved in the decision? • Can you describe this in more detail? • Can you give examples of what you mean?	• Exploring factors that influenced decisions to develop science curriculum • Exploring influences and how they impacted on development • Direct experiences and assumptions
Is there anything further you would like to say about the processes and how decisions are made when developing science curriculum policy documents?	Ending question • Provide participant with an opportunity to add anything related to the study that was not addressed directly	

Appendix K Example of transcribed interview

M = interviewer (me) P = participant

Date: January 19, 2007
Recorded Length: 00:41:19

- Non-verbal behavior not included unless there was a motion emphasizing a point
- Short pauses (…)
- Interruptions //
- Protecting identity (***)
- Words spoken louder or emphasized are <u>underlined</u>
- Punctuation was added to be faithful to the delivery of the dialogue and to make the text more legible and intelligible to the reader.

ID#	Transcription	Transcription reflections/ comments
P1	M: So I'm going to put this on and we'll just leave it here. Do you want a copy of the general questions in front of you?	Prior to the recording started we had exchanged some opening pleasantries. P was aware of the purpose of my study and the focus of the research. P was the first participant who when asked wanted the questions in front of her. Other participants had declined when this was offered.
P2	P: Okay. That would be useful.	
P3	M: I know you have history not just at the government level with science curriculum or curriculum development. But also through your involvement with (***). So at the very end I do have a couple questions just about some documents that were developed back in the late 70s or early 80s that I'm just having a little hard time tracking down through (***).	I did not feel it was appropriate to begin the interview without acknowledging our connections over the years in Ontario science education. I felt it was better to get right to the point given that P's current position had demands on her time and that this interview was outside of her work commitments.
P4	M: I just wanted to mention that. What I'm interested in initially just is your background in terms of what your involvement was in the development of science curriculum policy in Ontario. So I'm really talking about something that led to the Ministry documents of science curriculum rather than classroom documents or Board documents	Because P had been involved at all levels of education (government, school board, classroom) I wanted to be clear that when I was referring to curriculum that I was referring to the Ministry documents. I found in a previous interview the term 'curriculum' was used in many different contexts and I needed to clarify or remind participants about how curriculum was being defined for this study.
P5	P: Well there were two. Three different occasions. The first one was under (…) um (…). I don't recall the Minister but it was under the former Tory government not the last one. But the one before. And my task was to complete the development of the curriculum under OS:IS.	This was a surprise for me. I had not realized that P was also involved in its development/ completion.
P6	M: Okay.	
P7	P: Remember we were doing basic, general and advanced and then the elementary. At the time there was no elementary curriculum so this was a major, major, major thrust. And there was also a kind-of assessment process where there was the development of assessment questions.	This is pre-*Science is Happening Here*. The assessment process and questions that P is referring to is OAIP (Ontario Assessment Instrument Pool). I missed an opportunity to probe what P meant by 'no elementary curriculum' and that OS:IS was a major thrust. I believe she is referring to the development of science curriculum under OS:IS as being major for elementary and not

		Science is Happening Here. Initially I thought that she was referring to *SiHH* as there had been no science curriculum for these grades since the 1960s. Upon listening to the recording, I now think that her comment is referring to grades 7 and 8.
P8	P: And there was a review process in place so in that sense at the elementary level the assessment was more driving what was going on in schools if schools choose to use it. There was no compulsion for schools to use it. I can't remember the name of that process but it was a fairly common process used for a number of subjects.	P is a little muddled on remembering the process but it is evident that the memory that is retained is assessment. Interesting to note in another interview the participant mentioned that the OAIP process was delayed in getting out and when it finally did get out that it was no longer current in terms of software, etc. I also vaguely recall when I was City of York consultant that at a SCCAO retreat, the person responsible for the OAIP for elementary science was frustrated by the delays at the Ministry.
P9	P: (…) The secondary curriculum was developed mainly with teachers writing and universities and to some extent colleges. Colleges got involved towards the end of the time of development there was. People started to get concerned about something that we called streaming. //	P got up while talking and closed the outside door to the room where we were having the interview. There was no loud external noise that was interfering with the interview and P made no indication as to why P was closing the door. I felt it was inappropriate to ask and it would also have interrupted the flow of P's thoughts.
P10	P: And the fact that these kids in what we called the general level were not being well served. And so the colleges were called in and there was also a lot of other systemic things underway which was the initiation of partnerships amongst industry, college, universities and school boards and the province at the time. I'm going to another government now. Let me backup. When OS:IS was released there was not a lot of consultation. Virtually none with parents, community etc.	Of note here is the comment made about the consultation of stakeholders in the development of OS:IS. This is quite different to the development of the current Harris curriculum in which there was more extensive input. Something P refers to later in the interview. Since P is recalling memories over several decades, I need to ensure there is cross-checking of data so that analysis of P's data is not out of context for the time period.
P11	P: A fair amount with subject associations. STAO was quite involved. And a fair amount with universities. But it was mostly a closed shop. Mostly teachers developing curriculum and evaluating curriculum. And at the time when I took it through a government process it was pretty simple. I basically did a briefing note saying what are the so-called hotspots. (…). And I'm trying to think of (…) I guess it doesn't really matter what government it was cause the Liberals came in.	STAO has often come up from other participants as an organization that has had extensive involvement in the Ministry science curriculum development processes. An interesting follow-up study would be to examine the influence of STAO as an organization on Ontario science curriculum policy documents. From preliminary date, it seems more of an individual's involvement who is a member of an organization than the member being a representative of an organization's collective thinking.
P12	M: Was it Peterson maybe?	
P13	P: Yeah it was Peterson but I don't remember if it was for the end of the Conservatives or the beginning of Peterson. I think it was at the beginning of the Liberals. And I think what happened was very simple and straightforward to bring the curriculum through everything being relative. In science the hotspot in biology was evolution at the time.	P's confusion about whether it is Davis PCs or Peterson Liberals could be related to the fact that OS:IS policy was approved by the PCs but the actual development of the curriculum occurred during the Peterson Liberal governments – at least for science.
P14	P: And we had to meet with a lot of people and I have to say that within the Ministry including the person I replaced there was a fairly strong objection to the teaching of evolution. So there were some issues that may have precipitated the issues around evolution. I don't know but there was a significant groundswell against the	Interestingly in the media articles at that time, there was discussion about how the word 'evolution' was not to be used in the development of the OS:IS curriculum. Jack Bell (Ministry of Education) was quoted in one of the articles regarding the controversial nature of using the term.

	teaching of evolution I do recall that.	I am able to track some of the discussions around evolution though other documentation. Could it be that this issue was a ‘hot topic’ because full-funding was extended to Catholic schools and there were many petitions in the legislative assembly brought forward by MPPs about teaching evolution as a theory alongside creationism. Note: Check timing of debate about evolution and what was the climate of the times.
P15	M: Hm.	
P16	P: That was probably the only big issue in the development and release of the documents [taps hand on table]. I believe the other thing was more of a what-happens-in-classrooms kind of issue which affected some districts like Toronto in that we changed what was taught in grade 9. Rather than having a year of biology or chemistry or whatever. So that precipitated some dialogue. But other than that it was pretty straightforward and there wasn't (…) significant policy changes because even though the government said we were moving to a four-year high school. We never really did. So we still have the five-year high school and we still continued along the same general path as had been in the past. I don't think there was radical structural changes that occurred in schools at the time.	Data related to approval of curriculum development. There is also reference to implementation in that the structure of the grade 9 curriculum was a mosaic of areas of science as opposed on focusing on a full-year on one area like the model in the US.
P17	P: The elementary curriculum development began with a very, very generic document which didn’t have any kind of great specificity or really any content specificity. It was very generic. And as I say the assessment strategies were much more specific than the actual curriculum.	The generic document P is referring to is the one developed by Orpwood during the Peterson-era. The OAIP was moving ahead without a clearly defined curricula but the OAIP was never meant to be mandatory implementation but rather a resource for teachers to use.
P18	M: Hm.	
P19	P: And again that was developed by teachers with a lot of input from subject associations and I think at the elementary level the early childhood group as well. And that was released and I don't think there was a lot of attention paid to implementation at a provincial level. There were some structures put in place. There was no kind of strategy for ongoing renewal at the time.	The statement about not a lot of attention paid to implementation at a provincial level was also mentioned by other participants knowledgeable about this time period. It has been stated that the Ministry was not involved in implementation. There was also not central funding at that time. Boards raised funds through municipal taxes. This also reminds me of the comment by a former DM in the McGuinty government who declined to be interviewed because he felt he had little to do with curriculum development even though the government was reviewing and revising curriculum.
P20	M: Uh hum.	
P21	P: There was again a radical (...) When the Liberal government came in power. They had a different structure for developing curriculum. In fact they had a different structure for bringing about change that did not include the development of curriculum (...) if you remember the transition years. //	My novice interviewing technique is evident here. I was listening to the flow of P talk that I missed following up about the ‘different structure for developing curriculum’. I should have asked for further clarification as to what was meant by this. If it is not possible to follow-up with P then I need to be diligent about seeing what other participants involved in this curriculum had to say about its development processes and find other supporting data. The big change for transition years, early years, etc. was enacted by the NDP government. Note: Could P be confusing governments
P22	M: Uh hum.	
P23	P: The early years.	
P24	P: Etc. The emphasis was more on how children learn and some of the supports that kids need and how you prevent kids from dropping out. They were more systemic kinds of issues and curriculum came started to be	

	addressed later. Then the NDP came in.	here?
P25	P: And they picked up on the need. There was a public outcry for consistency and accountability in the province. There were no standard report cards. No standard curriculum and no testing. And that was addressed really by the NDP as part of that review which was called something. For the Love of Learning, the Royal Commission.	The need is referring to the need to pay attention to curriculum because of the public discontent with the quality of public education and lack of consistency and accountability. This trend in public opinion can be tracked by examining the Livingstone surveys. As P is talking she got up to check the bookshelves behind her for the name of the review. She had the documents for the Royal Commission on Learning on the shelf. Note: An interesting probe here would have been to ask P what she thought about the need for accountability given her earlier comments about assessment (in the form of OAIP) driving curriculum.
P26	M: The Royal Commission. Right.	
P27	P: And they established the EQAO. But once you're going to have provincial assessment. You have to have a curriculum. So the curriculum that was developed under the NDP was very generic and was not subject specific [taps hand on table] if you remember. And went 'til the end of Grade 9.	Point of clarification when I pull this comment out of this transcription and into matrices - 'they' refers to the Rae government and not the Royal Commission. The Royal Commission only made recommendations.
P28	M: Uh huh.	
P29	P: Which was very disorienting for grade 9 teachers because they were used to math, science, etc. And the subjects were done in clumps. And there was no streaming done in grade 9. They eliminated streaming. I would say with no accurate documentation that teachers never really moved away from teaching the *OS:IS* curriculum and streaming kids because they didn't have any supports to do anything else. It was way too generic and 7, 8 and 9 teachers didn't have a chance to talk to each other to find out who did what, when and how.	There are support documents, media articles and comments recorded in *Hansard* to tell the story of how destreaming was not supported. Preliminary data is showing that the elements of the *OS:IS* curriculum still remains with revised curriculum because curriculum development is not a rethink of what should be taught but rather a massaged version of the previous curriculum.
P30	M: Uh hum.	
P31	P: So that was not an incredible success. However it took the province on the road to having more and more specificity at the elementary level. The Conservatives continued to hear the grave concern. At the time from the public about the lack of standards. The lack of accountability. The lack of consistency. And it not only came from the public but it came from the universities and colleges as well.	The themes of centralized curriculum for specificity and accountability are emerging from the data. In analyzing the data, indicate support for this occurrence to see if it is a trend. In particular, what is the political climate (globally and locally) and what impact did this have on curriculum.
P32	M: Hm.	
P33	P: So I was brought in to develop the curriculum. And the decision that was made at Cabinet was to do a subject specific K-12 curriculum and a report card with some accountability.	There is some historical muddle here. Another participant interviewed was in the position that this P is talking about but left. It was at that point that P was brought in but by then the elementary science and technology curriculum had been developed. Note: Check documentation regarding this government time period. Cross-checking of data should clarify the muddle.
P34	M: Uh hum.	
P35	P: And we structured a process which I think based on all the reading and work I've done. It was probably the most collaborative process which was approved by the government in	P is referring to the secondary curriculum development process and not the elementary one. This is confirmed in P37 and from other data sources.

	which we had community. We had (…) Chamber of Commerce's across the province. We had skilled trades. We had apprenticeship. We had parents. The world. And you probably would be involved (…). Most familiar with the development of the science curriculum at time, which I believe was done through York University.	
P36	M: Uh huh.	
P37	P: In other words we did RFPs out to groups across the province and then on the basis of the RFPs we selected [taps hand on table] maybe thirty writing groups.	It is interesting to compare perceptions of other participants. There is an extensive description in two other interviews conducted so far about the frustrations experienced with this process.
P38	M: Uh huh.	
P39	P: And they had to meet certain criteria. Have certain groups on it. But the writing actually had to be done by teachers. The interesting part of it and the part that had much more political involvement that I had experienced in the past was when the material came in. There was a very, very strict review process. And it had to go through significant stakeholders that were friendly to the government. They had to also go through a Catholic filter. So we had to make sure that whatever we did met the requirements of certain stakeholder groups. But there was a large number of stakeholder groups. And for the first time the aboriginal community had an opportunity to write their own curriculum and actually Native as a Second Language was changed to Native Languages cause Native is not a second language to the native community.	Some interesting comments to pick-up here as data about the review process. Again there seems to be a dual track with curriculum development. The actual writing of the curriculum which involves teachers, STAO, etc. and then the political process. In this case the political process was quite extensive in that the curriculum had to meet the approval of the stakeholders who were invited to be part of the process. Interesting that P justified the stakeholders sympathetic to the government's views by commenting on the large number of stakeholder groups that were involved. Note: A missing prompt here is 'Who was excluded from the process?' You can have a large number of stakeholders but they can all hold the same or similar perspectives and values.
P40	M: Uh hum.	
P41	P: So there was some significant breakthroughs for them. The curriculum development process that had very, very tight timelines. It has to be done within a certain (...) I believe it was three years. We used people from across Canada in terms of the editing, writing. Uh. And it went through a Cabinet process. It wasn't just to give it to the Minister and have him or her ask us what the hotspots was. It went right through Cabinet. So we had to meet with all of the different ministries. For example in science it impacted on mining, on fisheries (...) etc.	Data for PC curriculum development process. The approval process is quite different from that of previous governments. This implies government interest in curriculum as political documents. I am still trying to gain access to a government perspective on the current curriculum process under McGuinty to see what the approval process was.
P42	M: Uh hum.	
P43	P: And we had to get input from them and then we also had to meet with the stakeholder groups as defined by the Ministry. Defined by the government. As well as the traditional groups like STAO, etc.	Questions that need follow-up and could lend themselves to further study: What role did the stakeholder groups have in the curriculum development? How did the Ministry define the groups that it wished to involve? Were any groups not invited?
P44	M: Uh huh.	I missed an important prompt here. This maybe due to honing my listening skills. Although I was listening intently to what P was saying, I wanted to hear more and not interrupt the flow and thereby missed the opportunity to probe into 'who is invited'.
P45	P: We also had to ensure that it met specifications. So that in order for it to be actually released we had to get a letter of authorization saying that it met requirements from the perspective of the people who	Again, some very important points here that should have been probed more deeply. <u>Follow-up:</u> What specifications had to be met? Who determined these?

	actually elected the government because they were the ones who were calling for accountability.	Who wrote the letter of authorization?
P46	M: Uh hum.	
P47	P: So it was a very, very intensive interesting process that had a huge involvement. And some would say that it was...at the end that it was filtered. But I would say that all curriculum is filtered is. And biased. Um (…) I (...) I believe that the science probably have the least filtering because it was done by the academic and there was I would say virtually no concern about evolution. I don't recall getting one letter about evolution. Uh (…) at that (...) at that stage.	Interesting to note that P’s perception is that the science curriculum had the least filtering. However, this is beyond the scope of this study to pursue. Also interesting to note is P’s comment that all curriculum is filtered and biased. I think that P is perceptive. Curriculum writers also use personal biases of what they like and don’t like when revising or rewriting curriculum. If curriculum is filtered and biased then what processes can be put in place so that personal opinions and biased views of a few don’t shape the curriculum.
P48	P: Uh (…)the other thing that happened is that the government again tried to eliminate (...) or (...) or to focus on not streaming grade 9 and 10. And um. (...) Not offering courses at different levels. And that was very controversial with the teachers. Because they said you have to have different levels.	P is referring to the whole debate about academic and applied. There are other perspectives about this from the secondary science curriculum writers of that curriculum as well as teacher perceptions in the focus group discussions. This will provide data cross-checks.
P49	M: Hm	
P50	P: You have to have streaming. So the uh. (...) Uh. The focus then was on having a significant block of material that was the same but taught (…) but taught differently. Which was inconsistent with the philosophy of the curriculum because the philosophy of the curriculum was not how teachers teach but what kids are expected to know and be able to do [taps hand on table]. So that never did get reconciled.	
P51	M: Hm.	
P52	P: And that was one of the challenges in the curriculum. Because when it came out unfortunately with fewer supports because of the nature of the funding formula etc. There was. It was very difficult for (...). And because of quite frankly mindsets of how we think kids should learn and (…) and uh (…) proceed.	P’s tone is quite strong here and her own personal view about supporting destreaming comes through.
P53	M: Hm.	
P54	P: And there (...) there was a lot of um. There was a number of students who were not successful and that was identified very early. Virtually by everybody in the Ministry at the time and by all of us including people outside. So the government started making changes and putting supports in place. And one of the first changes, of course, and that included...and that included science, math and English I think. Was to have a different level of course.	The failure of academic and applied courses being implemented as intended led to the need for the essential courses. I believe the issue was strongly related to implementation rather than the course content. The essential courses also had similar content to the academic and applied but they had more teacher support regarding teaching strategies and assessment and evaluation. More data sources will be needed to tell this story.
P55	M: Uh huh.	
P56	P: What we called essential courses at the time and I think they have a different name now. I can’t remember what it's called. So those were developed but they're never. They’re not part of the so-called a traditional set of courses. First they were locally developed.	
P57	M: Uh huh.	
P58	P: Those students who take those courses	P said the word IQ in a chagrined tone when

	aren't. Don't do the IQ. IQ (…) EQAO tests. Uh. So they're not being assessed. Of course science isn't EQAO and you're asking me about science. In language for example when we get EQAO results. We're only getting them from applied and academic.	she realized what she said instead of EQAO.
P59	M: I hadn't realized that.	
P60	P: Yeah. So when the Liberals took (...) came into power. They made. That was. This is a major platform [taps hand on table] for this government.	P is referring to the McGuinty government. She spoke in an adamant tone when referring to the 'major platform for this government'. This was further emphasized when she tapped her hand on the table as she spoke those words.
P61	M: Uh huh.	
P62	P: Uh (...) is to make sure that kids are successful. And in fact we just got Bill 852 the other day. Which received Royal accent in December on learning to 18 [taps hand on table]. In other words it is now compulsory for kids to stay in school to 18. And there will be a variety of uh (…) learning experiences for them. Which uh (...) in other words besides the actual content of the curriculum [taps hand on table] there are structural changes that are occurring. For example, kids can. There's a pilot now and eventually if the pilot goes through. The kids can take four credits outside of a regular (...) that are (...) that is not offered by [inaudible word] teachers. And as long as they're approved by certain criteria and approved by the principal.	It is notable the words that P emphasizes. The emphases are not curriculum related in terms of curriculum policy documents. They are about structural education policies requiring kids to stay in school and ways in which this can happen. What is emerging from the data to date is that accountability is becoming higher stakes. Check literature related to audit as it appears there is a confluence of accountability measures and an audit culture.
P63	M: Hm.	
P64	P: So that is one of the ways in which the feeling is that we can make learning more relevant for kids and keep kids in school. Or keep kids until graduation not necessarily in a formal school program. With respect to science also since the government came in place. Uh. Possibly because they had to put their mark on it. Which is (…) which is a good thing. They (...) they initiated a (…) um. A systematic review of all the curriculum.	Interesting comment 'possibly because they had to put their mark on it'. There appears to be an emerging trend since the 1990s that curriculum reform is something that is visible for governments to do to address education concerns by the public and can potentially be done within the lifespan of a government.
P65	M: Hm.	
P66	P: Which was a very good thing because the first time you develop something. There's no (…). It does need to be field tested and then reviewed [taps hand on table] and then revised. Because when teachers develop curriculum. They write (...) and they think (…) And when people evaluate it from the public. It's everything they think everybody ought to know. Ever [tapping hand on table]. And so when you take seven of the subjects together in elementary school. There's enough for 20 years of schooling. Uh. And so after teachers had a chance to go through it for a while they recognized the quality. Or the quantity of the material. And in some cases the (…) uh (…) complexity of it. Although we had tested it against (...) uh (...) Alberta. We tested it against other provinces. Not tested it but evaluated it. So it wasn't more difficult. It wasn't easier or more difficult [tapping hands on table].	This is a very interesting comment. In Ontario, curriculum was never field-tested or even presented for optional implementation prior to mandatory implementation. It has always been 'here are the documents – implement them'. With the McGuinty government there is now a process starting with the science for a year of optional implementation before it becomes mandatory. There is no mention from the Ministry that there would be changes made if during the mandatory implementation problems are identified. It would be interesting to compare with other jurisdictions in Canada or other countries whether they 'field-test' curriculum before it becomes official policy, but that is beyond the scope of this study. It's already complex enough and would require a design that incorporates methods and analyses for comparative studies. That's a whole other research area!

