Use and Usefulness of Mathematics Curriculum Guides in Prince Edward Island

Kenneth F. Roper

University of Prince Edward Island

A thesis submitted to the Faculty of Education in partial fulfillment of the requirements

for the degree of Master of Education

July 7, 2004

Your file Votre référence
ISBN: 0-612-93884-0
Our file Notre référence
ISBN: 0-612-93884-0

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Abstract

This study explored the perceptions Prince Edward Island senior high mathematics teachers have of the use and usefulness of the academic mathematics curriculum guides. The degree to which curriculum guides are being used to deliver courses is not well known. Much anecdotal information has been available, but there is a marked absence of quantitative data.

This study, used an integrated research methodology, in which the use and usefulness of the mathematics curriculum guides in Prince Edward Island as perceived by Island high school teachers was investigated. The use of the curriculum guides was researched using a survey in which 32 of the 48 academic mathematics teachers on PEI participated. Of the 32 participating teachers, 14 agreed to take part in an electronic interview where the usefulness of the curriculum guides was explored. The study revealed the substantive use of the curriculum guides and the perception by PEI mathematics teachers that the guide was useful. The positive view that Island teachers expressed to the guides presents a model for curriculum development and implementation that could possibly be utilized in other curriculum areas. The researcher outlined the curriculum development process, which was viewed by teachers as a possible framework for future curriculum guide development. A number of recommendations were made to the Department of Education, that may inform development of future curriculum guides by a collaborative-teacher-assisted procedure.

Acknowledgments

Thank you to all the members of the Faculty of Education at UPEI for their part in making it possible to complete a Master of Education degree at UPEI. I would be remiss if I did not make special mention of my Thesis Advisory Team of Dr. Kevin MacLeod and Dr. Anne-Louise Brookes for their support, guidance, and encouragement.

Thank you to Dr. Kevin MacLeod, thesis supervisor, Dr. Anne-Louise Brookes, second reader, Dr. Elizabeth De Freitas, internal examiner, and Dr. David Reid, external examiner for the constructive feedback which allowed for the improvement of this thesis. A special thanks to Dr. Kevin MacLeod for being such a supportive, positive, and cheerful influence during the entire process.

Thank you to Barb Trainor, Secondary Coordinator of English Programs and Frank Hennessey, Director of English Programs at the Department of Education. Their support and encouragement meant a great deal.

Thank you to Ms. Judy Hughes, Acting Director of Instruction/Program Services, Eastern School District and Mr. Alan Kennedy, Acting Superintendent of Education, Western School Board.

A special thank you to my colleagues in my cohort of the Master of Education degree in Leadership and Learning at UPEI. We all were able to feed off each others energy and encouragement through the course taken together.

Dedicated to

My wife, Marilyn, and two sons - Daniel and Benjamin. Their encouragement and support sustained me throughout the journey.

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Chapter One

Introduction

Overview of the Problem

In the mid 1990's under the direction of the four Atlantic Premiers, the Atlantic Provinces Education Foundation (APEF) embarked on developing a new Atlantic mathematics curriculum based on the latest research and in conjunction with the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics. Four Atlantic mathematics consultants were directed by the Atlantic Ministers of Education to develop a common mathematics curriculum for the Atlantic region based on research and best practices. The consultants met on a regular basis and Nova Scotia, as the lead province, began to write curriculum guides. A publisher was sought to write a resource that would be custom-made for the Atlantic region. The successful educational publisher consequently began writing units for the new texts based on the curriculum units written by the Nova Scotian mathematics consultant. Unlike any of the other Education Departments in the Atlantic Provinces, the Prince Edward Island (PEI) Department of Education asked Island mathematics teachers to review the units being developed for use in the Atlantic region by the educational publisher and to provide feedback on the material. Island teachers expressed concerns about the use of the discovery approach, which was employed in the units to the exclusion of other possible teaching methodologies. Island teachers expressed their concerns to the representatives from the educational publisher and teachers were assured that their concerns would be