P67	M: Right.	
P68	P: It was right along the level of other provinces. And we also looked at IB in other countries for the (…) for the high school curriculum. And AP.	Data re: development process – looking at other programs and curriculum. Note: A missing prompt here is how was this information used in shaping Ontario curriculum. This should be included when interviewing other curriculum policy-makers/ influencers.
P69	M: Uh huh.	
P70	P: And some of the test results or test questions. So there is a review process in place now but I would say uh. As somebody who spent most of their life developing curriculum that that is not the driver [taps hand on table] for change. I think that the real driver for change for some of the. For (…) for success are some of the things that the government is now doing to make a difference for kids. And those are structural changes. And those are changes in spending money in. In staff development. Spending money on alternative ways of delivering education. Encouraging co-op [taps hand on table]. Encouraging work experiences. Encouraging apprenticeships. I would (...) I think those are the kinds of things that really turn kids on to learning and are really going to make a difference for all of students. Not (…). Including the kids going to university.	P placed a slight emphasize on the word 'now'. It was not stated with an emphatic tone but it seemed to reinforce her point that changes in curriculum are not where she would be spending a lot of money but rather on structural and funding changes. This implies diminished importance on curriculum development, yet from my practitioner experiences, the content of the curriculum documents impact on what students learn in schools. They are part of the overall process which is why it is important not to just isolate research to the content of the documents. To have a deeper understanding of curriculum policy requires looking at the climate-of-the times in relation to the documents.
P71	P: So if I were in charge of curriculum again. I wouldn't spend a whole pile of money developing a new curriculum. I think it's always important to reduce. But I would spend a lot of time and money on structural changes //	However, P's comment does raise an interesting question as curriculum documents become political tools/documents: If the processes for curriculum development perpetuate what was in previous curricula, then is the money spent on their development well-spent? IS it the curriculum or the processes that need change?
P72	M: Hm.	
P73	P: In response to urgent needs.	
P74	P: Um. I think by-an-large if you give teachers what we expect kids to know which are pretty generic.//	
P75	M: Uh hum.	
P76	P: And be able to do. And try to get teachers to keep up (…) up-to-date in terms of their content areas. I think we'd probably. And also I would think having textbooks online so that we can make changes as needed. Would be some of the structural things I would pay attention to.	
P77	M: Yeah. So you have actually really been through. (...) Uh. (...) Under different governments.	
P78	P: Yes. NDP. Conservative. What I call the Red Tories back then. And now under Mike Harris.	Red Tories was a reference made to Bill Davis' government which was the government of the day prior to the Peterson era.
P79	M: Right.	
P80	P: And then I also worked in (***). And they (...) they were coming from a very different starting point.	It was interesting to hear that P was involved in the development of their curriculum. I had spent 2 weeks in South Africa inservicing teachers. It was an amazing experience! Like P, I found the people that I met and their interest and understanding of education was inspiring as was their dedication to building a democracy and they saw education as a key component. However at that time there was much criticism about the structure of the curriculum because if was based on outcomes-based education. I recall a very negative press article about OBE
P81	M: Uh huh.	
P82	P: And they were clearly starting fresh. But there was a brilliant group of people who were working on it.	
P83	M: Uh huh.	
P84	P: And they were very well organized. But they had so many structural problems that it was going to take a long, long time for //	
P85	M: Right.	
P86	P: [inaudible word: them to?].	

		which could have been written in our newspapers as the arguments against it were similar.
P87	M: So under these (…) these different governments then. There were different processes under //	
P88	P: Oh yes. [inaudible phrase]	The inaudible word can't be clearly heard. P was talking softly at this point but was communicating that there were different processes for different governments.
P89	M: Different governments? And what do you think influenced that?	
P90	P*:* Ideology and your stakeholder groups and I think the public. I think politicians are always responsive to what the public wants.	Important data point on curriculum influences. Documents are clearly showing evidence that politicians are responsive to the public. A significant comment P is making is politicians are particularly sensitive to responding to the electorate that votes for them. This could imply ideology influences – or maybe it's power – politicians wanting to be elected to form the government.
P91	M: Uh huh.	
P92	P: Or their perceptions of what the public wants. And in particular what the public that are committed to their particular goals want. It's really, really important to have input into their white paper at the very beginning. And to read it very carefully because I think to be fair to the conservatives they were all. Under Mike Harris. They were all very, very clear about what there were going to do. And they did it. There should have been no surprises.	
P93	M: Yeah. I've actually noticed through this study that the white papers and discussion papers outline where the direction is going.	
P94	P: Uh huh.	
P95	M: But we often don't seem to pay attention.	
P96	P: We probably don't teach our students and we ourselves don't make decisions when we vote. For the right reasons.	
P97	M: Uh hum. That's an interesting learning curve //	There was no need for personal comments like this in the interview. Although it provides a friendly tone, the purpose of the interview is to let the participant speak and not to state one's own opinion. This is an example of my novice and developing skills as a student-researcher in conducting interviews.
P98	P: Uh huh.	
P99 P100	M: For myself as well as I embark on this. Um (…) with the NDP you had mentioned under the or (...). Under the OS:IS curriculum for just lack of another description for it. Um (...) which was through the Davis-Tory/ Peterson time	
P100	P: Uh huh.	
P101	M: Uh (…) the NDP. The NDP process do you recall anything about their process cause you were saying with OS:IS it was more of a closed shop and (...) and//	Is seems prior to '95 that curriculum development was more in the hands of educators with minimal if any input by other stakeholders. This definitely changed under the Harris years. Note: I need to find out if this extensive external consultation is also the case for the McGuinty revisions or because there is not a focus on curriculum change that the process has become more educator focused again.
P102	P: It was very closed. NDP was a very closed shop too.	
P103	M: It was closed shop as well?	
P104	P: They had a very specific (...) And it was wonderful to read. It (…) it (...). They had a very specific ideology.	
P105	M: Uh hum.	
P106	P*:* Uh. (...) And you. When you read it. You read a lot of commitments to social justice uh (…) to collaboration. To(…). It was a very, very different approach. Very different ideology. Ideological to the one (…) the one that came after and even the one before.	Data point regarding perception of the NDP curriculum. It is notable that P comments it was quite different from other curricula and also that she saw the influence of the NDP ideology in that document.
P107	M: Uh hum. Uh hum. And so they adhered to their//	
P108	P: They adhered to their values. Yeah.	

P109	M: Yeah. Yeah. And in terms of, from what you recall involvement of //	There was no need for me to interrupt here.
P110	P: And it got. It got very negative press when it went out in the field.	This is supported by media articles. There was much concern about outcomes-based education which is how *The Common Curriculum* was written. This is also supported by other interviews by government people.
P111	M: Oh. Is that right?	
P112	P: Yup. Because I don't think this is an NDP province. I just think they didn't like Peterson.	
P113	M: Right. Right.	
P114	P: That's my own opinion.	
P115	M: Yeah. Yeah. No that's okay. Um. Because actually what I am doing through the course of this is I'm actually looking at the government debates.	I deliberately wanted to let P know about the sources I was using in my study to see how she would respond. I have done this with several government people that I have interviewed and all seemed to affirm that these are indeed sources to include to get a large-picture view.
P116	P: Uh huh.	
P117	M: The *Hansard* transcripts of government debates. Um. Newspaper and media reports as well as the papers that the government has (…). Uh has done. Rather than just the science curriculum. And it's //	
P118	P: Oh yeah. You have to.	
P119	P: I personally feel. (…) Believe very strongly in what the government called destreaming. I think we should keep kids. Maximize kids opportunities as long as possible. Uh. So I had absolutely no difficulty going out and speaking across the province but boy did I ever get beaten up about it. It was a very, very (…). People were very negative about it	My comment about sources seemed to have sparked a memory of the negativity around the destreaming debate.
P120	M: Uh hum.	
P121	P: Very negative. But interestingly enough when the Conservatives came in. I guess they did some testing and it depends on how you ask the question always. There (…). There's no question that people want to maximize (…). The kids to maximize their opportunities so they truly tried to do that with the way they initially established their policy. But I would say we're now back to looking at kids in different streams [taps hand on table]	I haven't come across any evidence to support that the Conservatives under Harris did any testing for science. P is more than likely referring to the EQAO testing for reading, writing and mathematics that began under Harris. Regarding curriculum, my impression and other data sources seem to indicate that this government were more interested in ensuring curriculum was 'rigorous' and not about kids maximizing their opportunities. Students were expected to measure up to the standards regardless of whether or not they could. I need to cross-reference this data with (***) and (***) interviews and what their impressions were regarding academic and applied.
P122	M: Uh hum. Uh hum.	
P123	P: And that's just the way we think about kids or about teaching and learning I guess.	
P124	M: Or the culture of //	
P125	P: The culture of //	
P126	M: This province is //	
P127	P: The culture of this province is.	
P128	M: Um. Yeah.So with the decisions that actually happen internally at government (…) um (…) for a curriculum. If you compare the different governments. Um. I'm not sure if I (…) um (…) understood it correctly. That it was more cabinet-oriented with the. Under the Harris government and more at the Deputy Minister level with previous //	Not a very articulate way of phrasing a question!
P129	P: Deputy and (...) and Ministers office. Yeah.	Clearly there was a different process under Harris. Was this an anomaly then in Ontario curriculum development compared to previous governments in that curriculum 'sign-off' did not necessarily have to have cabinet approval? Why was this so important with the Harris
P130	M: And didn't (...) didn't necessarily go (...) um //	
P131	P: No I don't recall it going anywhere else.	
P132	M: Right. Right. And so it was a very different process then in terms of decision-making	

P133	P: Totally different. Totally different.	government? I wonder if it might be possible to find an MPP from that time who might shed light on this or check data sources if there is any indication as to why.
P134	M: Yeah. And so //	
P135	P: Now I had left. I wasn’t with the NDP when the actual curriculum was out. I was with the (***) at the time. So I don't know what their process was to take that through the (…) through the cabinet.	I can check what the NDP process was for releasing *The Common Curriculum* through other data sources including interviews.
P136	M: Uh hum.	
P137	P: But I would. It really did reflect the NDP ideology and so I would expect that it might have gone through some similar process.	
P138	M: Some review process there.	
P139	P: Yeah. Yeah.	
P140	M: If we can just go to your experiences with science curriculum because you have been involved with that on just (...). Uh (...) on multiple different levels. And you know when you go through what some of the books //	
P141	P: Uh huh.	
P142	M: That started from here [holds up old Ontario school books that were in room] which are interesting. To the changes that happen in science curriculum. And I think you were once involved in STAO.	I am referencing the old Ontario school books that were on a display in a corner of the room on an old wooden school desk.
P143	P: I was (***).	I knew P was (***) but I wanted to know more about her prior experiences as other participants had mentioned her in their interviews. As this interview is publicly accessible through its inclusion in this thesis, I have decided to use (***) for this section to protect the identity of P. The specific references are not critical data but led to the discussion that followed beginning on line P148. The original transcribed interview does include the text for (***) just not this publicly accessible version.
P144	M: Yeah. You were (***)	
P145	P: Yeah. I (***).	
P146	M: (***)	
P147	P: Yeah. [some inaudible comment]	
P148	M: Can you just talk a little bit about um (…). What was going on at that time because there seemed to be this flurry of activity?	
P149	P: With the uh (…) support of the government, they turned to subject associations. As we did also when we developed curriculum in the (…) in the (…). Under the Conservatives. When we turned to the subject associations and. Or the government turned to the subject associations and asked for all sorts of advice. They would bring drafts to respond to or they would ask for writers. Um. They asked to (…) to recommend people to be part of writing teams. And I think at the time. It seems to me that when the elementary curriculum was developed. Uh. That they asked STAO or SC (…). What was the other organization?	This theme has come up in several interviews: the involvement of subject organizations in the development of science curriculum. STAO and SCCAO seem to be major contributors to writing and providing input to science curriculum development. As mentioned earlier, an interesting follow-up study would be examining the impact that this organization had on science curriculum and the processes they used to make decisions, choose people, etc.
P150	M: SCCAO.	
P151	P: SCCAO.	
P152	M: Uh hum.	
P153	P: And I think that there was a person there who was charged with being responsible for developing the elementary science curriculum. So they had a huge impact on science curriculum at the time.	There may be some inaccuracies in the recollection of elementary. P seemed knowledgeable about secondary issues but more vague about the development of the elementary science curriculum.
P154	M: Right.	

P155	P: [inaudible phrase: the whole thing]	The phrase uttered remains unclear.
P156	M: And the um (...) influences that sort of um. Uh. Sparked changes in science education. Uh. D'you recall any? I mean obviously Sputnik back in (…). We know that. But in terms of Ontario's experiences. Is there anything that you can?	Not a very articulate way of phrasing a question!
P157	P: Oh I think that (...) Oh yes. I certainly think the government was uh (…) really concerned about being competitive and saw science as one of the drivers of competition.	Data points for science being seen as important for the economy and having a workforce that is globally competitive. Further data sources needed to confirm P's perception of this between the Peterson Liberals and the NDP governments.
P158	M: Oh. Okay.	
P159	P: There's no question about that. If you go beyond when they (…). If you looked to how they were looking at the future and looking to the economy and how it was moving. Looking to the careers and how they were moving. They saw. They saw science as being a very important subject.	
P160	M: Uh hum.	
P161	P: Yup. I don't think the NDP did as much but certainly the Liberals did under Peterson.	
P162	M: Yeah. And actually I'm just going through the Premier's Council report //	
P163	P: Yeah.	
P164	M: That (…) uh (…) was done at that time.	
P165	P: Yeah.	
P166	M: And certainly science is (...) is mentioned.	
P167	P: And…and they were the ones that established those industry-education councils. And um. Sean Conway was the Minister I was thinking of when I was involved with the evolution debate. But they were very interested in science and I remember one of the potential election platforms that Dave (…) that Peterson was announcing. But of course they announce a lot of stuff during an election. Was to give kids 2 credits for taking a science course in high school. To encourage kids to take science.	
P168	M: Uh hum.	
P169	P: I recall that. And they gave a lot of money and you know (…) X number. I think it was five dollars per student or 25 dollars per student probably for science equipment.	There are other data sources regarding the Peterson Liberals commitment to elementary science education.
P170	M: Uh hum.	
P171	P: There was lots of incentive.	
P172	M: What's interesting now is that um (...) science does not seem to have that same heightened importance at all. Um.	This question was asked to probe for P's perception regarding science education, considering there was curriculum development happening now.
P173	P: Well right now there is a focus on literacy provincially.	This is emerging from the data as well regarding the emphasis of literacy and numeracy with the McGuinty government. Still to be examined and requiring more data is the status of science within this emphasis. I have my own personal views based on practitioner experiences but evidence is needed before any claims can be made.
P174	M: Uh hum.	
P175	P: And numeracy. Because the feeling is that they drive success in all subjects. And I think that if I were to do a meta-analysis of what is being said at a provincial level they are also very interested in (...) uh (...) having kids expand their repertoire of career choices more into (...) uh (...) apprenticeships. And some of the high skills and the knowledge economy. Etcetera.	
P176	M: Yeah. Yeah. It's interesting when you look at that flow which is why I didn't want to do my	A very inarticulate and convoluted way of expressing that I did not feel examining one

	study on a particular curricular development cause as I started digging deeper you really need to have //	government curriculum would raise interesting data to see if there were any trends across governments! P seems to have understood what I was saying but in hearing it and reading the transcript, it was very muddled!
P177	P: Yeah	
P178	M: That broader perspective with it to see where they lie. Where things lie. Um (...). I think. Um. We touched on a lot (***) just in //	
P179	P: Uh hum.	
P180	M: In talking about. Um. Do you feel there. Throughout the process particularly if it was a highly political process. There were (...) um (...) people who were not involved in the process? Deliberately chosen not to be involved in (...) in development?	The muddled phrasing continues until I finally get to the question!
P181	P: Well first of all I think all curriculum development is political. Uh. Even teachers when they develop something in the classroom. Hence the debate yesterday when the OSSTF//	An interesting perspective given Ps involvement in curriculum at different levels.
P182	M: Oh yeah. Right.	P is referencing a current events item where a branch of OSSTF passed a motion to engage the union in a debate as to whether to condemn Israel's treatment of Palestinians as a human rights issue.
P183	P: In the Jewish community picketing out there in their headquarters.	
P184	P: There's no such thing as apolitical curriculum. Uh. I think people who are really concerned about certain issues. (…) We had a lot of environmental. Uh. People who were concerned about the environment. Um. They would have (…). They would have a larger impact now than they had then. Because (...). I would think sustainability would be much more important to the Conservatives than um. They would just have different language talking about it. Uh and people who for a variety of reasons choose not to be involved in decision-making.	This data point needs to be supported by other sources. There is already some emerging data that those who become involved in curriculum writing have their own issues that they bring to the table. Likewise in the political arena, various actors with interest in education, bring their values and beliefs to the discussion. There is the potential for a future study on values and beliefs of those who participate in curriculum development. For this study, I am examining the processes and will be interested to see what unfolds regarding how different values and beliefs are accommodated with the development and decision-making processes.
P185	M: Uh hum.	
P186	P: Look at the number of people who vote.	
P187	M: Yeah. Yeah. (…) Is there anything else just when you scanned through [clears throat]. Um. Because you really have um (...) addressed issues on influencing decisions. Um. [coughs]. And uh (...) certainly what your role was (…) was within this. Um.	During the interview, I had noticed that P was glancing at the questions as we were speaking and I had the clear impression that she was conscious of the questions as she spoke. This is why I referenced the question sheet that she had in front of her as I knew she was familiar with it. I was feeling a coughing fit coming on as I spoke.
P188	P: Well the one thing I always. The one thing I wanted. (...) The reason I wanted to come back. And I’m not going to tell you who the Minister was that said this to me and it was relating to the science curriculum. When I went to do the briefing. And. And I was asked how much time it would take. I think this was June or something. No it was the math curriculum. Anyway it doesn’t matter. Uh. How much time it would take to get it implemented. And I was sitting there thinking should I say 5 years. 7 years. And he. He. Before I had a chance to say anything. He said could we say the beginning of August? [laughs]	There seems to be a fundamental misunderstanding by government as to why implementation in education is complex. This may become more evident with more data.
P189	M: [laughs]	
P190	P: There’s a real sense you know, when. When you’re involved in policy and in politics	

	(…) but you know we've got the policy done. It's finished kind of thing and it really just begins.	
P191	M: Uh hum.	
P192	P: And so I (…) I would say that there's a tremendous um. Uh. Sense of urgency at a policy level about why that isn't done already [bangs hand on table several times]. We've already given you some. You know. Two weeks. That's typical of politicians in general and I can understand it. Because they're got an electorate to speak to. But then when you get into reality and you get into the messiness of the school and the teachers and the attitudes and everything. It's a very, very complex and probably the more interesting process in a sense. In (…) in many ways the development is the easy part even though when you're doing it, it doesn't feel that way. But the implementation [bangs hand on table] is the important and hard part.	
P193	M: Yeah. And then what actually gets attained.	
P194	P: Yeah.	
P195	M: Through that.	
P196	P: Yeah.	
P197	M: Is (…) is really the interesting part. It's just too difficult to attribute.	This was something that I remembered Pat mentioned to me the first time we spoke on the phone and she had read my RDP1 proposal. I initially had included attainment as part of the study. She challenged me as to how would I actually be able to tell what influences attainment when there are so many variables to consider. She was quite which is why this study is examining the intended curriculum by governments.
P198	P: Yeah.	
P199	M: Um. What really has influenced that (…) that attainment.	
P200	P: Yeah.	
P201	M: Which is why I. I'm can't do. I'm not doing the whole um. (…) Uh (…) perspective of it. But I am doing what the perception was of these different curricula.	I do find it helpful to have to restate and talk about my study to have it become clearer in my head. This is probably not good protocol in an interview unless it is for clarification purposes for the participant however I find in talking about the direction and scope of my study that some further insights can be provided by participants particularly when they have deep experiences.
P202	P: Uh hum.	
P203	M: So that. Because it's not only uh (…) how was it developed but then how is it perceived.	
P204	P: Uh hum.	
P205	M: By users and what is their interpretation of the documents.	
P206	P: And the way it's perceived by users depends on how they perceive the government as well. You know that the Harris government was not //	Is P's perception of the Harris government biased because she had worked with this government? There is no question that the Harris government policies were not well received in general by teachers and that they definitely did not show respect for teachers. Already I have much data to illustrate this. I will revisit Gidney's book *Hope to Harris* as it also has good insights and examples about this government.
P207	M: Uh hum.	
P208	P: Respected. I think they did some really good stuff. But they did a lot of stuff and they look a lot of money away. And they didn't respect teachers.	
P209	M: Uh hum.	
P210	P: Which made it. Everything else. (…) Coloured all of the good stuff they did.	
P211	M: Yeah.	
P212	P*:* But I think that over time its garnering respect. Uh. Even though it has to be branded. You know. Changed and branded by different governments. So uh. (…) I think every government. I really do think that. (…) I was. (...) I feel fortunate to have worked in the different governments since I've been in Ontario because I think it took us down. It took	P's comment implies that centralizing is good progress. This makes me wonder about her value towards accountability in the form of testing and having measures in place to demonstrate accountability (like a standardized curriculum). A curriculum study examining the identities, beliefs and values of those involved in

	us down a path of being the most decentralized province in Canada to one of the most centralized provinces in Canada for a whole variety of reasons. Uh and that (...) that journey and (…). I guess I wasn't here in the 60s but I (...) I imagine it was very open.	curriculum development could be interesting and shed more light on the complexities of curriculum policy-making.
P213	M: Uh hum.	
P214	P: And teachers could do virtually anything they wanted. Uh (…) in terms of the whole. You know the whole child approach and what was it called Living and Learning or //	
P215	M: Living and Learning.	
P216	P: Loving and learning or something.	
P217	M: And curriculum was at that time really up to the Boards to develop.	I wanted to probe P's comments a bit more as it was becoming clearer that she was not as supportive of a decentralized curriculum where there was flexibility for teachers to develop their own curriculum. This would reinforce my perception that P was supportive of accountability measures and not decentralization of curriculum.
P218	P: Yes. And up to the teachers.	
P219	M: And up to the teachers to develop their own.	
P220	P: Yeah. So. //	
P221	M: Yeah so there's definitely been a //	
P222	P: It's been a very trans (…). And I (…) I would say that even though at the political level the federations are still anti-EQAO. But I would say that there's a tremendous amount of support right now amongst the teachers for testing.	These comments imply that P is supportive of accountability. P's comment that educators are supporting testing. Are they supporting it or resigned that they have to work within the government's testing requirements. Also, these tests are literacy and numeracy-based so where is this support? I should have probed deeper than just saying 'right'.
P223	M: Uh hum.	
P224	P: Accountability. Not so much testing but accountability.	
P225	M: Right. Right.	
P226	P: And EQAO is a good. I think the development. (…) The process that's used is an excellent. It was an excellent process in that it got people on board.	I should have probed as to who 'got on board'. Many teachers and even parents have issues regarding EQAO. The tests have also changed over the years and therefore comparing results is questionable including the intent of the government of the day when they announce the results.
P227	M: Right. Just one (…) uh minor thing I want to revisit with the OS:IS curriculum. When you talked about evolution and (…) um (…) that there was some resistance to that even at the government level.	I was conscious of the time here and wanted to revisit an issue as I was seeing it in media articles and in *Hansard*. Another participant had mentioned that the Ministry bureaucrat responsible for OS:IS was a Christian Conservative and this participant speculated that he did not believe in evolution!
P228	P: Huge. Huge.	A most telling comment to support the other participant's comments.
P229	M: Huge resistance. The reason I am interested in that is um (...). In the government debates at that time. And that would have been Peterson's uh (…) time.	P is muddled here with dates. I have the dates for this discussion in *Hansard* and media articles. It was definitely the time of the Peterson Liberals. I did not want to debate the time frame as P was recalling from memory and I was more interested in her recollections of what transpired.
P230	P: Uh hum. No that was. (…) That was Tory.	
P231	M: Pre-Peterson?	
P232	P: Pre.	
P233	M: It was in the 80s. Uh. //	
P234	P: Yeah STAO was sued. (***) They wouldn't let the Creationists display something at a conference. (***)	This was new information! I had not realized the evolution debate had done to this level. I will check further data sources to see if this is mentioned.
P235	M: Because there were petitions that were (...). That uh (...) Members of Parliament brought forward (...) uh (...) in the legislature.	
P236	P: Uh hum.	
P237	M: From groups. Um. Requesting that (…) uh (…) creationism be taught.	
P238	P: Uh hum.	

P239	M: And in some cases the Member of Parliament (...) um //	I found it interesting that P finished my sentence and was not surprised that MPPs would sign their names to such as petition!
P240	P: Signed their name.	
P241	M: Yes. Signed their name to it.	
P242	P: Most people really don't understand the issue. So //	
P243	M: Yeah.	
P244	P: And so you. You know. (...) You could. (...) You could present it as (…). It would be very difficult. And now that I think about it probably the reason is isn't a big issue now is because creationism is Christian. Right? And we have a multi-faith.	P's comment is further support that the 'issues of the times' can impact on curriculum.
P245	M: Yeah. So that's why the comment that you (...). You had made was interesting because that seemed to coincide up at the time when there were petitions. I haven't seen similar petitions like that.	
P246	P: About curriculum? Well we get //	I think that we have been crossing so many time periods that P misunderstood my comment about evolution and creationism in that I was still thinking of it as a major issue today. I did not correct this perception but let P complete her thought. As a result the issue of dissection came up as being 'hot' today, something that may not have been raised otherwise.
P247	M: About evolution and specifically about creationism.	
P248	P: No. Not in Ontario.	
P249	M: Since that 80s time when //	
P250	P: No.	
P251	M: It was very common to (…). That they were brought forward.	
P252	P: There still are boards where there are Christian-right who are opposed to. We don't have that at all in (***).	
P253	M: Uh hum.	
P254	P: We have for example Muslim groups who are opposed to music or you know sex education or whatever but not (…) not teaching of evolution. That's not an issue.	
P255	M: So that really been a major change.	
P256	P: Yeah. The big issue in science right now is (...) is (…) uh. Is dissection. And (…) uh (…). Is a huge issue.	
P257	M: Yup. That's great. Um. Is there anything else that you can //	We were coming up to the time allotment for this interview and so I asked a general questions as to whether P had any further comments that she would like to say that she did not have the opportunity to say.
P258	P: I don't think so.	
P259	M: Think of? I mean this was very informative (***).	
P260	P: Well it's interesting to think back. I mean. I've kept some. I like. I'm very interested in policy so I've kept a lot of the old policies somewhere whenever I get around to cleaning out my files.	
P261	M: Uh hum.	
P262	P: But I would expect the government would have all that stuff in the archives.	Given the experiences that I was having in trying to access previous government documents, this is not necessarily the case. Archiving seems to be more at libraries (university/ research libraries).
P263	M: Well that's the interesting part. They don't from previous governments.	
P264	P: Well I know they shred everything.	That would certainly be one of the reasons why it is difficult to access prior government documents! I was under the assumption that government would be obligated to have some form of document management considering taxpayers money pays for government. It strikes me as odd that they can just wipe the records of a previous government.
P265	M: [laughs] Yeah.	
P266	P: But I. It was interesting because when I went back and went into the room where you do your (…) your copying. There was still the same stuff that was there when I was there. And there's no. So I actually went through a lot of stuff and we cleaned up and archived stuff. But that's not a high priority.	
P267	M: No. It's. There's really not.	
P268	P: People leave and history leaves.	This is not an insignificant comment. How do

P269	M: Yeah. There's not an institutional history //	government's learn from previous policies if there is no institutional history especially now in Ontario when many government education officers are seconded for specific projects and not career bureaucrats?
P270	P: No. No.	
P271	M: Um. For it. And (…) um (...) I was fortunate that um (…). Uh. One of the people who does work within the (***). Alerted me to the Library Congress in the US has a Webback Machine where if you type the URL address if it has been archived. You can get access to. So unfortunately it doesn't go as far as what I would like to. But at least I was able to access //	The Wayback Machine has been an excellent source to gather documents of the Harris government, a small bit from the NDP government, and earlier websites of the current McGuinty government.
P272	P: Is (***) still alive?	As the interview was coming to a close, P began to suggest names that I might consider interviewing. A couple that were mentioned, I already had interviewed or on my list to interview. I did not divulge this information nor that I had spoken to them. This is left for participants to divulge themselves.
P273	M: No he died a couple of years ago.	
P274	P: Oh.	
P275	M: Yeah, he would have been a.	
P276	P: And how about the other guy? The elementary. (***) somebody?	
P277	M: I don't know. I don't know how to track him down. So. I don't know if he's still in Ontario.	
P278	P: (***) the Director of Education when I came on. (***). I can't remember her name. I know she's still around. Any people back from former Directors. Um. You could probably can get some stories from them.	
P279	M: Yeah.	
P280	P: They don't very often they don't have. May not have an understanding of science. Because they were more uh //	
P281	M: Right.	
P282	P: Unless you come from a specific background you don't pay much attention to a specific subject.	P's comment here and in P280 reinforce for me the importance of looking at data not only specific to science curriculum but data that surrounds the development of the science documents, the origins of the documents – was it curriculum reform or specific to science, if curriculum reform then how did this look in science curriculum.
P283	M: Yeah. Yeah. And sometimes the processes are similar because it's a curriculum process.	
P284	P: Yeah.	
P285	M: Um. But then how did science differentiate //	
P286	P: Yeah.	
P287	M: From that is part of the role of what I'm doing.	
P288	P: Yeah.	
P289	M: But if you do come across any. Anything sometime when you're flipping through your (...) your material.	Since P had commented at the beginning of the interview that she had documents, I mentioned about my interest in looking at these. This prompted her to get up and check a filing cabinet for a document that she thought might be of interest. However as it turns out, when she found it, I already had a copy.
P290	P: Uh hum. Let me just check. I had something and I may have just thrown it out. [leaves room]	39:28 – 39:58 P in adjoining room looking in her filing cabinet.
P291	P: [inaudible]	Calls out title.
P292	M: Oh. I actually have a copy of that.	
P293	P: Oh. Okay.	
P294	M: Thank you very much. Um (…) It's some of the other documentation at that time. Um.	
P295	P: And I don't know what I saved from that time.	40:14 P can be still heard speaking from the other room.
P296	M: Yeah.	
P297	P: I don't have anything here.	
P298	M: (***) had been trying to dig stuff up for me as well. In '73 STAO curriculum study did a	(***) is not a participant in the study but was referred by a participant to see if he might be

	proposal for curriculum development and science education.	able to locate a 1973 document that was referred to in other documents from the 1980s.
P299	P: How about somebody like (***) or //	40:27 P coming back into room and sitting down.
P300	M: Yeah. There've been so many people that have been so supportive and have really helped with documentation.	
P301	P: (***)? (***)? I can't believe (***) didn't save everything.	P was still trying to think of people that I might want to interview (an example of snowball sampling.
P302	M: Yeah. Maybe he's left it at (…). But I need to go to OISE and maybe see //	
P303	P: Yeah. There might be a lot of reference. //	
P304	M: A lot of reference there that (…). Uh. (…) But I'll do that.	
P305	P: And (***) hadn't archived stuff. (***)	
P306	M: Oh, I don't know her, I know (***) but not //	
P307	P: (***). Talk to (***) about them. She used to (***).	
P308	P: Those are the only people I remember.	
P309	M: Right. That's great. Thank you so much (***) //	
P310	P: OK. You're very welcome.	
P311	M: Appreciated.	
P312	P: [inaudible]	*– was offering me to look at old science textbooks she had in the room*
P313	M: Yes.	

End of recorded interview [00:41:19]

Conducting the interview

When I initially requested an interview, P quickly agreed to participate. Finding a mutually agreeable time was a little more challenging as her schedule was quite busy. We met in a meeting room adjoining her office. The receptionist brought me to the room and offered a coffee while I waited as P was going to be a few minutes late. She also mentioned that P had another meeting scheduled immediately following mine and so I was aware that for this interview, it needed to be kept within one hour. I took the offer for coffee and while I waited I also noticed that in a corner of the room there was a little display of a variety of old school books, many of them about science. They were from an era long past and prior to the timeline of my study. While I waited I had a look through a couple of the science books. It was interesting to see what students were expected to learn in the early 1900's. One of them had an interesting statement about justifying why science, in this case it was called nature study, was on the school curriculum "providing its power to equip the pupil for the responsibilities of citizenship". It made me wonder about a historical analysis of the 'science-for-all' discourse since science became a school subject considering the dichotomy that exists re: science-for-specialists and science-for-all.

P came into the room from her office door and we began the interview after about 5 minutes of preliminary discussion. The recorder was placed between us on the table. Prior to turning it on, I asked for her permission and also asked her to sign the ethics consent form which had been sent to her via email prior to the interview. Prior to the start of the recording, I reminded her about the purpose of the study although this had already been communicated by sending her the research overview when I requested the interview. All prior communication was through email. With these preliminary discussions completed, the recorder was started.

We sat directly across from each other at a meeting table. P had requested a copy of the questions prior to the interview. She commented that there was a time constraint as she had another meeting after this one and she wanted to make sure the questions that I was asking were addressed. Her eyes scanned the page during the course of the interview. At one point P got up to close the door that led to the outside hall. The door to her office remained open. There was little extraneous noise and the recording can be heard quite clearly. This interview is similar in length to one I had with (***). Interestingly my relationship to both of these people was mostly by reputation and not much direct personal contact.

P was knowledgeable about curriculum development across different governments. I was unaware of the extent until the interview was conducted.

Appendix L Participant information form

Information Form

Name: ______________________________

Address (include street, city, postal code):

____

____

____

E-mail: ______________________________

Phone: ______________________________

(Best contact time): ______________________________

Preferred days of the week to meet and times:

____

Current Teaching Assignment

Elementary ☐ Primary ☐ Junior ☐ Intermediate ☐ Other (please specify ______

Secondary

☐ Grade 9 (specify which course) ______________________________
☐ Grade 10 (specify which course) ______________________________
☐ Grade 11 (specify which course) ______________________________
☐ Grade 12 (specify which course) ______________________________
☐ Other (please specify) ______________________________

Have you previously been involved in science curriculum development?

☐ At the school level?
☐ At the Board level?
☐ At the provincial level?

Briefly describe how

____

____

Years of teaching experience: ______________

Send the completed form directly to **Marietta (Mars) Bloch**:

e-mail mbloch@edu.yorku.ca
or fax 905-886-7980
or mail 79 Ramblewood Lane,
Thornhill, ON
L4J 6R9

Appendix N Focus group interview guide

Question	Prompts and probes	Relevance
Can you tell me which Ministry science curriculum documents you are familiar with or have used?	Introductory question • participants describe their experiences and familiarity with the Ministry science curriculum policy documents <u>Follow-up questions</u> • Can you describe how you have used the documents? • Do you have any further examples? • Can you describe how you are familiar with the documents that you have not used?	• Exploring participants experiences with the science curriculum documents
What were your impressions of the Ministry documents as you received them? ***RQ4***	<u>Follow-up questions</u>: • Did your perceptions change over time? • What do you attribute to this? • How did the climate of the times impacted on your impressions? • Can you say something more about that? • Do you have any further examples?	• Exploring perceptions of the users
Have you noticed any significant changes in the structure and content of the Ministry documents since you started teaching/developing resources? ***RQ3*** ***RQ4***	<u>Follow-up questions</u>: • Can you give a more detailed description? • What do you think influenced these changes?	• Exploring changes in science curriculum content • Exploring influences on science curriculum development
What are the main positive and negative impacts of the changes in the Ministry science curriculum documents that have occurred since you started teaching/developing resources? ***RQ2*** ***RQ3*** **RQ4**	<u>Follow-up questions</u>: • Can you say something more about that? • Do you have any examples? • How do you think these documents were developed?	• Exploring changes in science curriculum content • Exploring perceptions of curriculum development • Exploring perceptions of the users
Is there anything further you would like to say about the curriculum development processes for science?	Ending question	

Appendix O Screenshot examples of policy cycle data matrix for Accord government

Context of influence

Sub theme	Who said it	Supporting quote	Comments	Source
economic competitiveness	interview	I certainly think the government was really concerned about being competitive and saw science as one of the drivers of competition. There's no question about that. … They saw science as being a very important subject. And they were the ones that established those industry-education councils. I remember one of the potential election platforms that Dave Peterson was announcing was to give kids two credits for taking a science course in high school, to encourage kids to take science."	pre: OS:IS one credit; OS:IS two credits; TOC (Harris) 2 + 1 credit required science credits for high school graduation increased across government (no change with McGuinty)	L 178, 180, 188
economic competitiveness	government	We must provide excellence and relevance in education and training, particularly in shaping a generation capable of innovating and seizing opportunities.	rhetoric: excellence; relevance; innovating	Hansard L001 Apr 22/86 (throne speech)
economic competitiveness	Minister of Finance	The wide-ranging report I am tabling today analyses the roles of education, entrepreneurship, social policy and export initiatives in a strategy to maximize growth opportunities in an economy where knowledge-intensive services play such an important role.	linking economic need to school system	Hansard L064 Nov 17/86
economic competitiveness	opposition	A global economy now exists, and Ontario's industries are fighting a world-wide competitive battle, based on services, knowledge, information and new technology.	rhetoric: warlike…battle, fighting	Hansard L009 May 6/86
economic competitiveness	government	In an increasingly knowledge-intensive world economy, a relevant and purposeful education is critical to personal growth and economic development.	linking economic need to school system/ rhetoric: relevant, purposeful	Hansard L001 Apr 28/1987
government language	government	The importance my government attaches to the growth of entrepreneurship can be seen in the priority it has been given by the Premier's Council.	rhetoric: entrepreneurship… McGuinty it was innovation	Hansard L001 Apr 28/1987
economic competitiveness	media	Now more than ever, they say - as brainpower becomes the new economic fuel - we must get rid of the unimportant, streamline what is important, and create a curricular launching pad for the 21st century. Indeed, not only do we have to stop stacking new courses on top of old - we need to reassess the old. We must stop crowding the curriculum with an insistence on learning outdated facts.	linking economic need to school system	Toronto Star May 3/87
accountability	Premier Council as reported in media	This month's report of the Premier's Council has flunked Ontario's primary and secondary education system.	linking economic need to school system	Toronto Star Apr 18/88 (A14)
economic competitiveness	Premier Council as reported in media	"While education and training are often seen as social programs, they are really investments in our economic future," write the Ontario Premier's Council earlier this year.	linking economic need to school system	Globe and Mail, Dec. 16/88 (A7)

Economy | Accountability | Education | Corporate | Parents | Bureaucracy | Politicans

Context of policy text production

Sub theme	Who said it	Supporting quote	Comments	Source
values/ beliefs	senior educator (also seconded to MoE)	[When you talked about evolution and...um... that there was some resistance to that even at the government level.] Huge. Huge.	evolution	L 248, 249, 267
values/ beliefs	seconded bureaucrat	And we likely talked about the degree to which we should use the word 'play'. My recollection is that there's a little bit in there about the importance of play in the learning environment.	process vs content	Ha206
values/ beliefs	career bureaucrat	Course we were stuck for so many years with the old PSSE physics that came out in I guess the 60s. [It] Was really the basis for senior physics for so long until 87. So I think that was.was good in that it went back to more traditional kinds of topics uh for science. Atomic energy. Electricity and magnetism. And mechanics. They [US alphabet curricula] had particular philosophies they were promoting in terms of science and physics. In hindsight I think it was really too theoretical.	process vs content	C310, 312, 316
values/ beliefs	career bureaucrat	I think what we ended up doing with 87. We ended up going back to more traditional kinds of topics. But rather the approach was saying these are the things we believe are important to be taught. And this is how we believe it should be taught. These are the things we need to evaluate on this topic.	process vs content	C326
values/ beliefs	Dave Gregory (seconded educator to MoE) in media	"We don't want them just looking at the hard chemistry. We want them to talk about not just what occurs when an atom breaks down but how the nuclear age has affected people's lives. We are dealing with children and science has an obligation to say something."	STSE	Toronto Star, Jul 31/86 (A20). Trish Crawford. Teaching science: Back to the beaker [Headline]
value	Paul Barron (past president of STAO) in media	Barron [past president of STAO] says the subject matter will augment the basic scientific principles and disciplines of biology, chemistry and physics with a hands-on, rather than theoretical approach. "Science education must help kids prepare for the world of work, and with the days of our fishing, forestry and mining industries being numbered, they're in for some big changes when they get out there," says Barron. "We'll be expected to teach the applications of science to today's technology and bring in career awareness to the courses – looking at what exactly a chemical engineer, nuclear scientist or computer programmer does for a living. The other emphasis will be to put science education into a Canadian context – how many famous Canadian scientists could you name?"	STSE/ preparation for work	Ottawa Citizen, Sept 2/86 (D1)
beliefs	John Percy through media	Pressure from creationists will keep Ontario high school students from being taught the sun is billions of years old, says a University of Toronto astronomer working on a revision of the province's science curriculum. The same pressure has forced him to remove the word evolution from his description of the history of the universe and substitute development or change, John Percy said the Ministry of Education told him to revise a chapter on astronomy in the Grade 12 physics curriculum, deleting the word evolution. "The person involved said that if he used the word evolution he would get 600 letters from	evolution	The Windsor Star, Jul 25/87 (A4)

Origins Who **Content** Process Implementation

Context of practice

Sub theme	Who said it	Supporting quote	Comments	Source
values/ beliefs	educator (and seconded bureaucrat)	Science is Happening Here spent a lot more of the document talking philosophically about the teaching of science in primary-junior. And last time laying down the specifics.	process vs content	Ha208
beliefs	educator (also seconded bureaucrat)	I think by elementary school teachers. Pretty positive. By some of the science folks. It didn't go far into it. Well they wanted to see something more specific. They wanted to see something by the grade level. Basically their attitude was. If you want elementary school teachers to teach science you have to force them. And as I said if there's much more things to change than the document.	process vs content (elementary)	Hb123, 125, 127
values/ beliefs	teacher	Teachers really didn't pay any attention to general discussion at the front end. They pay specific attention to the specific expectations.	how to teach vs. what to teach	Wb218
values/ beliefs	career bureaucrat	I think that in many cases they [educators] weren't really sure how to deal with it. It was restrictive if you wish. These were the things or these were the objectives that you were to cover.	how to teach vs. what to teach	C150
values/ beliefs	career bureaucrat	And I remember attending a curriculum superintendent's meeting and [faculty] representatives on this. And this new curriculum had just come out. You know it was being promoted. And I remember him getting up in the meeting saying. At the university we do not believe the direction you're going in curriculum is appropriate. So therefore we're not gonna teach it to the students. I think if there hadn't been a table between him and the other superintendents. They'd have been right at 'em. And I mean an outrageous statement to make.		C566
relationship with government	teacher	The OS:IS stuff, the government was at least not fighting the teachers. You had them fighting a different battle in terms of credit systems.		A313
values/ beliefs	teacher	But to get you started it gave you the idea of what you should be doing. I found it very helpful. It wasn't a day-by-day teaching. But just, here's some stuff be aware of. Here's some things you can do to demonstrate. And here's some things that all kids should get their hands on to actually do. And so it really emphasized the hands-on piece as well	"hands-on"	AA158, 160, 168, 170, 172
values/ beliefs	media (DM Shapiro as quoted in the media)	The Ministry of Education's new science guidelines, introduced this year, provide some hope. They describe a scientifically literate student in today's society as one who can think on his or her own, while understanding the impact of technology and the ethical questions it raises....Bernard Shapiro, Ontario's deputy minister, caused a stir recently when he told a conference of science teachers that schools are producing "too many scientifically illiterate people." What students lack, Shapiro says, are the skills scientists use to make sense of the world: asking questions, making observations, conducting tests and drawing conclusions. They are skills essential to	Student quoted about teaching of facts and all you do is "we memorize them and as soon as yuou finish the test, you forget about it."	Toronto Star, Dec. 18/88 (B1) Sandro Contenta, Why our science students just don't measure up

Educators / Public / Media / Government

Appendix P Ten essential outcomes of *TCC Working Document* and *TCC Final Version*

TCC Working Document	***TCC Final Version***
Be able to use language to think, learn, and communicate effectively in a variety of contexts and curriculum areas	Communicate effectively
Be able to employ mathematical knowledge and skills to solve practical problems	Solve problems and make responsible decisions using critical and creative thinking
Be able to use scientific methods to solve problems, and apply scientific perspectives to better understand their world and make responsible decisions	Use the skills of learning to learn more effectively
Be able to evaluate and use a wide variety of technologies to improve their performance in school- and work-related areas and generally enhance the quality of life	Use technology effectively
Demonstrate an understanding of how history, geography, and cultural forces have shaped the past and the present, and be able to apply this understanding in planning for the future	Demonstrate an understanding of the world as a set of related systems
Demonstrate a commitment to peace, social justice, and the protection of the environment, and apply a global perspective in both their attitudes and behaviour	Participate as responsible citizens in the life of the local, national and global communities
Be able to interact and work effectively with other, demonstrate respect for human rights, and be motivated to fulfil the responsibilities of citizens in a democratic society	Apply the skills needed to work and get along with other people
Value work and learning of all types not only for their practical benefits but also for the sense of purpose and satisfaction that they can bring, and be able to develop relevant, well-prepared plans for entering the work force or continuing their education	Explore educational and career opportunities
Be able to exercise aesthetic judgement in relevant contexts and to apply aesthetic standards to many facets of life and work	Apply aesthetic judgement in everyday life
Be motivated to build healthy lifestyles and relationships	Make wise and safe choices for healthy living

References

Abraham, C. (1996) ‘Overhaul of curriculum to focus on jobs’, *Windsor Star* (FIN edn.), 20 September, p. A9.

Abraham, C. (1997) ‘Province to get tough on 3 Rs; Higher standards spelled out for elementary grades’, *Ottawa Citizen*, (FIN edn.), 13 June, p.A1.