reflected in subsequent revisions of the units involved. This, however, did not happen. Island teachers recommended to the Department of Education that PEI withdraw from the APEF resource project but still use the APEF mathematics specific curriculum outcomes. The PEI mathematics consultant at the time started the development of the PEI curriculum guides. She moved to another position within the Department of Education in the Fall of 1999 and I assumed the Senior High Mathematics/Science Consultant position. Having taught both high school mathematics and science in Prince Edward Island for twenty five years, I was familiar with the existing mathematics curriculum on PEI. To say that I was familiar with the mathematics curriculum was not to say that I was happy with it. During my twenty five years teaching, I had seen essentially no change in curriculum, and perhaps even worse, I saw no direction from the Department of Education in terms of recommending particular teaching methodologies or recommending assessment strategies. In the Fall of 1999, the mandate of the Department of Education for senior high mathematics curriculum was to lead the province into a new mathematics curriculum that would serve the students of the twenty first century well. As this was my goal as well, my assuming the mathematics consultant's position was rather timely. The Department of Education wanted change to occur and I was a willing agent of change. This combination of a department wanting change and a teacher that had a vision for the depth of change the PEI mathematics teachers were ready for, furthered the successful implementation of the new mathematics curriculum. A mathematics curriculum committee, comprised of a mathematics teacher from each of the high schools in the province, the Head of the Mathematics Department at the University of Prince Edward

Island (UPEI), and a mathematics teacher from Holland College assisted in the development of the guides by reviewing my initial writings. Their comments were reflected in subsequent revisions of the curriculum guides. This collaborative approach to writing curriculum guides was welcomed by Island teachers. Since my arrival to the position, the following curriculum guides have been written, one for grade ten, two for grade eleven and three for grade twelve mathematics courses.

Purpose of the Inquiry

My purpose for initiating this inquiry was to explore the perceptions of PEI mathematics teachers and their receptiveness towards the introduction of the new mathematics curriculum guides. In particular, I wanted to determine the degree of use of the new curriculum guides. Just as importantly, I was interested in teachers' perceptions on the usefulness of the curriculum guides. In this time of outcomes-based education, which is a result of educational reform, the use of curriculum guides can focus teacher and student activities to best achieve the course outcomes. This inquiry sought to determine senior high academic mathematics teachers' perceptions of the use and usefulness of the academic mathematics curriculum guides and in order to do so, an integrated methodologies approach was used. The quantitative component was comprised of a survey and analysis, while the qualitative component utilized a phenomenological approach.

By investigating teachers' views towards these curriculum guides, a secondary goal of this study was to identify a process to be used for future curriculum guide

development.

Definitions

Several of the most commonly used terms in this study are as follows.

For the purpose of this study, the phrase "curriculum guide" will refer to the guides developed for the newly implemented APEF senior high academic mathematics program.

The term "senior high" on Prince Edward Island refers solely to grades ten, eleven, and twelve.

The term "academic mathematics" on Prince Edward Island is equivalent to the term "pure mathematics" used in some other jurisdictions such as in Western Canada.

Lastly, the term "phenomenological approach" refers to how people make sense of experience and transform experience into consciousness. To gather such data, interviews were conducted with teachers who had directly experienced the phenomenon of interest. In this case, these teachers were teaching the new academic mathematics curriculum with the aid of the provincially developed curriculum guide(s). This group of teachers have lived the experience of the topic of interest to this study, as opposed to those who possess secondhand experience (Patton, 2002; van Manen, 1997).

Significance of the Inquiry

Historically, senior high mathematics teachers have not had a provincially developed curriculum guide that was comprehensive in structure to aid them in achieving the outcomes of the mathematics curriculum. Newfield (1982) states that two concepts

define the essence of teaching, one being valued outcomes and the other being intentional intervention. A useful curriculum guide, designed to encourage good teaching, should fulfill both of these objectives. Valued outcomes have been described as clearly delineated, and worthwhile outcomes that students should achieve, while intentional interventions of teachers are teaching strategies that enable teachers to best assist students in achieving those valued outcomes (Newfield, 1982). According to Newfield (1982), guides should not be perceived by teachers as a management tool put out by boards to control teacher activity.

Curriculum guides, if they are to be seen as useful by the teachers, must be written so that the writer of the guides and the teachers both speak the same language (Olson, 1981). As a consultant writing the curriculum guides, I still thought of myself as a teacher and always at the forefront of my mind was the question, "How would I teach this topic?" This mind-set kept me focussed on trying to develop a variety of teaching strategies that would best allow teachers to convey mathematical knowledge, understanding, and appreciation to students. The curriculum guide development process that I followed was comprised of initial writing by the consultant, reviewing by the curriculum committee, and revising by the consultant. Next, classroom teachers piloted the curriculum guide. Final revisions, as a result of pilot teacher feedback, was established as a final step by the mathematics curriculum committee to be responsive to teacher feedback at all stages of the development process. Shkedi (1995) maintains that the curriculum development approach that seeks partnership between external writers and teachers is a good one. Thus Island teachers' views on the use and usefulness of the

guides were invited and received in order to inform future modifications and improvements of the curriculum guides.