Aikenhead, G. (1990) ‘Scientific/technological literacy, critical reasoning, and classroom practice’, in Norris, S.P. and Phillips, L.M. (eds.) *Foundations of literacy policy in Canada*. Calgary: Detselig Enterprises Ltd., pp.127-145.

Aikenhead, G. (2002) ‘Renegotiating the culture of school science: Scientific literacy for an informed public’ [Online]. Available at: http://www.usask.ca/education/people/aikenhead/portugal.htm (Accessed: 6 July 2008).

Aikenhead, G. (2006) *Science education for everyday life: Evidenced-based practice*. New York: Teachers College Press.

Ainsworth, L. (1989) ‘The debate goes on. Economics challenges philosophy. Should students be trained for jobs or should goal be individual growth, self-reliance?’, *Toronto Star* (FIN edn.), 5 September, p.G8.

Albota, N. (1999) ‘Tired of waiting’, *The Ottawa Citizen*, 7 May, p. F5.

Alexander, L. (1989) ‘Speech from the throne.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 2nd Sess. (April 25, 1989) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1989-04-25&Parl=34&Sess=2&locale=en (Accessed: 20 March 2008).

Alexander, L. (1990) ‘Speech from the throne.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (November 20, 1990) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1990-11-20&Parl=35&Sess=1&locale=en (Accessed: 31 July 2006).

Alphonso, C. (2004) ‘Grade expectations for new education initiative’, *The Globe and Mail*, 23 April, p.A6.

American Association for the Advancement of Science (AAAS) (1965) *Science – A process approach*. Washington, D.C.: Commission on Science Education.

American Association for the Advancement of Science (AAAS) (1990) *Science for all Americans*: *Project 2061*. New York: Oxford University Press.

American Association for the Advancement of Science (AAAS) (1993) *Benchmarks for scientific literacy*. New York: Oxford University Press.

Andrew, A. (1993) *The rise and fall of a middle power: Canadian diplomacy from King to Mulroney*. Toronto: James Lorimer & Company Ltd.

Arnott, T. (1992) 'Academic streaming.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (June 22, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-06-22&Parl=35&Sess=2&locale=en (Accessed: 3 August 2006).

Apple, M. (1993) 'The politics of official knowledge: Does a national curriculum make sense?', *Discourse: Studies in the Cultural Politics of Education*, 14 (1), pp. 1-16.

Apple, M. (1996) *Cultural politics and education*. New York: Teachers College Press.

Apple, M. (1999) 'Rhetorical reforms: Markets, standards and inequality', *Current Issues in Comparative Education*, 1 (2), pp. 6-18.

Apple, M. (2000) 'Between neoliberalism and neoconservatism: Education and conservatism in a global context', in Burbules, N. and Torres, C. (eds.) *Globalisation and education: Critical perspectives*. New York: Routledge, pp.57-78.

Apple, M. (2001) *Educating the 'right' way*. New York: RoutledgeFalmer.

Apple, M. (2004) 'Creating difference: Neo-liberalism, neo-conservatism and the politics of education reform', *Education Policy*, 18 (1), pp. 12-44.

Apple, M. (2005) 'Education, markets, and an audit culture', *Critical Quarterly*, 47 (1-2), pp. 11-29.

Apple, M., Kenway, J. and Singh, M. (2005) *Globalizing education: Policies, pedagogies and politics*. New York: Peter Lang.

Astiz, F., Wiseman, A. and Baker, D. (2002) 'Slouching toward decentralization: consequences of globalization for curricular control in national education systems', *Comparative Education Review*, 46 (1), pp. 66-88.

Atkins, J. M. and Black, P. (2003) *Inside science education reform: A history of curricular and policy change*. New York: Teachers College Press.

Baker, B. and Richards, C. (2004) *The ecology of educational systems: Data, models, and tools for improvisational leading and learning*. Upper Saddle River, NJ: Pearson Education.

Ball, S. (1990a) *Politics and policy-making in education: towards a policy sociology*. London: Routledge.

Ball, S. (1990b) ‘Self-doubt and soft data: social and technical trajectories in ethnographic fieldwork’, *International Journal of Qualitative Studies in Education,* 3 (2), pp. 157-171.

Ball, S. (1993) ‘What is policy? Texts, trajectories and toolboxes’, *Discourse*, 13 (2), pp. 10-17.

Ball, S. (1994) *Education reform: a critical and post-structural approach.* Buckingham: Open University Press.

Ball, S. (2003) ‘Power, conflict, micropolitics and all that!’ in Walford, G. (ed.) *Doing Educational Research. Ebrary Reader* [Online]. Available at: http://site.ebrary.com.ezproxy.library.yorku.ca/lib/oculyork/docDetail.action?docID=10060965 (Accessed: 9 August 2010) p.166-192.

Ball, S. (2008) *The education debate*. Bristol, UK: The Policy Press.

Ball, S. (2012) ‘Performativity, commodification and commitment: An I-spy guide to the neoliberal university’, *British Journal of Educational Studies*, 60 (1), pp. 17-28.

Ball, S. and Bowe, R. (1992) ‘Subject departments and the ‘implementation’ of National Curriculum policy: an overview of the issues’, *Journal of Curriculum Studies*, 24 (2), pp. 97-115.

Ball, S. and Shilling, C.(1994) ‘At the cross-roads: Education policy studies’, *British Journal of Educational Studies*, 42 (2), pp. 1-5.

Bann, S. (1981) ‘Towards a critical histography: Recent work in philosophy of history’, *Philosophy*, 56, pp. 365-385.

Barab, S. and Roth, W-M. (2006) ‘Curriculum-based ecosystems: Supporting knowing from an ecological perspective’, *Education Researcher*, 35 (5), pp. 3-13.

Bartleman, J. (2002) ‘Speech from the throne.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 37th Parl., 3rd Sess. (May 9, 2002) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2002-05-09&Parl=37&Sess=3&locale=en (Accessed: 1 August 2006).

Bates, R. (2005) ‘Can We Live Together?: Towards a global curriculum’, *Arts and Humanities in Higher Education*, 4 (1), pp. 95-109.

Battagello, D. (2000) ‘Put to the test; Boards work to improve scores in province-wide assessment’, *Windsor Star* (FIN edn.), 6 May, p. A1.

Bedard, G. and Lawton, S. (1998) ‘The battle over Ontario’s Bill 160 and the shape of teacher collective bargaining’, *Policy Options*, July-August, pp.49-54.

Beer, C. (1991) 'Education program evaluation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (May 6, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-05-06&Parl=35&Sess=1&locale=en (Accessed: 31 July 2006).

Beer, C. (1992a) 'Academic streaming.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (November 24, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-11-24&Parl=35&Sess=2&locale=en (Accessed: 25 March 2006).

Beer, C. (1992b) 'Academic streaming.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (October 20, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-10-20&Parl=35&Sess=2&locale=en (Accessed: 25 March 2006).

Bellack, A. (1969) 'History of curriculum thought and practice', *Review of Educational Research*, 39 (3), pp. 283-292.

Ben-Peretz, M. (2009) *Policy-making in education: A holistic approach in response to global changes*. Lanham, Maryland: Rowman & Littlefield Education.

Berg, D. and MacKeracher, D. (1985) 'Science education past contexts', in Connelly, F. M., Crocker, R. and Kass, H. (eds.) *Science education in Canada, Volume 1: Policies, practices & perceptions*. Toronto: OISE, pp.32-48.

Bernstein, B. (1975) *Class codes and control, vol 3: Towards a theory of educational transmissions*. London: Routledge and Keegan Paul.

Blackmore, J. (1995) 'Review essay: Changing educational policies', *Discourse*, 19 (2), pp. 249-253.

Bloch, M. (2010) *Building Blocks for Education conference*, personal reflexive notes.

Bloch, M. and Laurie, R. (2009) 'Assessing PISA 2006 scientific competencies', in Bybee, R.W. and McCrae, B.J. (eds.) *PISA science 2006: Implications for science teachers and teaching*. Arlington: NSTA Press, pp.215-224.

Bloch, M. and Orpwood, G. (1996) *Science and technology, grades 1-9: A consultative draft*. Assessment of Science and Technology Achievement Project Working Paper #4. Toronto: York University.

Bloch, M. And Orpwood, G. (1997) *Ontario curriculum framework, science and technology, grades 1-9: A consultative draft. Revised*. Toronto: York University.

Bolton, G. (2010) *Reflective practice: Writing & professional development*. 3rd edn. London: Sage.

Bowan, G. (2009) ‘Document analysis as a qualitative research method’, *Qualitative Research Journal*, 9 (2), pp. 27-40.

Bowe, R., Ball, S. and Gold, A. (1992) *Reforming education and changing schools*. London: Routledge.

Boyd, M. (1991a) ‘Education program evaluation.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (May 7, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-05-07&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Boyd, M. (1991b) ‘Education policy.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (April 22, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-04-22&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Boyd, M. (1991c) ‘Education policy.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (May 2, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-05-02&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Boyd, M. (1991d) ‘Education program evaluation.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (October 2, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-10-02&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Boyd, M. (1991e) ‘National testing ignores factors that shape education in each province’, *The Globe and Mail*, 6 August, p.A10.

Boyd, M. (1991f) ‘School curriculum.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (May 9, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-05-09&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Boyle, T. (2004) ‘Making a difference in students’ lives; Premier has new education adviser, push is on to improve student marks’, *Toronto Star*, (ONT edn.), 31 July, p.H04.

Brennan, R. (1995) ‘Minister plotted to‘to invent a crisis’ Snobelen video spurs angry calls for him to resign’, *Toronto Star*, (MET edn.), 13 September, p.A3.

Brennan, R. (1997) ‘Education: Time to go beyond blame’, *Windsor Star* (FIN edn.), 8 February, p.A6.

Breuer, F., Mruck, K. and Roth, W-M. (2002) ‘Subjectivity and reflexivity: An introduction’, *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*. 3 (3), 10 paragraphs [Online]. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/822 (Accessed: 2 February 2007).

Bridges, D. (2001) ‘The ethics of outsider research’, *Journal of Philosophy of Education*, 35 (3), pp. 371-386.

British Educational Research Association (BERA) (2004) *Revised ethical guidelines for educational research* [Online]. Available at www.bera.ac.uk/files/guidelines/ethica1.pdf (Accessed: 10 May 2005).

Brown, L. (1987) ‘Critics say many courses a waste of time’, *Toronto Star* (SU2 edn.), 3 May, p.A1.

Brown, L. (2012) ‘High school teachers leave contract talks’, *Toronto Star* (ONT edn.), 24 April, p.A8.

Bybee, R. (1991) ‘Science-Technology-Society in science curriculum: The policy-practice gap’, *Theory into Practice*, 30 (4), pp. 294-302.

Bybee, R. and Mau, T. (1986) ‘Science and technology related global problems: An international survey of science educator’, *Journal of Research in Science Teaching*, 23 (7), pp. 599-618.

Bybee, R., McCrae, B. and Laurie, R. (2009) ‘PISA 2006: An assessment of scientific literacy’, *Journal of Research in Science Teaching*, 43 (4), pp. 349-352.

Caldwell, S. and Mays, N. (2012) ‘Studying policy implementation using a macro, meso and micro frame analysis: the case of the Collaboration for Leadership in Applied Health Research & Care (CLAHRC) programme nationally and in North West London’, Health Research Policy and Systems, 10 (32) [Online]. Available at http://www.health-policy-systems.com/content/10/1/32 (Accessed: 10 October 2012)

Cameron, D. and Stein, J. (2000) ‘Globalization, culture and society: The state as place amidst shifting spaces’, *Canadian Public Policy*, 26 Supplement, pp. S15-S34.

Cameron, D. and White, G. (2000) *Cycling into Saigon: The Conservative transition in Ontario.* Vancouver: UBC Press.

Cameron, D., Mulhern, C. and White, G. (2003) ‘Democracy in Ontario: A paper prepared for the panel on the role of government’ [Online]. Available at: http://www.law-lib.utoronto.ca/investing/reports/rp35.pdf (Accessed: 2 June 2008).

Campion-Smith, B. (1993) ‘School destreaming essential, Cooke says’, *Toronto Star* (FIN edn.), 22 February, p.A9.

Canada. Science Council of Canada (1984) *Science for Every Student: Educating Canadians for Tomorrow’s World, Report No, 36*, Ottawa: Minister of Supply and Services.

Canadian Education Statistics Council (2007) *Education indicators in Canada: report of the Pan-Canadian Education Indicators Program*. Ottawa: Library and Archives Canada.

Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada (2003) *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*. [Online]. Available at http://reportal.jointcentreforbioethics.ca/document/view/id/17 (Accessed: 23 May 2005).

Capper, C. and Jamison, M. (1993) 'Outcomes-based education re-examined: From structural functionalism to poststructuralism', *Educational Policy*, 7 (4), pp. 427-446.

Carrol, J. (1996) 'School curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (November 4, 1996) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1986-05-08&Parl=33&Sess=2&locale=en#P354_110305 (Accessed: 22 March 2008).

Carter, C. (1991) 'Science-Technology-Society and access to scientific knowledge', *Theory into Practice*, 30 (4), pp.273-279.

Carter, L. (2005a) 'Globalisation and policy reforms: science education research', in Zajda, J. (ed.) *International handbook on globalisation, education and policy research*. Dordrecht: Springer, pp. 733-744.

Carter, L. (2005b) 'Globalisation and science education: Rethinking science education reforms', *Journal of Research in Science Teaching*, 42 (5), pp. 561-580.

Carter, L. (2007) 'Science education and contemporary times: Finding our way through the challenges', in Atweh, B., Barton, A., Borba, M. And Gough, N. (eds.) *Internationalisation and globalisation in mathematics and science education*. Dortrecht: Springer, pp.79-94.

Carter, L. and Dediwalage, R. (2010) 'Globalisation and science education: the case of Sustainability by the Bay', *Cultural Studies of Science Education*, 5 (2), pp. 275-291.

Caulley, D. (1983) 'Document analysis in program evaluation', *Evaluation and Program Planning*, 6, pp. 19-29.

Chin, P., Munby, H. and Krugly-Smolska, E. (1997) *Science, Secondary School Curriculum: Background research*. Ontario Ministry of Education and Training available online at https://stao.ca/resources/archived-materials/science-background-pape/science-background-paper.htm (Accessed: 1 August 2008).

Chodzinski, P. (2008) *Rainbow folders v.2.05* [Online] Available at: http://www.english.aionel.net/ (Accessed: 23 July 2011).

Christians, C. (2003) ‘Ethics and politics in qualitative research’, in Denzin, N. And Lincoln, Y. (eds.) *The landscape of qualitative research: Theories and issues*. Vol. 2. Thousand Oaks: Sage Publications, pp.208-252.

Christodoulou, N. (2010) ‘Deliberative curriculum’, in Kridel, C. (ed.) *Encyclopedia of curriculum studies*. Vol.2. Thousand Oaks: Sage Publications, pp.277-278.

Clark, B. (2000) ‘Education labour dispute.’ ’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (November 15, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-11-15&Parl=37&Sess=1&locale=en#P185_46469 (Accessed: 14 August 2006).

Cleary, J. (1991) ‘Religious education.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (October 29, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-10-29&Parl=35&Sess=1&locale=en (Accessed: 2 August 2006).

Codd, J. (1988) ‘The construction and deconstruction of educational policy documents’, *Journal of Education Policy*, 3 (3), pp. 235-247.

Cohen, R. and Greaves, B. (2001) ‘Of Caterpillars and butterflies: Reading John Snobelen’s infamous “Caterpillar” speech’, in Cohen, R. (ed.) *Alien invasion: How the Harris Tories mismanaged Ontario*. Toronto: Insomniac Press, pp.130-133.

Cohen, L., Manion, L. and Morrison, K. (2000) *Research methods in education.* 5th edn. London: Routledge Falmer.

Cohn, M. (2012) ‘McGuinty’s tough teacher talk’, *Toronto Star*, (ONT Edn.), 11 March, p.A5.

Colombo, M. (2003) ‘Reflexivity and narratives in action research: A discursive approach’, *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*. 4 (2) [Online]. Available at: http://www.qualitative-research.net/index.php/fqs/rt/printerFriendly/718/1554 (Accessed: 2 February 2007).

Conference Board of Canada (1992) *Employability skills profile: What are employers looking for?* [Brochure from personal files].

Connelly, M. (1987) ‘Science study covers 25 countries’, *Toronto Star* (FIN edn.), 15 April, p.A26.

Connelly, M., Crocker, R. and Kass, H. (Eds.) (1985) *Science Education in Canada: Policies, practices, and perceptions, Vol. 1*. Toronto: OISE Press.

Contenta, S. (1987) ‘Western students beat Ontario’s at science’, *Toronto Star* (FIN edn.), 4 April, p.A1.

Contenta, S. (1988a) 'High schools fail to educate half of students Ontario is told', *Toronto Star* (FIN edn.), 15 February, p.A1.

Contenta, S. (1988b) 'High schools need complete overhaul Ontario study says, Working class kids ;shortchanged'', *Toronto Star* (FIN edn.), 16 February, p.A1.

Contenta, S. (1988c) 'Jobs, not individual growth said aim of school reforms', *Toronto Star* (FIN edn.), 18 July, p.A5.

Contenta, S. (1988d) 'Schools are wasting potential, critics say', *Toronto Star* (FIN edn.), 22 July, p.H7.

Contenta, S. (1988e) 'Schools failing to teach basics Minister warns', *Toronto Star* (FIN edn.), 18 January, p.A1.

Contenta, S. (1988f) 'The urge to reform our schools : Will latest review of Ontario education system kill it—or cure its ills?', Toronto Star (FIN edn.), 14 October, p.A24.

Contenta, S. (1988g) 'What path should schools take? The old debate whether teachers should stress the basics or the growth of students as individuals is raging again as Ontario looks to future', *Toronto Star* (SA2 edn.), 30 July, p.D1.

Conway, S. (1986) 'Science education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 33rd Parl., 2nd Sess. (May 8, 1986) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1986-05-08&Parl=33&Sess=2&locale=en#P354_110305 (Accessed: 17 August 2009).

Conway, S. (1987) 'Education reviews.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 33rd Parl., 3rd Sess. (April 30, 1987) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1987-04-30&Parl=33&Sess=3&locale=en#P168_60373 (Accessed: 19 August 2009).

Cooke, D. (1993a) 'Education program evaluation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 35th Parl., 3rd Sess. (April 29, 1993) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1993-04-29&Parl=35&Sess=3&locale=en (Accessed: 25 March 2006).

Cooke, D. (1993b) 'Ontario Parent Council.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 35th Parl., 3rd Sess. (November 29, 1993) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1993-11-29&Parl=35&Sess=3&locale=en (Accessed: 25 March 2006).

Cooke, D. (1993c) 'Royal Commission on Learning.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 35th Parl., 3rd Sess. (May 4, 1993) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1993-05-04&Parl=35&Sess=3&locale=en (Accessed: 25 March 2006).

Costante, K. (2010) 'Committee Transcript: Standing Committee on Public Accountability – May 19 2010 – 2009 Annual Report, Auditor General: Ministry of Education' [Online]. Available at: http://www.ontla.on.ca/web/committee-proceedings/committee_transcripts_details.do?locale=en&Date=2010-05-19&ParlCommID=8861&BillID=&Business=2009+Annual+Report%2C+Auditor+General%3A+Ministry+of+Education&DocumentID=24965 (Accessed: 05 January 2011).

Coulter, K. (2009) 'Deep neoliberal integration: The production of third way politics in Ontario', *Studies in Political Economy* [Online]. Available at: http://spe.library.utoronto.ca/index.php/spe/article/view/6084 (Accessed: 6 July 2010).

Council of Ministers of Education, Canada (CMEC) (1996) *SAIP Science Assessment 1996: The Public Report* [Online]. Available at: http://204.225.6.243/saip/scie96en.htm (Accessed: 2 February 2006).

Council of Ministers of Education, Canada (CMEC) (1997) *Common framework of science learning outcomes K to 12*. Toronto: author.

Council of Ministers of Education, Canada (CMEC) (2005) *The Pan-Canadian assessment program: Literature review of science assessment and test design*. Unpublished report. Toronto: CMEC.

Council of Ministers of Education, Canada (CMEC) (2007) *PCAP-13 science assessment framework.* Unpublished report. Toronto: author.

Crawford, T. (1993) 'What happens when you get out of streaming strait-jacket', *Toronto Star* (AM edn.), 12 February, p.A27.

Creswell, J. (2003) *Research design: qualitative, quantitative, and mixed method approaches*. Thousand Oaks: Sage Publications.

Cresswell, J. and Miller, D. (2000) 'Determining validity in qualitative inquiry', *Theory into Practice*, 39 (3), pp. 124-130.

Crone, G. (1996) 'Teachers accuse Snobelen of creating 'crisis, part 2''. *Windsor Star* (FIN edn.) 27 August. p.A2.

Cuban, L. (1992) 'Curriculum stability and change', in Jackson, P. (ed.) *Handbook of Research on Curriculum*. New York: Macmillan, pp.216-247.

Cuban, L. (2008) *Frogs into princes: Writings on school reform*. New York: Teachers College Press.

Cunningham, D. (1991a) 'Education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard).* 35th Parl., 1st Sess. (April 4, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-04-04&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Cunningham, D. (1991b) 'Education policy.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (September 26, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-09-26&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Cunningham, D. (1991c) 'Education program evaluation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (December 9, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-12-09&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Cunningham, D. (1991d) 'Education program evaluation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (May 7, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-05-07&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Cunningham, D. (1991e) 'Religious education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (March 21, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-03-21&Parl=35&Sess=1&locale=en (Accessed: 31 July 2006).

Cunningham, D. (1992) 'School curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (November 16, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-11-16&Parl=35&Sess=2&locale=en (Accessed: 28 March 2006).

Cunningham, D. (1994) 'School curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 3rd Sess. (November 2, 1994) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1994-11-02&Parl=35&Sess=3&locale=en#P371_99071 (Accessed: 25 March 2006).

Dale, R. (1983) 'The Political Sociology of Education', *British Journal of Sociology of Education*, 4 (2), pp. 185-202.

Dale, R. (1992) 'Whither the state and education policy? Recent work in Australia and New Zealand', *British Journal of Sociology of Education*, 13 (3), pp. 387-395.

Daly, R. (1993a) '4 boards given exemption to destream', *Toronto Star* (SA2 edn.), 4 September, p.A10.

Daly, R. (1993b) 'Teachers seek results of destreaming projects', *Toronto Star* (AM edn.), 24 February, p.A10.

Daly, R. (1993c) 'Today's lesson: C-u-r-r-i-c-l-u-m', *Toronto Star* (AM edn.), 2 June, p.A8.

Dare, P. (1996) ‘Education: Back to basics, Snobelen says’. *Windsor Star* (FIN edn.). 23 November. p.A.

Daws, L. (1995) 'From Chalky Towers to Class 10B Plain Street: Policy construction on different sites', in Limerick, B. and Nielsen, H. (eds.) *School and community relations: Participation, policy and practice*. Sydney: Harcourt Brace, pp.119-131.

DeBoer, G. (2000) ‘Scientific literacy: Another look at historical and contemporary meanings and its relationship to science education reform’, *Journal of Research in Science Teaching*, 37 (6), pp. 582-601.

DeBoer, G. (2011a) ‘The globalization of science education’, *Journal of Research in Science Teaching*, 48 (6), pp. 567-591.

DeBoer, G. (ed.) (2011b) *The role of public policy in K-12 science education*. North Carolina: Information Age Publishing Inc.

Dei, G. and Karumanchery, L. (1999). ‘School reforms in Ontario: The ‘marketization of education’ and the resulting silence on equity’, *Alberta Journal of Educational Research*, 45 (2), pp.111-131.

Deng, Z. (2007) ‘Scientific literacy as an issue of curriculum inquiry’, in Linder, C., Őstman, L. and Wickman, P-O. (eds.) *Promoting scientific literacy: science education research in transaction*. Proceedings of the Linnaeus tercentenary symposium. Uppsala University, Uppsala 28-29 May, pp.134-139 [Online]. Available at: www.fysik.uu.se/didaktik/lsl/Web%20Proceedings.pdf (Accessed: 12 June 2008).

Denzin, N. and Lincoln, Y. (2000) ‘Introduction: The discipline and practice of qualitative research’, in Denzin, N. and Lincoln, Y. (eds.) *Handbook of qualitative research.* 2nd edn. Thousand Oaks: Sage Publications, pp.1-28.

Doll, W. (2002) ‘Ghosts and the curriculum’, in Doll, W. and Gough, N. (eds.) *Curriculum visions*. New York: Peter Lang, pp.23-73.

Doll, W. (2008) ‘Complexity and the culture of curriculum’, *Educational Philosophy and Theory*, 40 (1), pp. 190-212.

Dombrowsky, L. (2010) ‘An interview with Ontario’s Minister of Education’. Available at: http://tvoparents.tvo.org/video/162375/interview-ontarios-minister-education (Accessed: 28 September 2010).

Donnelly, J. (2005) ‘Reforming science in the school curriculum: a critical analysis’, *Oxford Review of Education*, 31 (2), pp. 93-309.

Dow, P. (1999) *School house politics: Lessons from the Sputnik era*. Lincoln NE: iUniverse.com Inc.

Driver, R. (1983) *The pupil as scientist?* Buckingham: Open University Press.

Duffy, A. (1995a) ‘‘Drop out’ who runs our schools gets down to business’. *Toronto Star* (FIN edn.), 10 September, p.A1.

Duffy, A. (1995b) ‘Schools ‘broken,’ says new minister. Big changes on the books for Ontario’s classrooms’, *Toronto Star* (FIN edn.), 19 August, p.A1.

Dye, T. (1992) *Understanding public policy*. 7th edn. New Jersey: Prentice Hall.

Earl, L. (1995) ‘Accountability and assessment: Ensuring quality in Ontario schools (Draft)’ in RCoL *For the love of learning: Background papers*, Vol. II. Toronto: Publications Ontario, pp.399-429.

Earl, J., Martin, A. McCarthy, J. and Soule, S. (2004) ‘The use of newspaper data in the study of collective action’, *Annual Review of Sociology*, 30 (2004), pp. 65-80.

Earl, L., Freeman, S., Lasky, S., Sutherland, S. and Torrance, N. (2002) *Policy, politics, pedagogy and people: Early perceptions and challenges of large-scale reform in Ontario secondary schools*. Toronto: Ontario Secondary School Teachers’ Federation.

Earl, L., Watson, N. And Katz, S. (2003) *Large-scale education reform: Life cycles and implications for sustainability*, Centre for British Teachers: Research and Development [Online]. Available at: http://www.cfbt.com/pdf/lifecycles.pdf (Accessed: 14 July 2010).

Easton, D. (1965) *A framework for political analysis*. Englewood Cliffs, NJ: Prentice-Hall.

Ecker, J. (2000a) ‘Education legislation.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (May 8, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-05-08&Parl=37&Sess=1&locale=en#P73_17945 (Accessed: 14 August 2006).

Ecker, J. (2000b) ‘Education legislation.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (May 10, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-05-10&Parl=37&Sess=1&locale=en#P181_22350 (Accessed: 14 August 2006).

Ecker, J. (2000c) ‘Education reform.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (May 11, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-05-11&Parl=37&Sess=1&locale=en#P296_113061 (Accessed: 14 August 2006).

Ecker, J. (2001a) ‘Education reform.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl., 2nd Sess. (April 26, 2001) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2001-04-26&Parl=37&Sess=2&locale=en#P728_159493 (Accessed: 14 August 2006).

Ecker, J. (2001b) 'Education legislation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl., 2nd Sess. (June 12, 2001) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2001-06-12&Parl=37&Sess=2&locale=en#P258_25838 (Accessed: 8 August 2008)

.

Ecker, J. (2001c) 'Education reform' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl., 2nd Sess. (May 16, 2001) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2001-05-16&Parl=37&Sess=2&locale=en#P293_35799 (Accessed: 14 August 2006).

Edighoffer, Hugh. (1988) 'Select Committee on education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 1st Sess. (February 11, 1988) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1988-02-11&Parl=34&Sess=1&locale=en#P978_305848 (Accessed: 12 March 2008).

Editorial (1986) 'Throne speech the right stuff', *Toronto Star* (FIN edn.), 23 April, p.A20.

Editorial (1987) 'Second-rate learning', *Toronto Star* (FIN edn.), 7 April, p.A18.

Editorial (1996) 'Manufactured crisis plagues our schools', *Toronto Star* (HO2 edn.), 26 December, p.A46.

Editorial (1997) 'Harris 'gofers'', *Toronto Star* (TOR edn.), 24 October, p.1.

Editorial (2004) 'Politics and class size', *The Globe and Mail*, 29 April, p. A22.

Education Improvement Commission (EIC) (1997a) *The Road Ahead: A report on learning time, class size and staffing* (August, 1997) [Online]. Available at: http://web.archive.org/web/20010714024507/http://eic.edu.gov.on.ca/eicroot/english/public/road1/ahead1.asp (Accessed: 4 January 2007).

Education Improvement Commission (EIC) (1997b) *The Road Ahead-II: A report on the role of school boards and trustees* (December, 1997) [Online]. Available at: http://web.archive.org/web/20010910085247/http://eic.edu.gov.on.ca/eicroot/english/public/road2/default.asp (Accessed: 4 January 2007).

Education Improvement Commission (EIC) (2000a) *School improvement planning: A handbook for principals, teachers, and school councils* (November, 2000) [Online]. Available at: http://web.archive.org/web/20010820053508/http://eic.edu.gov.on.ca/eicroot/english/public/road4/default.asp (Accessed: 4 January 2007).

Education Improvement Commission (EIC) (2000b) *The Road Ahead-V: A report on improving student achievement* (December, 2000) [Online]. Available at: http://web.archive.org/web/20010627104631/http://eic.edu.gov.on.ca/eicroot/english/public/road5/default.asp (Accessed: 4 January 2007).

Education Quality and Accountability Office (2005a) *The EQAO guide to school and board improvement planning* (March, 2005) [Online]. Available at: http://www.eqao.com/pdf_e/05/05P011e.pdf (Accessed: 5 September 2013).

Education Quality and Accountability Office (2005b) *Working together for student success: A school improvement planning guide* (March, 2005) [Online]. Available at: http://www.eqao.com/pdf_e/05/05p043e.pdf (Accessed: 5 September 2013).

Ehring, G. and Roberts, W. (1993) *Giving away a miracle: Lost dreams, broken promises and the Ontario NDP*. Oakville, ON: Mosaic Press.

Egan, K. (1988) 'School daze: A report damns Ontario system', *The Ottawa Citizen* (FIN edn.), 20 February, p.B1.

Egan, K. (2003) 'What is curriculum?', *Journal of the Canadian Association for Curriculum Studies*, 1 (1), pp. 9-16.

Eisner, E. (2002) *The educational imagination: On the design and evaluation of school programs*. 4th edn. Upper Saddle River, NJ: Merrill Prentice-Hall.

Elmore, R. and Sykes, G. (1992) 'Curriculum policy', in Jackson, P. (ed.) *Handbook of research on curriculum*. New York: Maxwell Macmillan, pp. 185-215.

Fanelli, C. and Thomas, M. (2011) 'Austerity, competitiveness and neoliberalism redux: Ontario responds to the great recession' *Socialist Studies/ Études socialistes* [Online]. Available at: http://socialiststudies.com/index.php/sss/article/view/180 (Accessed: 15 November 2011).

Fang, Z. (2004) 'Scientific literacy: a systemic functional linguistics perspective', *Science Education*, 89 (2), pp. 335-347.

Farnan, M. (1990) 'Teachers.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 1st Sess. (May 15, 1990) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1990-05-15&Parl=35&Sess=1&locale=en#P20_5151 (Accessed: 4 September 2009).

Fensham, P. (1985) 'Science for all: A reflective essay', *Journal of Curriculum Studies*, 17 (4), pp. 415-435.

Fensham, P. (1988) *Development and dilemmas in science education*. London: Routledge-Falmer.

Fensham, P. (1993) 'Academic influence on school science curricula', *Journal of Curriculum Studies*, 25 (1), pp. 53-64.

Fensham, P. (2002) 'Time to change drivers for scientific literacy', *Canadian Journal of Science, Mathematics and Technology Education*, 2 (1), pp. 9-24.

Fensham, P. (2007) 'Competencies, from within and without: new challenges and possibilities for scientific literacy', in Linder, C., Őstman, L. and Wickman, P-O. (eds.) *Promoting scientific literacy: science education research in transaction*. Proceedings of the Linnaeus tercentenary symposium. Uppsala University, Uppsala 28-29 May, pp.113-119 [Online]. Available at: www.fysik.uu.se/didaktik/lsl/Web%20Proceedings.pdf (Accessed: 12 June 2008).

Fensham, P. (2008a) 'Context or culture: Can TIMSS and PISA teach us about what determined educational achievement in science?', in Atweh, B., Borba, M., Calebrese Barton, A., Gough, N., and Keitel, C. (eds.) *Internationalisation and Globalisation in Mathematics and Science Education*. Dordrecht: Springer, pp.151-172.

Fensham, P. (2008b) 'The link between policy and practice in science education: Where does research fit in?', Keynote address, Baltimore 1st April. NARST. Available at: http://www.narst.org/news/index.cfm (Accessed: 15 August 2008).

Fensham, P. (2009) 'The link between policy and practice in science education: The role of research', *Science Education,* 93 (6), pp. 1076-1095.

Fensham, P. (2012) 'The science curriculum; the decline of expertise and the rise of bureaucratise', Journal of Curriculum Studies, pp.1-17. [Online]. Available at : http://www.tandfonline.com.ezproxy.library.yorku.ca/doi/pdf/10.1080/00220272.2012.737862. (Accessed: 18 February 2013).

Ferguson, W. (1992) 'Academic streaming.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (July 6, 1992). Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-07-06&Parl=35&Sess=2&locale=en (Accessed: 25 March 2006).

Firestone, W. (1989) 'Educational policy as an ecology of games', *Educational Researcher,* 18 (7), pp. 18-24.

Fischer, F. (2007) 'Deliberative policy analysis as practical reason: Integrating empirical and normative arguments', in Miller, G. and Sidney, M. (eds.) *Handbook of public policy analysis*. Boca Raton: CRC Press. pp.223-236.

Fitz, J. (1994) 'Implementation research and education policy: Practice and prospects', *British Journal of Educational Studies,* 42 (1), pp. 53-69.

Flavelle, D. (1988) 'More drop-outs seen if schools return to '50s, trustees say', *Toronto Star* (FIN edn.), 17 February, p.A4.

Flick, U. (1998) *An introduction to qualitative research.* London: Sage Publications.

Fontana, A. and Frey, J. (2000) 'The interview: From structured questions to negotiated text', in Denzin, N. and Lincoln, Y. (eds.) *Handbook of qualitative research*. 2nd edn. Thousand Oaks: Sage Publications, pp.645-672.

Fox, B. (1988a) 'Peterson promises action on education', *The Windsor Star* (FIN edn.), 17 February, p.A1.

Fox, B. (1988b) 'Report aims at stemming dropout rate', *The Windsor Star* (FIN edn.), 16 February, p.A1.

Fox, B. (1988c) 'Time for some straight talking', *The Windsor Star* (FIN edn.), 19 February, p.A6.

Fox, B. (1988d) 'Ward gives failing grade to education', *The Windsor Star* (FIN edn.), 19 January, p.A1.

Fullan, M. (2007) 'Achieving large-scale reform', in Maclean, R. (ed.) *Learning and Teaching for the twenty-First Century*. Bonn: Springer, pp. 137-144.

Fullan, M. (2010a) *All systems go: The change imperative for whole system reform*. Thousand Oaks: Corwin.

Fullan, M. (2010b) *Michael Fullan on what school reform is.* Available at: http://tvoparents.tvo.org/video/162356/michael-fullan-what-school-reform (Accessed: 28 September 2011).

Fullan, M. (2010c) 'The big ideas behind whole system reform', *Education Canada*, 50 (3), pp. 24-27.

Gagnon, G. and Rath, D. (1991) *Not without cause: A cautionary tale for voters and politicians everywhere*. Toronto: HarperCollins Publishers, Ltd.

Gale, T. (1999) 'Policy trajectories: treading the discursive path of policy analysis', *Discourse: Studies in the Cultural Politics of Education*, 20 (3), pp. 393-407.

Galt, V. (1997a) 'Alberta ranks high in science, math; Results good news for Canadian children overall, but represent 'crunch time' for Ontario education', *The Globe and Mail*, 12 June, p.A10.

Galt, V. (1997b) 'Snobelen spells it out for students; Shape up or fail, Education Minister says in presenting tough new standards', *The Globe and Mail*, 14 June, p. A1.

Gerard, W. (1997a) 'Blinded by science? Ontario students among Canada's worst in test', *Toronto Star* (FIN edn.), 30 January, p.A1.

Gerard, W. (1997b) 'Ontario report cards coming; Parents to get Grade 3 test results in June', *Toronto Star* (FIN edn.), 28 May, p.A3.

Gerard, W. (1997c) 'Ontario science education goes under microscope: Curriculum, teachers blamed for poor grades', *The Ottawa Citizen* (FIN edn.), 24 February, p.A4.

Gerard, W. (1997d) 'Why our kids are at the bottom of the class in science, probe urged into 'what's going on in the classroom'', *Toronto Star* (FIN edn.), 23 February, p.A1.

Gerretsen, J. (2000) 'Education labour disputes.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (November 2, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-11-02&Parl=37&Sess=1&locale=en#P362_112220 (Accessed: 14 August 2006).

Gewirtz, S., Dickson, M. and Power, S. (2004) 'Unravelling a 'spun' policy: A case study of the constitutive role of 'spin' in the education policy process', *Journal of Education Policy*, 19 (3), pp. 321-342.

Gidney, R. (2002) *From Hope to Harris: The Reshaping of Ontario's Schools*. Toronto: University of Toronto Press.

Gilbert, J. (2004) 'Science Education: Global or national?', in Gilbert, J. (ed.) *The RoutledgeFalmer Reader in science education*. London: RoutledgeFalmer, pp.1-12.

Gillis, W. (2012) 'Collective bargaining rights are under attack, union president says', *Toronto Star* (ONT edn.), 11 March, p.A5.

Girard, D. (1998a) 'Teachers' talk again turns to picket lines', *Toronto Star* (1st edn.), 27 June, p.1.

Girard, D. (1998b) 'Tories in no rush to force teachers back to work', Toronto Star (1st edn.), 9 September, p.1.

Goodlad, J. (1979) *Curriculum inquiry: The study of curriculum practice*. New York: McGraw Hill.

Goodlad, J. (1987) *The Ecology of School Renewal*. Chicago: University of Chicago Press.

Goodlad, J. (1991) 'Curriculum making as a sociopolitical process', in Klein, F. (ed.) *The politics of curriculum decision-making*. New York: State University of New York Press, pp.9-23.

Goodson, I. (1988) *The Making of Curriculum: Collected essays*. London: Falmer Press.

Goodson, I. (1993) *School subjects and curriculum change*. London: Falmer Press.

Goodson, I. (1998) *Subject knowledge: Readings for the study of school subjects*. London: Falmer Press.

Goodson, I. (2005) *Learning, curriculum and life politics: The selected words of Ivor F. Goodson*. London: Routledge.

Goodson, I. (2006) *Chariots of fire: Etymologies, epistemologies and the emergence of curriculum* [Online]. Available at: http://www.ivorgoodson.com/s-Chariots (Accessed: 10 August 2008).

Greenberg, J. (2004) 'Tories, teachers and the media politics of education reform: News discourse and the 1997 Ontario teachers' strike'. *Journalism Studies*, 5 (3), pp. 352-371.

Hall, B. (1979) 'Knowledge as a commodity and participatory research'. *Prospects: Quarterly review of education*, 9 (4), pp. 393-408.

Hall, E. and Denis, L. (1968) *Living and Learning: The Report of the Provincial Committee on Aims and Objectives of Education in the Schools of Ontario***.** Toronto: Queen's Printer.

Hammersley, M. and Atkinson, P. (1995) *Ethnography: Principles in practice*. 2nd edn. London: Routledge.

Harms, N. and Yager, R. (eds.) (1980) *What research says to the science teacher, Volume 3* [Online]. Available at: http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED205367&ERICExtSearch_SearchType_0=no&accno=ED205367. (Accessed: 6 March 2006).

Harris, I. (1999) 'Deliberative inquiry: The art of planning', in Short, E. (ed.) *Forms of curriculum inquiry*. Albany: State University of New York Press, pp.285-307.

Harris, M. (1996) 'Government's agenda.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (December 4, 1996) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1996-12-04&Parl=36&Sess=1&locale=en#P60_15291 (Accessed: 8 August 2008).

Hart, E. (1989) 'Toward renewal of science education: A case study of curriculum policy development', *Science Education*, 73 (5), pp. 607-634.

Hatcher, R. and Troyna, B. (1994) 'The 'policy cycle': A Ball by Ball account', *Journal of Education Policy*, 9 (2), pp. 155-170.

Haysom, I. (1996) 'Ontario pupils trail in math, science', *Windsor Star* (FIN edn.), 21 November, p.A11.

Head, J. (1991) 'Ontario's education system not afraid of accountability', *Toronto Star* (SA2 edn.), 11 May, p.D3.

Helgeson, S., Blosser, P. and Howe, R. (1977) *The status of pre-college science, mathematics, and social sciences education: 1955-1975. Volume I, Science education*. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Henderson, J. (2001) *Reflective teaching: professional artistry through inquiry*. Upper Saddle River, N.J.: Merrill/Prentice Hall.

Henry, M. (1993) ‘What is policy? A response to Stephen Ball’, *Discourse: Studies in the cultural politics of education*, 14 (1), pp. 102-105.

Hill, D. (1997) ‘Equality and Primary Schooling: the policy context intentions and effects of the Conservative 'Reforms'’, in Cole, M., Hill, D. and Shan, S. (eds.) *Promoting equality in primary schools*. London: Cassell, pp.15-47.

Hlebowitsh, P. (1999) ‘The burdens of the new curricularist’, *Curriculum Inquiry*, 29, pp. 343-354.

Hockey, J. (1993) ‘Research methods – researching peers and familiar settings’, *Research Papers in Education,* 8 (2), pp. 199-225.

Hodson, D. (1992) ‘In search of a meaningful relationship: An exploration of some issues relating to integration in science and science education’, *International Journal of Science Education,* 14 (2), pp. 541-562.

Hodson, D. (2003) ‘Time for action: Science education for an alternative future’, *International Journal of Science Education*, 25 (6) pp.645-670.

Hodson, D. (2005) What is scientific literacy and why do we need it? [Online]. Available at: http://www.mun.ca/educ/faculty/mwatch/fall05/hodson.htm (Accessed: 6 March 2010).

Hodson, D. and Reid, D. (1998) ‘Changing priorities in science education’, *School Science Review*, 70 (250), pp. 101-108.

Hogwood, B. and Gunn, L. (1984) *Policy analysis and the real world*. Oxford: Oxford University Press.

Hogwood, B. and Peters, B. (1982) ‘The dynamics of policy change: policy succession’, *Policy Sciences,* 14 (3), pp. 225-245.

Howlett, K. (2012a) ‘Return to bargaining table, elementary teachers told’, *The Globe and Mail,* 10 April, p.A6.

Howlett, K. (2012b) ‘Teachers’ union feels ‘betrayal’’, *The Globe and Mail*, 16 April, p. A6.

Howlett, K. and Alphonso, C. (2012) ‘McGuinty’s battle with teachers intensifies’, *The Globe and Mail,* 18 April, p.A6.

Humphrey, C. and Owen, D. (2000) ‘Debating the ‘Power’ of audit’, *International Journal of Auditing,* 4 (1), pp. 29-50.

Hurd, P. (1958) ‘Science literacy: Its meaning for American schools’, *Educational Leadership*, 16 (1), pp. 13-16.

Hurd, P. (1969) *New directions in teaching secondary school science*. Chicago: Rand and McNally Co.

Hurd, P. (2000) 'Science education for the 21st century', *School Science and Mathematics*, 100 (6), pp. 282-288.

Ibbitson, J. (1997) 'Curriculum battles frustrate Ontario parents, threaten publishers', *The Ottawa Citizen* (FIN edn.), 5 August, p.A3.

Ibbitson, J. (1998) 'Terror, exhilaration greet curriculum rewrite task', *The Windsor Star*, 30 January, p.A11.

Innes, S. (1992) 'Silipo's resignation demanded. Teachers stymied by reform package', *The Globe and Mail*, 23 November, p.A9.

Interim Parent Involvement Advisory Board (2006) Parent Involvement: *Report to the Minister of Education* [Online]. Available at: http://www.edu.gov.on.ca/eng/parents/parentinvolvement.pdf (Accessed: 11 October 2011).

Internet Archive Wayback Machine [Online] Available at: http://wayback.archive.org (Accessed: 15 May 2011).