Theoretical Framework

A traditional view of curriculum design and development holds that curriculum making is a systematic, linear activity performed by experts (Tyler, 1949) and may still provide the standard model for developing curriculum guides and implementing new curriculum. For example, the APEF mathematics curriculum guides are examples of guides that were developed with essentially little or no teacher input. An opposing view is held by writers such as Olson (1981), Newfield (1984), Clark and Reagan (1988), and Shkedi (1995) where teacher input is invited and desired. This dichotomy of views informed my involvement in the development of the senior high academic mathematics curriculum guides for Prince Edward Island and the implementation of the new APEF curriculum and new resources supporting this curriculum. I attempted to determine teachers' views on the new curriculum guides and the process surrounding the development of the guides. The framework for this study involved a number of researchers. Clark and Reagan (1988) maintain that the interests and values of teachers play an important role in curriculum development and use because it is the teacher who implements the curriculum in the classroom. These researchers state that too often the classroom teacher is overlooked when curriculum is being developed, adopted or adapted (p. 66). Apple (1981) believes that teacher input should be encouraged and even sought. Newfield (1982) claims that many times when writing curriculum guides, the purpose of

helping teachers is lost in the emphasis on student and teacher management. Olson (1981) states that "if a curriculum guide is to be effective, the writer of the guide and the teachers must both speak the same language" (p. 2). Olson (1981) also states, "It is not surprising, then, that the teachers did not use the guides - when they went for guidance, most often they got a lecture" (p. 20). Vann (1994) suggested that curriculum committees should devote considerable time and effort to textbook review, in which teachers have an opportunity to examine books from many publishers. Shkedi (1995) finds that a basic condition for partnership must be a degree of trust and respect. Thus, the partnership between external writers and teachers is important during the curriculum guide development process.

Clark and Reagan (1988) developed a curriculum guide evaluation tool which was a quantitative survey instrument. Their survey questions attempted to probe and measure teachers' opinions on curriculum guides. I believe that it is essential to reach all teachers of the new curriculum guides if the mathematics implementation is to succeed. Thus, I developed a survey questionnaire and a series of open-ended questions for interviewing senior high mathematics teachers to express their opinions on these curriculum guides and the implementation of the APEF mathematics curriculum.

Research Questions

My research investigated the effectiveness of the senior high mathematics curriculum guides in facilitating the delivery of the new APEF courses. The specific research questions are.

1. To what extent are the curriculum guides being used by teachers?

2. Do teachers view the curriculum guides as useful in delivering the curriculum to students?

Chapter Two

Literature Review

In a search of the literature, a number of papers were found on curriculum guide development and curriculum implementation. The themes of the papers were divided into five categories: (1) planning for development of curriculum guides; (2) structural organization of guides; (3) teacher involvement in guide development; (4) guide/program implementation; and (5) guide evaluation.

(1) Planning for development of curriculum guides

There was a paradigm shift in curriculum development from the middle of the twentieth century. Development of curriculum guides was originally a systematic, linear activity performed by experts, devoid of any teacher input (Tyler, 1949), and more recently teacher input was not only desired but sought (Apple, 1983).

When planning for development of new curriculum guides, English (1987) suggests that "useable curriculum guides aren't developed by accident. They are produced after school systems establish a sound plan and set of specifications to which they are the desired product" (p. 50). Littrell (1981) found that "increased use of the guides can be achieved if there is an organized plan for developing them" (p. 32).

Lynch (1988) writes "teachers are unlikely to use the new curriculum guide effectively if they have to familiarize themselves with both a new text series and a new curriculum guide without any system-wide assistance in indexing the two sources" (p. 66). Vann (1994) concluded that curriculum committees should devote considerable time

to textbook review, in which teachers have an opportunity to examine books from various publishers. In the development of the mathematics curriculum guides on Prince Edward Island, the Mathematics Curriculum Committee developed a plan before any curriculum was written. The plan entailed dividing the outcomes into sections that had a sequential presentation of topics and identified an implementation schedule within the time restrictions inherent in a semester credit system. Available resources were identified by the mathematics consultant and were presented to mathematics teachers for teacher feedback on quality of the resources. Curriculum guides were written by the mathematics consultant and revised a number of times using committee and teacher feedback. A schedule of in-services was devised that allowed for more than the provincially allotted time, when necessary, in order to ensure teacher comfort and competence in the new curriculum areas.