Ipsos Reid (2010) Canadian youth science monitor: Prepared for the Canada Foundation of Innovation. [Online]. Available at: http://www.ipsos-na.com/download/pr.aspx?id=9583 (Accessed: 16 November 2010).

Ivany, G., Sherwood, A. and Wideen, M. (1997) 'The Science Council of Canada report, science for every student: A solution in search of a problem', *Canadian Journal of Education*, 12 (1), pp.87-104.

Jackman, H. (1992) 'Speech from the throne.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (April 6, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-04-06&Parl=35&Sess=2&locale=en (Accessed: 7 August 2006).

Jackman, H. (1993) 'Speech from the throne.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 3rd Sess. (April 13, 1993) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1993-04-13&Parl=35&Sess=3&locale=en (Accessed: 7 August 2006).

Jackman, H. (1995) 'Speech from the throne.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (September 27, 1995) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1995-09-27&Parl=36&Sess=1&locale=en (Accessed: 22 March 2008).

Jackson, C. (1987) ‘School drop-outs.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 1st Sess. (December 7, 1987) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1987-12-07&Parl=34&Sess=1&locale=en (Accessed: 12 March 2008).

Janigan, M. (1996) ‘The Harris revolution’ *Maclean's*, 109 (24), p.24-30.

Janigan, M. and Wilson-Smith, A. (1997) ‘Harris under siege’ *Maclean's*, 110 (45), pp.12-16.

Jann, W. and Wegrich, K. (2007) ‘Theories of the policy cycle’, in Miller, G. and Sidney, M. (eds.) *Handbook of public policy analysis*. Boca Raton: CRC Press, pp.43-62.

Jenkins, E. and Pell, R. (2006) ‘The relevance of science education project (ROSE)in England: a summary of findings’, [Online] http://roseproject.no/network/countries/uk-england/rose-report-eng.pdf

Jensen, R. (1997) *The common curriculum in Ontario, Canada: A study investigating the historical, theoretical and practical foundations of its development.* Unpublished MEd thesis. York University.

Jewkes, Y. and Letherby, G. (2001) ‘Insiders and outsiders: Complex issues of identification and difference in social research’, *Auto/Biography*, 9 (1&2), pp. 41-50.

Kanuka, H. (2010) ‘Deliberative inquiry’, in Baden-Savin, M. and Major, C. (eds.) *New approaches to qualitative research: Wisdom and uncertainty*. London: Routledge, pp.100-107.

Kelchtermans, G. (2005) ‘Teachers’ emotions in educational reforms: Self-understanding, vulnerable commitment and micropolitical literacy’, *Teaching and Teacher Education*, 21 (8), pp. 995-1006.

Kerr, L. (2006) *Between Caring & Counting: Teachers Take on Education Reform.* Toronto: University of Toronto Press.

Kingdon, J. (1995) *Agendas, Alternatives, and Public Policies. 2nd edn. New York: Harper Collins.*

Klein, M. (1991) ‘A conceptual framework for curriculum decision making’, in Klein, M.F. (ed.) *The Politics of Curriculum Decision-Making*. New York: State University of New York Press, pp.24-41.

Kliebard, H. (1968) ‘The curriculum field in retrospect’, in Witt, P. (ed.) *Technology and the curriculum*. New York: Teachers College Press, pp.69-84.

Kogan, M. (1978) *The politics of educational change*. Manchester: Manchester University Press.

Kogan, M. (1999) 'The impact of research on policy', in Coffield, F. (ed.) *Speaking truth to power: Research and policy on life-long learning*. Bristol: The Policy Press, pp.11-18.

Kozolanka, K. (2006) 'Taming labour in neo-liberal Ontario: Oppositional political communication in a time of "crisis"', Canadian Journal of Communication, 31 (3) [Online] http://www.cjc-online.ca/index.php/journal/article/view/1753/1866 (Accessed: 08 October 2012).

Krueger, R. and Casey, M. (2000) *Focus groups: A practical guide for applied research.* 3rd edn. Thousand Oaks: Sage Publications.

Kuzel, A. (1999) 'Sampling in qualitative inquiry', in Crabtree, B. And Miller, W. (eds.) *Doing qualitative research*. 2nd edn. Thousand Oaks: Sage, pp.33-45.

Kvale, S. (1996) *InterViews: An introduction to qualitative research interviewing*. Thousand Oaks: Sage Publications.

Kyle, W. (1991) 'Curriculum development projects of the 1960s', in Holdzkom, D. and Lutz. P. (eds.) *Research within Research: Science Education.* Washington, DC: National Science Teachers Association, pp. 3-24.

Laubach, T. (2005) *A case study of systemic, curricular reform: A forty year history*. Unpublished PhD thesis. University of Oklahoma.

Lemke, J. (2001) 'Articulating communities: Sociocultural perspectives on science education', *Journal of Research in Science Teaching*, 38 (3), pp. 296-316.

Levin, B. (2001) *Reforming education: From origins to outcomes*. London: RoutledgeFalmer.

Levin, B. (2007) 'Sustainable, large-scale education renewal', *Journal of Educational Change*, 8 (4), pp.323-336.

Levin, B. (2008) *How to change 5000 schools; A practical and positive approach for leading change at every level*. Cambridge, MA: Harvard Education Press.

Lewington, J. (1991) 'The blackboard dilemma', *The Globe and Mail*, 31 August, p.D1.

Lewington, J. (1992a) 'Canadian students mediocre in survey; Ontario announced education review', *The Globe and Mail*, 6 February, p.A1.

Lewington, J. (1992b) 'System can't turn on dime: To make schools more responsive to students and the economy, critics and defenders of the Canadian system call for change at the local level', *The Globe and Mail*, 2 May, p.A8.

Lewington, J. (1993a) 'Middle kingdom education: NDP learns to do about face', *The Globe and Mail*, 29 April, p.A17.

Lewington, J. (1993b) 'Ontario plans to rejoin education study. New minister does not want province to be seen as 'resisting accountability'', *The Globe and Mail*, 6 February, p.A8.

Lewington, J. (1993c) 'Revised curriculum under fire; Parents group says proposed changes still amount to 'child-centred learning'', *The Globe and Mail*, 9 February, p.A8.

Lewington, J. (1993d) 'Ways sought to weigh schools; Ontario wants to make education system accountable', *The Globe and Mail*, 20 February, p.A5.

Lewington, J. (1995) 'Tories hustling to chop grade 13; preschool could be next on the block', *The Globe and Mail*, 18 August, p. A1.

Lewington, J. (1996a) 'Education system broken, Snobelen declares Minister calls costs too high, cites study blaming teachers' pay', *The Globe and Mail*, 23 August, p.A1.

Lewington, J. (1996b) 'Stronger curriculum called for in mathematics, science', *The Globe and Mail*, 22 November, p.A3.

Lewis, M. (2000) 'Focus group interviews in qualitative research: A review of the literature', *Action Research E-Reports*, 2 [Online]. Available at: http://pandora.nla.gov.au/parchive/2001/Z2001-Mar-13/www.cchs.usyd.edu.au/arow/arer/002.htm (Accessed: 15 May 2011).

Lincoln, Y. and Guba, E. (1985) *Naturalistic inquiry*. Newbury Park: Sage Publications.

Lingard, B. and Garrick, B. (1997) 'Producing and Practising Social Justice Policy in Education: a policy trajectory study from Queensland, Australia', *International Studies in Sociology of Education,* 7 (2), pp. 157-179.

Livingstone, D. and Hart, D. (2010) *Public attitudes towards education in Ontario, 1980-2009 : OISE survey codebook* [Online]. Available at http://webspace.oise.utoronto.ca/~living13/@oisesurveyarchive/archives.htm (Accessed: 11 January 2011).

Looney, A. (2001) 'Curriculum as policy: some implications of contemporary policy studies for the analysis of curriculum policy, with particular reference to post-primary curriculum policy in the Republic of Ireland', *The Curriculum Journal,* 12 (2), pp. 149-162.

Loree, M. (2003) *The Ontario Curriculum, Grades 1-8: Science and Technology, 1998: Philosophical foundations*. Unpublished MEd thesis. Brock University.

Lustick, I. (1996) 'History, historiography, and political science: Multiple historical records and the problem of selection bias', *The American Political Science Review,* 90 (3), pp. 605-618.

Macdonald, B. (2002) ‘Marx, Foucault, Genealogy’, *Polity*, 34 (3), pp. 259-284.

Mackie, R. (1997) ‘Tories moving too fast for voters’, *The Globe and Mail*, 16 December, p.A4.

Mackie, R., and Lewington, J. (1997) ‘Teachers to walk out; Neither side in battle between Ontario, five unions will say when illegal strike might end’, *The Globe and Mail*, 27 October, p. A1.

Maguire, M. (2002) ‘Globalisation, education policy and the teacher’, *International Studies in Sociology of Education*, 12 (3), pp. 261-276.

Maguire, M. (2004) ‘The modern teacher: A textual analysis of educational restructuration’, in Lindblad, S. and Popkewitz, T. (eds.) *Educational restructuring: International perspectives on traveling policies*. Greenwich, CT: Information Age, pp.121-141.

Maharaj, S., Levin, B. & Segedin, L. (2012) ‘The impact of selected high school reforms in Ontario, Canada’, *Canadian Society for the Study in Education*. Wilfred Laurier University, Waterloo. 27-30 May. Available at:[URL for conference paper no longer available] (Accessed: 23 February 2013).

Mahony, P. and Hextall, I. (2000) *Reconstructing teaching*. London: RoutledgeFalmer.

Marshall, C. and Rossman, G. (2011) *Designing qualitative research*. 5th edn. Thousand Oaks: Sage Publications.

Martin, S. (1988a) ‘National standards, where angels dare not tread’, *Toronto Star* (FIN edn.), 20 October, p.A29.

Martin, S. (1988b) ‘Why the education system needs an overhaul’, *Toronto Star* (FIN edn.), 28 April, p.A25.

Martin, S. (2010) ‘”Act locally, publish globally”: international/ multi-disciplinary research efforts needed to understand the impact of globalization on science education’, *Cultural Studies of Science Education*, 5 (2), pp. 263-273.

Martin, M. and Kelly, D. (eds.) (1996) *TIMSS technical report, volume 1: Design and development*. Boston College, Chestnut Hill, Massachusetts: International Association for the Evaluation of Educational Achievement (IEA).

Mason, J. (2005) *Qualitative researching.* 2nd edn. Thousand Oaks: Sage Publications.

Maves, B. (2000) ‘Education labour disputes.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl. 1st Sess. (November 23, 2000) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2000-11-23&Parl=37&Sess=1&locale=en#P701_174971 (Accessed: 14 August 2006).

Maxwell, J. (1996) *Qualitative research design: an interactive approach*. Thousand Oaks: Sage Publications.

McCown, T. (2005) 'Policy entrepreneurs and policy change: Strategies beyond agenda setting.' Annual Meeting of the American Political Science Association. Washington, DC 1st to 4th September. American Political Science Association. Available at: http://citation.allacademic.com/meta/p_mla_apa_research_citation/0/4/1/0/8/pages41080/p41080-1.php (Accessed: 27 December 2010).

McCulloch, G. and Richardson, W. (2000) *Historical research in educational settings.* Buckingham: Open University Press.

McEneaney, E. (2003) 'The worldwide cachet of scientific literacy', *Comparative Education Review*, 47 (2), pp. 217-237.

McGee, C. (1997) *Teachers and curriculum decision-making*. Palmerston North: Dunmore Press.

McLeod, L. (1994) 'School curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 3rd Sess. (March 29, 1994) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1994-03-29&Parl=35&Sess=3&locale=en#P97_24088 (Accessed: 25 March 2006).

McLeod, L. (1997) 'Lennox and Addington County Board of Education and Teachers' Dispute Settlement Act, 1997.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl. 1st Sess. (January 30, 1997) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1997-01-30&Parl=36&Sess=1&locale=en#P717_206561 (Accessed: 14 August 2006).

McNeir, G. (1993) 'Outcomes-based education', *Research Roundup* [Online]. Available at: http://eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED379765&ERICExtSearch_SearchType_0=no&accno=ED379765 (Accessed: 4 July 2011).

McPherson, A. and Raab, C. (1988) *Governing Education: A sociology of policy since 1945*. Edinburgh: Edinburgh University Press.

Merton, R. (1972) 'Insiders and outsiders: a chapter in the sociology of knowledge', *The American Journal of Sociology*, 78 (1), pp. 9–47.

Miles, M. and Huberman, A. (1994) *Qualitative data analysis*. 2nd edn. Thousand Oaks: Sage Publications.

Millar, R. (2006) 'Twenty first century science: Insights from the design and implementation of a scientific literacy approach in school science', *International Journal of Science Education*, 28 (13), pp. 1499-1521.

Millar, R. and Driver, R. (1987) 'Beyond processes', *Studies in Science Education*, 14 (2): pp. 33-62.

Millar, R. and Osborne, J. (eds.) (1998). *Beyond 2000: Science education for the future*. London: King's College London School of Education.

Millar, R., Leach, J. and Osbourne, J. (2000) *Improving science education: The contribution of research.* Buckingham: Open University.

Mitchell, A. (1992) 'Implementation of key school curriculum change delayed', *The Globe and Mail*, 23 November, p.A11.

Mitchell, A. (2003) 'Ontario's new headmaster', *Voice: Magazine of the Elementary Teachers' Federation of Ontario*, 6 (1), pp.26-27.

Moore, P. (2003) *Battlefield classroom*. [Online]. Available at: http://www.cbc.ca/ontariovotes2003/features/education_052803.html (Accessed: 14 May 2010).

Morrow, R. and Torres, C. (2000) 'The state, globalization, and education policy', in Burbules, N. and Torres, C. (eds.) *Globalisation and education: Critical perspectives*. New York: Routledge, pp.27-58.

Morse, J. (2007) *A level playing field: School finance in the northeast*. State University of New York: Albany.

Morton, D. (2001) 'Sic Permanet: Ontario people and their politics', in White, G. (ed.) *The government and politics of Ontario*. 5th edn. Toronto: University of Toronto Press, pp.3-18.

Moss, G. and Huxford, L. (2007) 'Exploring literacy policy-making from the inside out', in Saunders, L. (ed.) *Educational research and policy-making: Exploring the border country between research and policy*. London: Routledge, pp.55-73.

Murnane, R. and Raizen, S. (1988) *Improving indicators of the quality of science and mathematics education in grades K-12*. Washington, D.C.: National Academy Press.

Nagy, P. (1995) 'National and international comparisons of student achievement: Implications for Ontario' in RCoL *For the love of learning: Background papers*, Vol. II. Toronto: Publications Ontario, pp.431-462.

Naidu, S. (2003) *Reconstructing the teacher: The challenges, rhetoric and reality of performance management in South Australian Schools*. Unpublished PhD thesis. Flinders University of South Australia.

National Research Council (1996) *National Science Education Standards*. Washington, D.C.: National Academy Press.

Noel, S. (1997) ‘Ontario’s Tory revolution’ in Noel, S. (ed.) *Essays on governing Ontario: Revolution at Queen’s Park,* Toronto: James Lorimer & Company, pp.1-17.

Norris, S. and Philips (2003) ‘How literacy in its fundamental sense is central to scientific literacy’, *Science Education,* 87 (20), pp.224-240.

Ontario. Ministry of Education (1975a) *Education in the primary and junior divisions*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1975b) *The formative years: Provincial curriculum policy for the primary and junior divisions of the public and separate schools of Ontario*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1983) *Ontario schools: Intermediate and senior*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1986) *Science in primary and junior education: A statement of direction*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987a) *Ontario science education report card: Canadian national comparisons*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987b) *Science intermediate and senior divisions: Part 1, program outline and policy.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987c) *Science intermediate and senior divisions: Part 2, science grades 7 and 8.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987d) *Science intermediate and senior divisions: Part 3, science grades 9 and 10, general.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987e) *Science intermediate and senior divisions: Part 4, science grades 9 and 10, advanced.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987f) *Science intermediate and senior divisions: Part 5, science grades 9 and 10, basic.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987g) *Science intermediate and senior divisions: Part 12, biology grade 11 advanced and OAC.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1987h) *Science intermediate and senior divisions: Part 13, chemistry grade 11 advanced and OAC.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1988a) *Curriculum Management Resource Guide*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1988b) *Science intermediate and senior divisions: Part 6, science grades 11 and 12, basic* . Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988c) *Science intermediate and senior divisions: Part 7, environmental science, grades 10 to 12, general.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988d) *Science intermediate and senior divisions: Part 8, environmental science, grades 10 and 12, advanced.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988e) *Science intermediate and senior divisions: Part 9, applied biology and chemistry grade 11, general.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988f) *Science intermediate and senior divisions: Part 11, geology grade 12, general and advanced.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988g) *Science intermediate and senior divisions: Part 14, physics grades 12 advanced and OAC.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988h) *Science intermediate and senior divisions: Part 15, Science and society OAC.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1988i) *Science is happening here*. Toronto: Queen's Printer for Ontario.

Ontario. Premier's Council (1988j) *Competing in the new global economy: Volume I.* Toronto: Queen's Printer for Ontario.

Ontario. Premier's Council (1988k) *Competing in the new global economy: Volume II.* Toronto: Queen's Printer for Ontario.

Ontario. Premier's Council (1988l) *Competing in the new global economy: Volume III.* Toronto: Queen's Printer for Ontario.

Ontario. Select Committee of Education (1988m) *First report of the Select Committee on Education*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1989a) *Science intermediate and senior divisions: Part 10, applied physics and technological science grade 12, general.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1989b) *Senior division advanced-level chemistry: A report card for Ontario*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1989c) *Senior division advanced-level chemistry Educator's report*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (1989d) *Senior division advanced-level physics: A report card for Ontario*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1989e) *Senior division advanced-level physics: Educator’s report*. Toronto: Queen’s Printer for Ontario.

Ontario. Select Committee of Education (1989f) *Second report of the Select Committee on Education: Modifications to the school day and the school year*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1990a) *Action plan 1990-1994, restructuring the education system*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1990b) *Ontario Education Act, R.S.O. 1990, Chapter E.2*. [Online]. Available at http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90e02_e.htm. (Accessed: 18 October 2008).

Ontario. Premier’s Council (1990c) *People and skills in the new global economy*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1991a) *Memorandum: Examination reviews in OAC chemistry and OAC physics.* Toronto: author.

Ontario. Ministry of Education (1991b) *Minister of Education annual report, 1990-1991*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1991c) *Science in primary and junior education: A report of progress*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1992a) *Minister of Education annual report, 1991-1992*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education (1992b) *Transition years, grades 7,8,and 9: Policies and program requirements*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education and Training (1993a) *OAC teacher in-service program: Provincial report OAC chemistry examination review.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education and Training (1993b) *OAC teacher in-service program: Provincial report OAC physics examination review.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education and Training (1993c) *The common curriculum, Grades 1-9: Version for parents and the general public.* Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education and Training (1993d) *The common curriculum: Grades 1-9 Working Document*. Toronto: Queen’s Printer for Ontario.

Ontario. Ministry of Education and Training (1994a) *Minister of Education annual report, 1993-1994*. Toronto: Queen's Printer for Ontario.

Ontario. Royal Commission on Learning (1994b) *For the love of learning; Vol. 1, Mandate, context, issues*. Toronto: Queen's Printer for Ontario.

Ontario. Royal Commission on Learning (1994c) *For the love of learning; Vol. 2, Learning, our vision for schools*. Toronto: Queen's Printer for Ontario.

Ontario. Royal Commission on Learning (1994d) *For the love of learning; Vol. 3, The educators.* Toronto: Queen's Printer for Ontario.

Ontario. Royal Commission on Learning (1994e) *For the love of learning*; *Vol. 4, Making it happen*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1995a) *Comprehensive testing program to improve Ontario's education system* [Online]. Available at: http://web.archive.org/web/19970705044753/http://www.edu.gov.on.ca/eng/document/nr/95.11/eqao1.html (accessed: 5 April 2008).

Ontario. Ministry of Education and Training (1995b) *Cooke introduces comprehensive testing* [Press release]. 17 February. [Online]. Available at: http://web.archive.org/web/19970705042913/http://www.edu.gov.on.ca/eng/document/nr/95.02/assess1.html (Accessed: 5 April 2008).

Ontario. Ministry of Education and Training (1995c) *Cooke Provides Funding for New Curriculum* [Press release]. 25 April. [Online] Available at: http://web.archive.org/web/19970705044258/http://www.edu.gov.on.ca/eng/document/nr/95.04/inovfnd1.html (Accessed: 28 May 2011).

Ontario. Ministry of Education and Training (1995d) *New foundations for Ontario education*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1995e) *Policy/Program memorandum no. 122 School Board Policies on School Councils* [Online]. Available at: http://www.peel.edu.on.ca/councils/policy/min.htm (Accessed: 7 July 2007).

Ontario. Ministry of Education and Training (1995f) *The common curriculum: Grades 1-9*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1995g) *The common curriculum provincial standards language, Grades 1-9.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1995h) *The common curriculum provincial standards mathematics, Grades 1-9.* Toronto: Queen's Printer for Ontario.

Ontario. Legislative Assembly (1996a) *Education Quality and Accountability Office Act*. (Bill 30). [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=1585&isCurrent=false&BillStagePrintId= (Accessed: 9 August 2008).

Ontario. Legislative Assembly (1996b) *Ontario College of Teachers Act*. (Bill 31) [Online]. Available at: http://ontla.on.ca/web/bills/bills_detail.do;jsessionid=c72d607830d8073102fdf7e643aa82ccd62026db37e6.e3eQbNaNa3eRe3eKc3aPb3yMbO1ynknvrkLOlQzNp65In0?locale=en&BillID=1586&isCurrent=false&ParlSessionID=36%3A1 (Accessed: 9 August 2008).

Ontario. Ministry of Education and Training (1996c) *Curriculum for Ontario Secondary Schools*. Toronto. Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1996d) *Moving Ontario students to the head of the class* [Advertisement] Available at: http://web.archive.org/web/19970705070256/http://www.edu.gov.on.ca/eng/document/nr/96.11/ad-en.pdf (Accessed: 6 August 2008).

Ontario. Ministry of Education and Training (1996e) *Moving Ontario students to the head of the class* [Press release]. 22 November. [Online] Available at: http://web.archive.org/web/19991014000402/http://www.edu.gov.on.ca/eng/document/nr/96.11/vision.html (Accessed: 15 December 1996).

Ontario. Legislative Assembly (1997a) *Education Quality Improvement Act, 1997*. (Bill 160). [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=1458&isCurrent=false&BillStagePrintId=&btnSubmit=go (Accessed: 9 August 2008).

Ontario. Legislative Assembly (1997b) *Fairness for Parents and Employees Act (Teachers' Withdrawal of Services)* (Bill 161). [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=1459&isCurrent=false&BillStagePrintId= (Accessed: 9 August 2008).

Ontario. Legislative Assembly (1997c) *Fewer school boards act.* (Bill 104). [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do;jsessionid=c72d607830d9cf2e3ebe01894a90bb0ff9db2720f703.e3eQbNaNa3eRe3iSaxuLahuPai1ynknvrkLOlQzNp65In0?locale=en&BillID=1490&isCurrent=false&ParlSessionID=36%3A1 (Accessed: 9 August 2008).

Ontario. Management Board Secretariat (1997d) *Government business plans 1997-1998, Ministry of Education and Training* [Online]. Available at: http://web.archive.org/web/19970705214356/http://www.gov.on.ca/MBS/english/press/plans/met.html (Accessed 20 September 2009).

Ontario. Ministry of Education and Training (1997e) 'EIC employment opportunities' [Online]. Available at: http://web.archive.org/web/19970705035644/http://www.edu.gov.on.ca/eng/general/abcs/eic/eic.html (Accessed: 9 August 2008).

Ontario. Ministry of Education and Training (1997f) *Excellence in education: Ontario's plan for reform*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1997g) *Excellence in education: Student-focused funding for Ontario: A guide book* [Online]. Available at: http://web.archive.org/web/19970705023220/http://www.edu.gov.on.ca/eng/document/brochure/excelfue.html (Accessed: 9 May 2006).

Ontario. Ministry of Education and Training (1997h) *Key directions in secondary curriculum development: A synthesis of the recommendations of 24 expert panels*. Available at: http://stao.ca/resources/archived-materials/synthesis-of-24-expert/synthesis-of-24-expert.htm (Accessed: 6 August 2008).

Ontario. Ministry of Education and Training (1997i) *Ontario must keep pace on education reform* [Press release]. 21 April. [Online] Available at: http://web.archive.org/web/19970705024415/http://www.edu.gov.on.ca/eng/document/nr/97.04/keeppace.html (Accessed: 5 September 2006).

Ontario. Ministry of Education and Training (1997j) *Ontario's plan for reform: Better-educated students for a brighter future*. [Online]. Available at: http://web.archive.org/web/19970705053158/http://www.edu.gov.on.ca/eng/document/brochure/exeng.pdf (Accessed: 24 December 2008).

Ontario. Ministry of Education and Training (1997k) *Putting students first: Ontario's plan for education reform* [Online] Available at: http://web.archive.org/web/19990427062956/http://www.edu.gov.on.ca/eng/document/brochure/tabloid/tabloid.html (Accessed: 5 September 2006).

Ontario. Standing Committee on Social Development (1997l) 'Standing Committee on Social Development – Bill 104, Fewer School Boards Act 1997.' 36th Parl, 1st Sess. (March 26, 1997) [Online]. Available at: http://www.ontla.on.ca/web/committee-proceedings/committee_transcripts_details.do;jsessionid=c72d607830d6197f9f6b4fa741178311f70b02af3e6f.e3eQbNaNa3eRe3qMb3uOaN8Qe6fznA5Pp7ftolbGmkTy?locale=en&Date=1997-0326&ParlCommID=54&BillID=&Business=Bill+104%2C+Fewer+School+Boards+Act%2C+1997&DocumentID=18884 (Accessed: 9 August 2008).

Ontario. Ministry of Education and Training (1998a) *High school reform increases emphasis on math, language and science; promotes responsible citizenship* [Press release]. 9 January [Online]. Available at: http://web.archive.org/web/19990203062453/http://www.edu.gov.on.ca/eng/document/nr/98.01/reform.html (Accessed: 6 August 2008).

Ontario. Ministry of Education and Training (1998b) *Science curriculum passport to jobs and opportunity, Johnson says* [Press release]. 30 March. [Online]. Available at:http://web.archive.org/web/19990429070609/http://www.edu.gov.on.ca/eng/document/nr/98.03/scitech.html (Accessed: 18 August 2008).

Ontario. Ministry of Education and Training (1998c) *Stepping up! Your guide to Ontario's new standards for high school* [Online]. Available at: http://web.archive.org/web/20000917064453/http://www.edu.gov.on.ca/eng/document/brochure/stepup/stepup.pdf (Accessed: 6 August 2008).

Ontario. Ministry of Education and Training (1998d) *The Ontario curriculum, science and technology, Grades 1 to 8.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education and Training (1999) *The Ontario curriculum, science, Grades 9 and 10.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2000) *The Ontario curriculum, science, Grades 11 and 12.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2001a) *Ontario approves standards for teacher appraisal* [Press release]. 12 December. [Online]. Available at: http://web.archive.org/web/20021220172128/http://www.edu.gov.on.ca/eng/document/nr/01.12/nr1212.html (Accessed: 5 April 2008).

Ontario. Ministry of Education (2001b) *Ontario to continue focus on improved student learning* [Press release]. 4 September. [Online]. Available at: http://web.archive.org/web/20041212160905/http://www.edu.gov.on.ca/eng/document/nr/01.09/nr0904b.html (Accessed 9 August 2008).

Ontario. Office of the Premier of Ontario (2001c) *Quality education reforms will continue in Ontario: Harris* [Press release]. 29 March. [Online]. Available at: http://web.archive.org/web/20010407213354/http://www.premier.gov.on.ca/english/news/Educ032901.htm (Accessed: 5 September 2006).

Ontario. Office of the Premier of Ontario (2002a) *Harris government's record: Building a stronger Ontario* [Press release]. 15 March. [Online]. Available at: http://web.archive.org/web/20020829004554/http://www.premier.gov.on.ca/English/news/archive2002/Gov031502_bd1.htm (Accessed: 5 September 2006).

Ontario. Office of the Premier of Ontario (2002b) *Harris predicts bright future for Ontario's education system* [Press release]. 12 February. [Online]. Available at: http://web.archive.org/web/20020829002531/http://www.premier.gov.on.ca/English/news/archive2002/Educ021202.htm (Accessed: 5 September 2006).

Ontario. Legislative Assembly (2004a) *Professional Learning Program Cancellation Act* (Bill 82) [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=52&isCurrent=false&BillStagePrintId= (Accessed: 9 August 2008).

Ontario. Ministry of Education (2004b) *Curriculum update*. [Online]. Available at: http://www.ontla.on.ca/library/repository/ser/214011/200401winter.pdf (Accessible: 6 August 2008).

Ontario. Ministry of Education (2004c) *McGuinty government encourages peace and stability in Ontario's schools* [Press release]. 7 December [Online]. Available at: http://web.archive.org/web/20050424185942/http://ogov.newswire.ca/ontario/GPOE/2004/12/07/c2487.html?lmatch=&lang=_e.html (Accessed: 9 August 2008)

Ontario. Ministry of Education (2004d) *New legislation recognizes teachers as professionals* [Press release]. 13 May [Online]. Available at: http://web.archive.org/web/20041118090318/http://ogov.newswire.ca/ontario/GPOE/2004/05/13/c2895.html?lmatch=&lang=_e.html (Accessed: 5 September 2006).

Ontario. Office of the Premier of Ontario (2004e) *Plan for Change invests in success for students* [Press release]. 26 May. [Online]. Available at: http://web.archive.org/web/20041208012151/http://www.premier.gov.on.ca/english/news/SuccessForStudents052604.asp (Accessed: 9 August 2008).

Ontario. Ministry of Education (2005a) 'Curriculum review: Overview of the process' PowerPoint, slide 4. [personal files] October. Toronto.

Ontario. Ministry of Education (2005b) 'Curriculum review: Overview of the process' PowerPoint, slide 4. *Science Teachers' Association of Ontario annual conference*. November. Toronto.

Ontario. Office of the Premier of Ontario (2005) *The Student Success Program* [Press release]. 14 October. [Online]. Available at: http://news.ontario.ca/opo/en/2005/10/the-student-success-program.html (Accessed: 5 September 2013).

Ontario. Parent Voice in Education Project (2005) *Parent Voice in Education Project Report* [Online]. Available at: http://www.edu.gov.on.ca/eng/document/reports/parentVoice.pdf (Accessed at: 6 June 2009).

Ontario. Ministry of Education (2006a) *Memorandum: Curriculum review feedback consultations on the drafts of the proposed revisions to the Ontario Curriculum for Science and Technology, Grades 1-8 and Science, Grades 9-10*. Toronto author.

Ontario. Office of the Premier (2006b) *Public education: Progress made, progress to continue* [Online]. Available at: http://www.premier.gov.on.ca/news/event.php?ItemID=4846&Lang=EN (Accessed: 28 December 2009).

Ontario. Ministry of Education (2007a) *Ontario Students' Achievement in Science Recognized Among the Best in the World*, 4 December [Online]. Available at: http://ogov.newswire.ca/ontario/GPOE/2007/12/04/c7536.html?lmatch=&lang=_e.html (Accessed: 6 December 2007).

Ontario. Ministry of Education (2007b) *Shaping our schools, shaping out future: Report of the working group on environmental education*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2007c) *The Ontario curriculum revised, science and technology, grades 1 to 8.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2008a) *Reach every student: Energizing Ontario education*. Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2008b) *The Ontario curriculum revised, science, grades 9 and 10.* Toronto: Queen's Printer for Ontario.

Ontario. Ministry of Education (2008c) *The Ontario curriculum revised, science, grades 11 and 12.* Toronto: Queen's Printer for Ontario.

Ontario. Office of the Premier of Ontario (2009) *Global Education Competitiveness Summit, Washington, D.C.* [Transcript]. 30 June. [Online]. Available at: http://www.premier.gov.on.ca/news/event.php?ItemID=7667&Lang=EN (Accessed: 07 January 2011).

Ontario. Office of the Premier of Ontario (2010) *Premier's remarks to the Building Blocks for Education Summit* [Transcript]. 13 September. [Online]. Available at: http://news.ontario.ca/opo/en/2010/09/building-blocks-for-education-summit.html (Accessed: 07 January 2011).

Ontario. Legislative Assembly (2012) *Putting students first act.* (Bill 115). [Online]. Available at: http://www.ontla.on.ca/web/bills/bills_detail.do?BillID=2665 (Accessed: 9 March 2013).

Ontario. Ministry of Education (2013) Specialist High Skills Major [Online]. Available at: http://www.edu.gov.on.ca/morestudentsuccess/SHSM.asp (Accessed: 28 May 2013).

Ontario College of Teachers (OCT) (2003a) *Developing the standards of practice for the teaching profession* [Online]. Available at: http://web.archive.org/web/20040725123605/http://www.oct.ca/en/CollegePublications/PDF/standards.pdf (Accessed: 16 May 2008).

Ontario College of Teachers (OCT) (2003b) *Ethical standards for the teaching profession* [Online]. Available at: http://web.archive.org/web/20030716085127/http://www.oct.ca/en/CollegePublications/PDF/ethics.pdf (Accessed: 16 May 2008).

Ontario English Catholic Teachers' Association (OECTA) (1997) *Submission to the Standing Committee on Administration of Justice re: Bill 160 The Education Quality Improvement Act, 1997* [Online]. Available at: http://www.oecta.on.ca/wps/wcm/connect/627e9b004e325fdaaefdae0ed7cd0271/bill160.pdf?MOD=AJPERES&CACHEID=627e9b004e325fdaaefdae0ed7cd0271 (Accessed: 22 January 2009).

Ontario Liberal Party (2003) *Excellence for all: The Ontario Liberal plan for education*. Toronto: author.

Ontario Liberal Party (2013) *Premier Wynne, new cabinet sworn-in* [News release]. 11 February [Online]. Available at: http://www.ontarioliberal.ca/NewsBlog/NewsDetails.aspx?id=Premier+Wynne%2C+New+Cabinet+Sworn-in (Accessed: 28 May 2013).

Ontario Progressive Conservative Caucus (1992) *New Directions Volume 2: A Blueprint for Learning in Ontario*. Toronto: author.

Organisation of Economic Co-operation and Development (OECD) (2006a) *Assessing scientific, reading and mathematical literacy: A framework for PISA 2006*. Paris: OECD.

Organisation of Economic Co-operation and Development (OECD) (2006b) *Global Science Forum: Evolution of student interest in science and technology studies policy report*. [Online]. Available at: http://www.oecd.org/dataoecd/16/30/36645825.pdf (Accessed: 5 May 2006).

Organisation of Economic Co-operation and Development (OECD) (2006c) *PISA 2006 Science competencies for tomorrow's world, Volume 1: Analysis*. Paris: author.

Organisation of Economic Cooperation and Development (OECD) (2010) 'Ontario, Canada: Reform to support high achievement in a diverse context', in *Strong Performers and Successful Reformers in Education: Lessons from PISA for the United States*.pp.65-81 [Online]. Available at: http://www.oecd.org/dataoecd/34/47/46580959.pdf (Accessed: 8 April 2012).

Orpwood, G. (1981) *The logic of curriculum policy deliberation: An analytical study from science education*. Unpublished PhD thesis. Ontario Institute for Studies in Education (OISE).

Orpwood, G. (1987) 'A new approach to what goes on in the classroom', *The Globe and Mail* (FIN edn.), 24 November, p.A7.

Orpwood, G. (1995a) 'Consideration of alternative models for assessment' in RCoL *For the love of learning: Background papers*, Vol. II. Toronto: Publications Ontario, pp.463-474.

Orpwood, G. (1995b) 'Juggling educational needs and political realities in Canada: National standards, provincial control, and teachers' professionalism', *Studies in Science Education*, 26 (1), pp. 39-57.

Orpwood, G. (1995c) 'Scientific literacy for all. Background paper on science education in Ontario' in RCoL *For the love of learning: Background papers*, Vol. I. Toronto: Publications Ontario, pp.229-249.

Orpwood, G. (2007) 'Assessing scientific literacy: Treats and opportunities', in Linder, C., Őstman, L. and Wickman, P-O. (eds.) *Promoting scientific literacy: science education research in transaction*. Proceedings of the Linnaeus tercentenary symposium. Uppsala University, Uppsala 28-29 May, pp. 120-129 [Online]. Available at: www.fysik.uu.se/didaktik/lsl/Web%20Proceedings.pdf (Accessed: 12 June 2008).

Orpwood, G. and Barnett, J. (1996) *Ontario curriculum framework*: *Assessment of Science and Technology Achievement Project Working Paper #3*. Toronto: York University.

Orpwood, G. and Souque, J. (1985) 'Toward the renewal of Canadian Science education:II. Findings and recommendations', *Science Education*, 69 (5), pp.625-636.

Osborne, J. (2000) 'Keynote speech', *Science education for contemporary society: Problems, Issues and dilemmas*. Poisson, M. (ed.), Final report. International Bureau of Education, The Chinese National Commission for UNESCO, Beijing 27-31 March, pp.8-14 [Online]. Available at: http://www.ibe.unesco.org/fileadmin/user_upload/archive/curriculum/China/Pdf/beijingrep.pdf (Accessed: 28 December 2010).

Osborne, J. (2007) 'Science education for the twenty first century', *Eurasia Journal of Mathematics, Science and Technology Education*, 3 (3), pp. 173-184.

Osborne, D. and Gaebler, T. (1992) *Reinventing government: How the entrepreneurial spirit is transforming the public sector*. Reading MA: Addison-Wesley Publishing.

Osborne, J., Simon, S., & Collins, S. (2003). 'Attitudes towards science: A review of the literature and its implications', *International Journal of Science Education , 25* (9), 1049-1079.

O'Sullivan, B. (1999) 'Global change and educational reform in Ontario and Canada', *Canadian Journal of Education*, 24 (3), pp. 311-325.

Ozga, J. (2000) *Policy research in educational settings: Contested terrain.* Buckingham: Open University Press.

Page, R. (1995) 'Who systematizes the systematizers? Policy and practice interactions in a case of state-level systemic reform', *Theory into Practice*, 34 (1), pp. 21-29.

Pan, S. (2010) 'Exploring how globalisation shapes education: methodology and theoretical framework', *Cultural Studies of Science Education*, 5 (2), pp. 315-324.

Papp, L. (1994) 'Plainly speaking rewrite costs $10 500', *Toronto Star* (MET edn.), 28 July, p.A3.

Paquette, J. (1991) ‘A New Policy Paradigm for Ontario Education?’, *Interchange*, 22 (4), pp. 1-23.

Paquette, J. (1998) ‘Re-engineering Ontario education: The process and substance of the Harris reforms in education in Ontario’ *Education and Law*, 9 (1), pp. 1-41.

Parsons, W. (1995) *Public policy: An introduction to the theory and practice of policy analysis*. Cheltenham: Edward Elgar Publishing Limited.

Payne, E. (1994) ‘Tower of babble: Education ministry churns out ‘atrocious’ bafflegab’, *Ottawa Citizen* (FIN edn.), 4 July, p.A1.

Pedretti, E. (2004) Notes taken from keynote address by Dr. Ermenia Pedretti, Scientific Literacy through STSE education: Power, Politics and Paradoxes. Science Coordinators and Consultants of Ontario Annual Conference, May 25, 2004, Kitchener, Ontario.

Peterson, D. (1985a) ‘Legislative program.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 33rd Parl., 1st Sess. (July 2, 1985) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1985-07-02&Parl=33&Sess=1&locale=en#P50_13864 (Accessed: 16 August 2008).

Peterson, D. (1985b) ‘Roman Catholic secondary schools.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 33rd Parl., 1st Sess. (July 2, 1985) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?locale=en&Parl=33&Sess=1&detailPage=%2Fhouse-proceedings%2Ftranscripts%2Ffiles_html%2F1985-07-02_L012.htm&Date=1985-07-02#P149_44170 (Accessed: 16 August 2008).

Peterson, D. (1988) ‘Premier’s Council.’ In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 1st Sess. (April 11, 1988) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1988-04-11&Parl=34&Sess=1&locale=en#P38_10439 (Accessed: 25 March 2008).

Pinar, W. (1992) ‘Dreamt into existence by others: Curriculum theory and school reform’, *Theory into Practice*, 31, pp. 228-235.

Pinar, W. (ed.) (2003) *International Handbook of Curriculum Research*. New Jersey: Lawrence Erlbaum Associates.

Pinar, W. and Grumet, M. (1981) ‘Theory and practice and the reconceptualization of curriculum studies’, in Lawn, M. and Burton, L. (eds.) *Rethinking curriculum studies: A radical approach*. New York: Wiley & Sons, pp.20-42.

Pinar, W., Reynolds, W., Slattery, P. and Taubman, P. (2008) *Understanding Curriculum*. New York: Peter Lang.

Pollard, A., Anderson, J., Madddock, M., Swatfield, S., Warin, J. and Warwick, P. (2008) *Reflective teaching*. London: Continuum.

Postlethwaite, T. and Wiley, D. (1992) *The IEA study in science II: Science achievement in twenty-three countries*. Oxford: Pergamon Press.

Postmedia Network Inc. (2011) [Online] Available at: http://www.postmedia.com/ (Accessed: 19 March 2011).

Power, M. (1994) *The audit explosion*. [Online]. Available at: http://www.demos.co.uk/publications/auditexplosion (Accessed: 22 December 2010).

Power, M. (1997) *The audit society: Rituals of verification*. Oxford: Oxford University Press.

Power, S., Whitty, G., Gewirtz, S., Halpin, D. and Dickson, M. (2004) 'Paving a "Third Way"? A policy trajectory analysis of education action zones', *Research Papers in Education*, 19 (4), pp. 453-476.

Progressive Conservative Party of Ontario (1994) *The Common Sense Revolution*. Toronto: author.

Queen's Park Bureau (1997) 'Bill puts principals', *Toronto Star*, (TOR edn.), 14 November, p.1.

Raab, C. (1994) 'Theorising the governance of education', *British Journal of Educational Studies*, 42 (1), pp. 6-22.

Rachlis, C. And Wolfe, D. (2001) 'An insiders' view of the NDP government of Ontario: The politics of permanent opposition meets the economics', in White, G. (ed.) *The government and politics of Ontario*. 5th edn. Toronto: University of Toronto Press, pp.331-364.

Radwanski, G. (1987) *Ontario Study of the Relevance of Education, and the Issue of Dropouts*. Toronto: Queen's Printer for Ontario.

Radwanski, A. (2010) 'Dalton McGuinty;s best case for re-election; International accolades pour in for Premier's policies, 'level of innovation'', *The Globe and Mail*, 23 December, p.A11.

Rae, B. (1996) *From protest to power: Personal reflections on a life in politics*. Toronto: McClelland& Stewart.

Raston, S. and Reshef, Y. (2003) *Unions in the time of revolution: Government restructuring in Alberta and Ontario*. Toronto: University of Toronto Press.

Razavi, S. (1992) 'Fieldwork in a familiar setting: the role of politics at the national, community and household levels', in Devereaux, S. and Hoddinott, J. (eds.) *Fieldwork in developing countries*. Hempstead: Harvester Wheatsheaf, pp.152-163.

Reid, W. (1997) 'Principle and pragmatism in English curriculum making 1968-1918', *Journal of Curriculum Studies*, 29 (6), pp. 667-682.

Reid, W. (1999) *Curriculum as Institution and Practice: Essays in the Deliberative Tradition*. London: Taylor & Francis.

Reycraft, D. (1990a) 'Religious education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl.,2nd Sess. (March 20, 1990) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1990-03-20&Parl=35&Sess=1&locale=en (Accessed: 11 April 2008).

Reycraft, D. (1990b) 'Religious education.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl.,2nd Sess. (March 29, 1990) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?locale=en&Parl=35&Sess=1&Date=1990-03-29 (Accessed: 11 April 2008).

Riffe, D., Lacy, S. and Fico, F. (2005) *Analyzing media messages: Using qualtitative content analysis in research*. Mahwah, N.J.: Lawrence Erlbaum Associates, Inc.

Ritchie, (1993a) 'Teachers, parents meet to criticize education', *Toronto Star* (ZONE edn.), 25 March, p.NY1.

Ritchie, (1993b) 'York teachers critical of destreaming plan. No planning, communication or training, critics say', *Toronto* Star (ZONE edn.), 4 February, p.NY2.

Rizvi, F. and Lingard, B. (2010) *Globalizing education policy*. London: Routledge.

Roberts, D. (1982) 'Developing the concept of "curriculum emphases" in science education', *Science Education*, 66 (2), pp. 243-260.

Roberts, D. (1983) *Scientific Literacy: Towards Balance in Setting Goals for School Science Programs*. Ottawa: Science Council of Canada.

Roberts, D. (1988) 'What counts as science education ?', in Fensham, P. (ed.) *Development and Dilemmas in Science Education*. Lewes: Falmer Press, pp.27-54.