(2) Structural Organization of Guides

The research identified how careful planning was necessary in the development of curriculum guides. For example, Armstrong and Shutes (1981) believe that "curriculum documents should be planned, developed, and published so as to organize the subject matter, structure the goals and objectives, and design the learning activities in ways that respond to legitimate staff needs" (p. 200). They listed 12 criteria that curriculum guides should meet in order to be termed a 'quality curriculum document', as follows:

1. legitimacy of the document,

2. credibility of the document,

3. specification of intended learners,

4. specification of intended users,

5. specification of document purpose,

6. scope of document coverage,

7. labelling of content,

8. consistency with other curriculum documents,

9. clarity and useability of format and organization,

10. maintenance of internal consistency,

11. specification of intended document use, and

12. evidence of professional editing and reproduction (Armstrong & Shutes, 1981, p. 200)

Further, M. Hopkin, M. Hopkin, P. Gunyuz, A. Fowler, R. Edmison, H. Rivera, and L. Ruberto (1997) listed four key objectives of a quality curriculum guide:

1. Provide a common curricular reference point,

2. Become a vehicle for open dialogue concerning instructional issues,

3. Hold teachers together in terms of expected outcomes, and

4. Orient new teachers quickly to the curriculum (p. 410).

Olson (1981) suggests that "if a curriculum guide is to be effective, the writer of the guide and the teachers must both speak the same language" (p. 2). Olson (1983) also states that "it is not surprising, then, that the teachers did not use the guides - when they went for guidance, most often they got a lecture" (p. 20). Participants in this study responded to the issues of language used by the writer and the amount of guidance

provided by the curriculum guides after the guides were written.

A theme in Shkedi's (1995) study was that teachers believed a teacher's guide added to and enriched what was found in the textbook. Shkedi (1995) maintains that "a good teacher's guide, many teachers believe, is one that adds to and enriches what is found in the textbook" (p. 168). The participants' opinions on the degree to which the curriculum guide complements the textbook formed part of both the survey and interview as well. In both the survey and the interview components of this study, I asked pertinent questions of the participants in order to determine the degree to which the above criteria had been met in the participants' opinion.

(3) Teacher Involvement

Participants' opinions were solicited on the amount of teacher involvement in the development of the mathematics curriculum guides. Clark and Reagan (1988) state that "the interests and values of the teacher play an important role in the curriculum because it is the teacher who implements the curriculum in the classroom" (p. 66). Newfield (1982) postulates that many times when writing curriculum guides, the purpose of helping teachers is lost in the emphasis on management. Reid (1983) claims that there should be productive collaboration between proposers and practitioners. Do teachers see themselves as valued contributors to this process? Teachers' contributions should be sought in order to involve them in future projects and Shkedi (1995) found that a basic condition for partnership must be a degree of trust and respect. Thus, the curriculum development approach that seeks partnership between external writers and teachers is a

desirable one.

(4) Guide/Program Implementation

The research also explained the implementation process and outlined the issues associated with implementing curriculum guides. Harris (1983) refers to problems and solutions that occur in the implementation process. She found that many times in the implementation of new programs, communication problems arise. Listed below are the problems that Harris (1983) outlined regarding communication.

1. teachers' roles in the dissemination of the new program,
2. evoking teachers' receptivity,
3. adequacy of communication,
4. negotiation and debate within the political arena,
5. adaptation within the cultural milieu of schools and communities,
6. availability of resources, including teachers' skills and suitable technologies, and
7. the soundness and generalizability of approaches (p. 27).

From her study, Harris (1983) grouped the solutions associated with communication problems into the following three areas:

1. Persuasive discourse tends to evoke receptivity to educational approaches (p. 33),
2. Descriptive discourse represents practical examples for use in the classroom (p. 35), and

3. Theoretical discourse formulates general principles and strategies in terms that address practical concerns (p. 36).

Harris (1983) maintains that all three forms of discourse must be present to insure successful implementation of new programs.

(5) Guide evaluation

Two studies were found that identified teacher attitudes towards curriculum guides. Both Clark and Reagan (1988) and Shkedi (1995) employed an integrated methodologies approach with both quantitative and qualitative components. In particular, many of the questions in Shkedi's (1995) study informed the present study's purposes. Teacher interviews formed the basis of Shkedi's study. The interviews were conducted following qualitative-ethnographic interviewing principles and the interviews were not limited to a predetermined list of questions. The interviews were comprised of two parts. The first part, lasting approximately thirty minutes, was concerned with teacher personal background. The second part, lasting thirty minutes, focussed on teacher's opinions on curriculum guides. Shkedi's (1995) study asked four questions of research participants as follows,

1. To what extent do teachers use teachers' guides and to what extent do they need them?

2. What qualities lead teachers to characterize a teachers' guide as effective?

3. What is the image of the author in the eyes of the teacher?

4. What are the teachers' attitudes to teachers' guides, and how do they use them?

In addition, Shkedi (1995) included two secondary questions that guided his inquiry around the fourth primary question, as follows:

> 4 a) Can teachers get along using the textbook and its activities, without reference to the teachers' guide?, and
>
> 4 b) Do the teachers' guide and the curriculum serve for the teacher as a resource for learning new educational approaches? (p. 156).