Roberts, D. (2007a) "Linné scientific literacy symposium opening remarks". in Linder, C., Őstman, L. and Wickman, P-O. (eds.) *Promoting scientific literacy: science education research in transaction*. Proceedings of the Linnaeus tercentenary symposium. Uppsala University, Uppsala 28-29 May, pp. 9-17 [Online]. Available at: www.fysik.uu.se/didaktik/lsl/Web%20Proceedings.pdf (Accessed: 12 June 2008).

Roberts, D. (2007b) Scientific literacy/science literacy, in Abell, S. and Lederman, L. (eds.) *Handbook of research on science education*. Hillsdale, NJ: Lawrence Erlbaum Publishers, Ltd., pp.729-780.

Roberts, D. (2011) ‘Competing visions of scientific literacy: The influence of a science curriculum policy image’, in Linder, C., Östmaan, L., Roberts, D., Wickman, P-O., Erickson, G., and MacKinnon, A. (eds.) *Exploring the landscape of scientific literacy*. New York: Routledge, pp.11-27.

Robitaille, D. (ed.) (1994) *TIMSS Monograph No. 1: Curriculum frameworks for mathematics and science*. Reprint, Vancouver: Pacific Educational Press.

Robson, C. (2002) *Real World Research*. 2nd edn. Oxford: Blackwell Publications.

Roher, E. (2001) ‘The changing role of the principal: Labour relations in a new context’, *Orbit*, 32 (2), pp.46.

Roscoe, K. and Mrazek, R. (2005) *Scientific literacy for Canadian students: Curriculum, instruction, and assessment*. Calgary: Detselig Enterprises.

Rosier, M. and Keeves, J. (eds.) (1991) *The IEA study of science I: Science education and curricula in twenty-three countries*. Oxford: Pergamon Press.

Ross, E. (2000) ‘The struggles for the social studies curriculum’ in Ross, E. (ed.) *The Social Studies Curriculum: Purposes, Problems, and Possibilities*. New York: State University of New York Press, pp.17-36.

Rozanski, M. (2002) *Investing in public education: Advancing the goal of continuous improvement in student learning and achievement, Report of the Education Equality Task Force*. Toronto: Queen’s Printer for Ontario.

Rushowy, K. (2012) ‘Teachers want to talk to premier; Emergency meeting sought after government proposes wage freeze, end of sick-day payouts’, *Toronto Star*, (ONT edn.), 6 March, p.GT2.

Sabatier, P. (2007) *Theories of the policy process*. 2nd edn. Boulder, CO: Westview Press.

Scheurich, J. (1994) ‘Policy archaeology: a new policy studies methodology’, *Journal of Education Policy*, 9 (4), pp. 297-316.

Schiller, B. (1987) ‘The doubts about Ontario schools’, *Toronto Star* (SA2 edn.), 25 April, p.A10.

Schwab, J. (1970) *The practical: A language for curriculum*. Washington: National Education Association, Center for the Study of Instruction.

Schwille, J., Porter, A., Alford, L., Floden, R., Freeman, D., Irwin, S. and Schmidt, W. (1988) ‘State policy and the control of curriculum decisions’, *Educational policy*, 2 (1), pp. 29-50.

Schuetze, H., Kuehn, L., Davidson-Harden, A., Schugurensky, D., and Weber, N. (2011) 'Globalization, neoliberalism and schools: The Canadian story', Olmos, L., Torres, C., and Van Heertum, R. (eds.) Educating the Global Citizen: In the shadow of neoliberalism, thirty years of educational change. Bentham Science http://www.eurekaselect.com/51474/chapter/globalization%2C-neoliberalism-and-schools%3A-the-canadian-stor (pp. 62-84).

Science Co-ordinators and Consultants of Ontario (SCCAO) (1993) *December 1, 1993 submission to the Royal Commission on Learning*. Toronto: author.

Science Co-ordinators and Consultants of Ontario (SCCAO) (2004a) *SCCAO Sustaining quality curriculum feedback*. [Online]. Available at: http://sccao.oise.utoronto.ca/downloads/sccao_sqc_feedback_strengths.pdf (Accessed: 5 September 2008).

Science Co-ordinators and Consultants of Ontario (SCCAO) (2004b) *Sustaining quality curriculum process proposal.* [Online]. Available at: http://sccao.oise.utoronto.ca/downloads/SQC_Process_Proposal_May04.pdf (Accessed: 5 September 2008).

Science Co-ordinators and Consultants of Ontario (SCCAO) (2005a) *SCCAO-SQC DRAFT report.* [Online]. Available at: http://sccao.oise.utoronto.ca/downloads/sept05%20SQC%20Report.pdf (Accessed: 5 September 2008).

Science Co-ordinators and Consultants of Ontario (SCCAO) (2005b) *Sustaining quality curriculum retreat*. [Online]. Available at: http://sccao.oise.utoronto.ca/downloads/SQCSpringSCCAOSTAORetreatPr1.pdf (Accessed: 5 September 2008).

Seale, C. (1999) *The quality of qualitative research.* London, Sage Publications.

Sears, A. (2003) *Retooling the mind factory: Education in a lean state*. Aurora, Ontario: Garamond Press.

Segworth, B. (2003) Accountability, evaluation and performance monitoring: A comparative perspective. [Online]. Available at: http://www.law-lib.utoronto.ca/investing/reports/rp15.pdf (Accessed: 5 July 2010).

Seidman, I. (1998) *Interviewing as qualitative research.* 2nd edn. New York: Teachers College Press.

Sheppard, R. (1992a) 'Bob Rae's labour pains', *The Globe and Mail*, 24, November, p.A27.

Sheppard, R. (1992b) 'D-day at Ontario high', *The Globe and Mail*, 13, August, p.A15.

Sheppard, R. (1997) 'The provinces; To overhaul a school system', *The Globe and Mail*, 18 June, p. A15.

Sheppard, R. (1999) 'The Harris factor', *Maclean's*, 112 (20), pp.18-23.

Shore, C. and Wright, S. (1999) 'Audit culture and anthropology: Neo-liberalism in British higher education', *The Journal of the Royal Anthropological Institute*, 5 (4), pp. 557-575.

Shujah, A. (1999) *Multicultural science education: An analysis of curriculum and policy in Ontario*. Unpublished Masters thesis. OISE/UT.

Shymansky, J. and Kyle, W. (1992) 'Establishing a research agenda: Critical issues of science curriculum reform', *Journal of Research in Science Teaching*, 29 (8), pp. 749-748.

Silipo, T. (1991) 'Education program evaluation.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 1st Sess. (December 10, 1991) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1991-12-10&Parl=35&Sess=1&locale=en (Accessed: 25 March 2006).

Silipo, T. (1992) 'Education policy.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 2nd Sess. (October 19, 1992) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1992-10-19&Parl=35&Sess=2&locale=en (Accessed: 25 March 2006).

Sjøberg, S. (2007) PISA and "Real life challenges": Mission impossible? Contribution to Hopman (Ed): *PISA according to PISA Revised version Oct. 8, 2007* [Online]. Available at: http://folk.uio.no/sveinsj/Sjoberg-PISA-book-2007.pdf (Accessed: 3 May 2008).

Sjøberg, S. and Shreiner, C. (2010) *The ROSE project: An overview and key findings*. [Online]. Available at: http://www.cemf.ca/pdfs/sjobergschreineroverview2010.pdf (Accessed: 15 April 2011).

Small, P. (1996a) 'Our kids no math whizzes, Ontario students lag behind other provinces in two subjects', *Toronto Star* (FIN edn.), 21 November, p.A3.

Small, P. (1996b) ''Rigorous' school standards pledged', *Toronto Star* (FIN edn.), 23 November, p.A1.

Small, P. (1997) 'The battle over the new curriculum; To a mixture of cheers and boos from teachers, Ontario's philosophy of education shifts from vague 'outcomes' to specific 'expectations'', *Toronto Star*, (FIN edn.), 30 August, p.B1.

Smith, D. (1989a) 'Academic curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 2nd Sess. (July 5, 1989) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1989-07-05&Parl=34&Sess=2&locale=en#P369_89241 (Accessed: 11 April 2008).

Smith, D. (1989b) 'Academic curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 2nd Sess. (July 18, 1989) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1989-07-18&Parl=34&Sess=2&locale=en#P238_66710 (Accessed: 4 September 2009).

Smith, E. (1990) 'Academic curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 2nd Sess. (April 23, 1990) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1990-04-23&Parl=35&Sess=1&locale=en#P280_87155 (Accessed: 12 April 2008).

Snobelen, J. (1995a) 'Academic testing.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (November 23, 1995) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1995-11-23&Parl=36&Sess=1&locale=en#P320_116855 (Accessed: 5 September 2006).

Snobelen, J. (1995b) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (November 2, 1995) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1995-11-02&Parl=36&Sess=1&locale=en#P477_159744 (Accessed: 5 September 2006).

Snobelen, J. (1996a) 'Education financing.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (March 20, 1996) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1996-03-20&Parl=36&Sess=1&locale=en#P274_88239 (Accessed: 22 March 2008).

Snobelen, J. (1996b) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (October 9, 1996) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1996-10-09&Parl=36&Sess=1&locale=en#P55_14574 (Accessed: 5 September 2006).

Snobelen, J. (1997a) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (January 13, 1997) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1997-01-13&Parl=36&Sess=1&locale=en#P76_20414 (Accessed: 22 March 2008).

Snobelen, J. (1997b) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (October 2, 1997) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1997-10-02&Parl=36&Sess=1&locale=en#P360_120309 (Accessed: 22 March 2008).

Snobelen, J. (1997c) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 1st Sess. (September 22, 1997) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1997-09-22&Parl=36&Sess=1&locale=en#P197_21161 (Accessed: 22 March 2008).

Snobelen, J. (2008) 'The business of learning', *Toronto Sun*, 4 May [Online]. Available at: http://www.parentseduchoice.org/newsRoom/050408%20-%20Toronto%20Sun%20-%20The%20Business%20Of%20Learning.pdf (Access no longer available: 15 April 2012).

Soloman, J. (2002) 'The evolution of education: Change and reform', in Wheeler, M., Boden, M., and Ziman, J. (eds.) *The Evolution of Cultural Entities*: *Proceedings of the British Academy*. Oxford University Press/British Academy, pp. 183-200.

Spady, W. (1994) *Outcomes-based education: Critical issues and answers*. Arlington: American Association of School Administrators.

Speirs, R. (1986) *Out of the blue: The Fall of the Tory dynasty in Ontario*. Toronto: Macmillan of Canada.

Stake, R. and Easley, J. (1978) *Case studies in science education*. University of Illinois: CIRCE.

Star Wire Services (1987) 'Ontario Grits unveil program for school kids', *The Windsor Star* (FIN edn.), 7 August, p.A1.

Sterling, D. (2004) *Science education video interview* [Online]. Available at: http://www.researchchannel.org/prog/displayevent.aspx?rID=3450 (Accessed: 14 December 2008).

Strathern, M. (1997) ''Improving ratings': audit in the British university system', *European Review*, 5 (3), pp. 305-321.

Strauss, S. (1988) 'Creationists, opponents criticize new school guidelines on biology', *The Globe and Mail* (FIN edn.), 26 January, p.A3.

Sumara, D., Davis, B. and Laidlaw, L. (2001) 'Canadian identity and curriculum theory: An ecological, postmodern perspective', *Canadian Journal of Education*, 26 (2), pp. 144-163.

Tanguay, A. (1997) '"Not in Ontario!" From the social contract to the Common Sense revolution', in Noel, S (ed.) *Revolution at Queen's Park: Essays on governing Ontario*. Toronto: James Lorimer & Company, pp.18-37.

Taylor, S., Rizvi, F., Lingard, B. and Henry, M. (1997) *Educational policy and the politics of change.* London: Routledge.

Tomkins, G. (2008) *A common countenance: Stability and change in the Canadian curriculum.* Vancouver: Pacific Educational Press.

Troman, G. (2007) 'Research on teachers' work and teacher professionalism: a short history', in Hextall, I., Gewirtz, S., Cribb, A. and Mahony, P. *Changing teacher roles, identities and professionalism: An annotated bibliography*. [Online]. Available at: http://www.kcl.ac.uk/content/1/c6/01/41/56/bibliography.pdf (Accessed: 9 September 2011).

Trowler, P. (2003) *Education policy*. 2nd edn. London: Routledge.

Troyna, B. (1994) 'Critical social research and education policy', *British Journal of Educational Studies,* 42 (1), pp. 70-84.

Turner, S. (2008) 'School science and its controversies; or whatever happened to scientific literacy?', *Public Understanding of Science,* 17 (1) [Online]. Available at: http://pus.sagepub.com.ezproxy.library.yorku.ca/content/vol17/issue1/ (Accessed: 6 April 2008).

Tyler, R. (1949) *Basic Principles of Curriculum and Instruction*. Chicago: University of Chicago Press.

UNESCO (1993) *Project 2000+, International Forum of Scientific and Technological Literacy for All,* Final report, Paris: UNESCO. Project 2000+ Forum, Paris, 5th to 10th July [Online]. Available at: http://unesdoc.unesco.org/images/0009/000952/095246eb.pdf (Accessed: 24 February 2010).

Ungerleider, C. (2003) *Failing our kids: How we are ruining our public schools*. Toronto: McClelland & Stewart Ltd.

Van den Akker, J. (2003) 'Curriculum perspectives: an introduction', in van den Akker, J., Kuiper, W. and Hameyer, U. (eds.) *Curriculum landscapes and trends.* Dordrecht: Kluwer Academic Publishers, pp.1-10.

Vidovich, L. (2001) 'A Conceptual Framework for Analysis of Education Policy and Practices', *Australian Association for Research in Education*. AARE 2001 International Education Research Conference, Coldstream, Victoria, Australia. Available at: http://www.aare.edu.au/01pap/vid01267.htm (Accessed: 17 October 2006).

Vidovich, L. (2003) 'Methodological framings for a policy trajectory study', in O'Donoghue, T. And Punch, K. (eds.) *Qualitative Educational Research in Action*. London: Falmer Press, pp.70-96.

Vincent, D. (1993) 'Dufferin-Peel board goes slowly on destreaming', *Toronto Star* (ZONE edn.), 25, February, p.BR3.

Waks, L. (2000) 'Essay review: Reid's theory of curriculum as institutionalized practice', *Journal of Curriculum Studies,* 32 (4), pp. 589-598.

Walford, G. (1994) *Researching the powerful in education*. London: Routledge.

Walford, G. (2005) 'Research ethical guidelines and anonymity', *International Journal of Research & Method in Education*, 28 (1), pp. 83-93.

Walker, D. (1971) 'A naturalistic model for curriculum development', *The School Review*, 80 (1), pp. 51-65.

Walker, D. and Soltis, J. (2004) *Curriculum and Aims.* 4th edition. New York: Teachers College Press.

Walker, S. (1993a) 'Confusion, fear surround destreaming, study shows', *Toronto Star* (AM edn.), 5 March, p.A12.

Walker, S. (1993b) 'Ontario flip-flops on world math test', *Toronto Star* (AM edn.), 10 February, p.A1.

Walker, S. (1993c) 'Ontario won't match students in global study of math, science', *Toronto Star* (AM edn.), 5 February, p.A16.

Walker, S. (1993d) 'See correction at end of story', *Toronto Star* (SA2 edn.), 20 February, p.A2.

Walker, W. (1986) 'Give young people work education until age 20: NDP', *Toronto Star* (HO2 edn.), 26 December, p.A1.

Walkom, T. (1988) 'In the blackboard jungle', *The Globe and Mail* (FIN edn.) 16 December, p.A7.

Walkom, T. (1993) 'Debt crisis? What debit crisis', *Toronto Star* (SA2 edn.), 27 March, p.D4.

Walkom, T. (1994) 'Reading between the lines of ministry bafflegab', *Toronto Star* (SA2 edn.), 30 July, p.C5.

Walkom, T. (1997) 'Will Bill 160 kill public education', *Toronto Star*, (TOR edn.) 1 November, p.1.

Walkom, T. (2001) 'The Harris government: Restoration or revolution?' in White, G. (ed.) *The Government and Politics of Ontario*. 5th edn. Toronto: University of Toronto Press, pp.402-417.

Walkom, T. (2002) *Rae days: The rise and follies of the NDP*. Toronto: Key Porter Books.

Wallace, M. (1993) 'Discourse of derision; the role of the mass media within the education policy process', *Journal of Education Policy*, 8 (4), pp. 321-337.

Walton, G. (2010) 'The problem trap: Implications of policy archaeology methodology for anti-bullying policies', *Journal of Education Policy*, 25 (2), pp. 135-150.

Ward, C. (1988) 'Drug use.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 1st Sess. (October 19, 1988) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1988-10-19&Parl=34&Sess=1&locale=en#P50_10682 (Accessed: 9 April 2009).

Ward, C. (1989) 'Academic curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 34th Parl., 2nd Sess. (April 26, 1989) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1989-04-26&Parl=34&Sess=2&locale=en#P51_11187 (Accessed: 20 March 2008).

Ward, S. (2012) *Neoliberalism and the global restructuring of knowledge and education*. New York: Taylor & Francis.

Weaver-Hightower, M. (2008) 'An Ecology Metaphor for Educational Policy Analysis: A call to complexity', *Educational Researcher*, 37, pp. 153-167.

Wedel, J., Shore, C., Feldman, G. and Lathrop, S. (2005) 'Toward an anthropology of public policy', *The Annals of the American Academy of Political and Social Science*, 600, July. pp.30-51 *JSTOR* [Online]. Available at: http://www.jstor.org/stable/25046109 (Accessed: 15 June 2011).

Wellington, J. and Osborne, J. (2001) *Language and literacy in science education*. Buckingham: Open University Press.

Weiss, I. (1978) Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education. Washington, D.C.: U.S. Government Printing Office.

Westbury, I. and Wilkof, N. (eds.) (1978) *Joseph J. Schwab science, curriculum and liberal education: Selected essays*. Chicago: University of Chicago Press.

Weston, H. (2001) 'Speech from the throne.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 37th Parl., 2nd Sess. (April 19, 2001) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2001-04-19&Parl=37&Sess=2&locale=en (Accessed 20 March 2008).

Whipp, T. (1988) 'New education strategies urged: The future is now', *The Windsor Star* (FIN edn.) 30 Sept, p.C9.

White, G. (2002) '*Change in the Ontario state 1952-2002*', Paper prepared for the Role of Government Panel [Online]. Available at: http://www.law-lib.utoronto.ca/investing/reports/rp8.pdf (Accessed: 15 November 2011).

White, R. (1988) *Learning science*. Oxford: Basil Blackwell.

Whitty, G. (2002) *Making sense of education policy: Studies in the sociology and politics of education*. London: Paul Chapman Publishing.

Wiles, R., Crow, G., Heath, S. and Charles, V. (2006) Anonymity and Confidentiality [Online]. Available at: http://eprints.ncrm.ac.uk/423/1/0206_anonymity%2520and%2520confidentiality.pdf (Accessed: 8 July 2012).

Williams, J. and Cummings, W. (2005) *Policy-making for education reform in developing countries: Contexts and processes*, Vol.1. Lanham, Maryland: ScarecrowEducation.

Wilson, J. (1997) 'The Ontario political culture at the end of the century', in Noel, S. (ed.), *Revolution at Queen's Park*, Toronto: James Lorimer & Company Ltd., pp.55-73.

Wittmer, E. (1993) 'Education reform.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 35th Parl., 3rd Sess. (April 27, 1993) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=1993-04-27&Parl=35&Sess=3&locale=en#P45_10847 (Accessed: 25 March 2006).

Wolfe, D. (1997) 'Queen's Park policy-making systems', in Noel, S. (ed.), *Revolution at Queen's Park*, Toronto: James Lorimer & Company Ltd., pp.151-164.

Wood, B. (1998) 'Curriculum.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 36th Parl., 2nd Sess. (April 30, 1998) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?locale=en&Parl=36&Sess=2&Date=1998-04-30#P660_219573 (Accessed: 23 March 2008).

Woolstencroft, P. (2001) 'Reclaiming the 'pink palace': The Progressive Conservative Party comes in from the cold', in White, G. (ed.) *The Government and Politics of Ontario*. 5th edn. Toronto: University of Toronto Press, pp.365-401.

Worldpress.org (2011) [Online] Available at: http://www.worldpress.org/newspapers/AMERICAS/Canada.cfm (Accessed: 19 March 2011).

Wraga, W. and Hlebowitsh, P. (2003) 'Toward a renaissance in curriculum theory and development in the USA', *Journal of Curriculum Studies*, 35 (4), pp. 425-437.

Wright, L. (1996a) 'Education reforms take slower stream; government finds revamping system isn't a simple task'. *Toronto Star* (Final edn.). 18 July. p.A21.

Wright, L. (1996b) 'Ontario plans standard report card; parents deserve to know how child is doing' *Toronto Star* (Final edn.). 20 September. p.A9.

Wyatt, J. (1988) 'A recipe for bad schooling', *The Whig-Standard* (FIN edn.) 8 March, p.1.

Wynne, K. (2006) 'Student achievement.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 38th Parl. 2nd Sess. (November 16, 2006). [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2006-11-16&Parl=38&Sess=2&locale=en#P470_139033 (Accessed 14 August 2008).

Wynne, K. (2007) 'Student achievement.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 39th Parl., 1st Sess. (December 4, 2007) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2007-12-04&Parl=39&Sess=1&locale=en#P216_37112 (Accessed: 14 March 2008).

Wynne, K. (2009) 'Student achievement.' In Ontario. Legislative Assembly. *Legislative Debates (Hansard)*. 39th Parl., 1st Sess. (May 28, 2009) [Online]. Available at: http://www.ontla.on.ca/web/house-proceedings/house_detail.do?Date=2009-05-28&Parl=39&Sess=1&locale=en#P421_118009 (Accessed: 14 March 2008).

Yore, L., Bisanz, G.L. and Hand, B.M. (2003) 'Examining the literacy component of science literacy: 25 years of language arts and science research', *International Journal of Science Education*, 25 (6), pp.689-725.

York University (1996) *Joint university-school board project releases draft standards in science and technology for teachers and students* [Press release]. 27 September. [Online]. Available at: http://web.archive.org/web/19970614065841/http://www.yorku.ca/admin/comm/release/092796.htm (Accessed: 9 August 2006).

Young, J. and Levin, B. (1999) 'The origins of educational reform: A comparative perspective', *Canadian Journal of Educational Administration and Policy*, 12 January [Online]. Available at: http://www.umanitoba.ca/publications/cjeap/articles/younglevin.html (Accessed: 10 December 2010).