Forty-three teachers from elementary, junior and senior high participated in Shkedi's (1995) study. One of the findings in Shedkei's study was that most of the teachers did not adhere to the teachers' guide or to the intentions of the authors. Generally, teachers had negative views regarding teachers' guides and their authors. Shedki noted that the basic conditions for partnership and guide author must be a degree of trust and respect; these conditions were found to be lacking among the teachers interviewed in her study. Only a small number of teachers thought that the authors were familiar with the world of teachers. According to the teachers involved in the study, a good teacher's guide gives options for choice, ideas, pedagogy, and content and presents a general overview that facilitates orientation to the curriculum (Shedki 1995).

Chapter Three

Design and Methodology

Integrated Research Methodology

"Not everything that counts can be counted, and not everything that can be counted counts.'

The words on a sign that supposedly hung in Albert Einstein's office at Princeton University was a determining factor to conduct an integrated approach on the use and usefulness of the senior high academic mathematics curriculum guides. This study used an integrated approach that combines both the quantitative and qualitative methods. The survey component of the study utilised quantitative methods while the interview component used a qualitative approach. My background as a mathematics and science teacher initially led me to adopt a quantitative approach, but further reading in research methodologies illustrated the power of adding a qualitative component. Therefore a combination of the two methodologies was chosen as the vehicle for this study, whereby the strengths of both methodologies were sought.

Another factor that led to my decision to include a qualitative component in the study can be found in Patton (2002) where an accountability system was instituted in a school district in Kalamazoo, Michigan. This system was presented as a model for school districts around the country. The quantitative results from a survey questionnaire completed by Kalamazoo teachers would lead one to believe that the system had strong teacher support. For example, when opposition to the results arose, school board officials cited the quantitative data to attempt to quell the unrest. The school board officials were

then directed by the teachers to read some of the substantial number of personal comments submitted by Kalamazoo teachers in the qualitative component of the survey.

An excerpt from one teacher's comments illustrates my reasoning for choosing a qualitative component to this study. I believed that figures and statistics would not be sufficient to develop a clear and complete understanding of the journey involving development and implementation of curriculum guides that Island high school mathematics teachers and I experienced together. In Chapter Five the survey and interview results discuss the lived experience of many Island teachers. The intensity of the teacher's emotions in the following excerpt demonstrates the depth of qualitative research.

> In order to fully understand the oppressive, stifling atmosphere in Kalamazoo you have to 'be in the trenches' - the classrooms. In 10 years of teaching, I have never ended a school year as depressed about 'education' as I have this year. If things do not improve in the next two years, I will leave education. The Kalamazoo accountability system must be viewed in its totality and not just the individual component parts of it. In toto, it is oppressive and stifling. The superintendent with his accountability model and his abrasive condescending manner has managed in three short years to destroy teacher morale and effective creative classroom teaching. While the school board does not 'pay us to be happy' it certainly must recognize that emotional stability is necessary for effective teaching to take place. The involuntary transfers, intimidation, coercion and top to bottom 'channelized' communication in Kalamazoo must qualify this school system for the list of 'least desirable' school systems in the nation. As a result of

reading this and many other teacher accounts, the superintendent 'resigned' and a healing process was begun (Patton, 2002, p. 19).

Qualitative responses by Prince Edward Island mathematics teachers were especially relevant for the research conducted in this study. Too often statistics can play a privileged role in discussions involving research. I believe that once the lived experiences of mathematics teachers are explored, then the depth of their perceptions about the curriculum guides may be revealed. An integration of both quantitative and qualitative methods has allowed the study to achieve a breadth and depth that may not have otherwise been realized.

Quantitative Component

All forty-eight senior high academic mathematics teachers, (PEI Department of Education, 2003b) determined from the school timetables provided to the Department of Education by PEI high schools, on Prince Edward Island were invited to participate in a survey questionnaire and thirty two of these teachers completed the survey questionnaire.

Qualitative Component

Of the thirty-two teachers who participated in the survey, nineteen agreed to take part in the interview process. Interviews were conducted electronically through e-mail messages. Fourteen teachers participated in the electronic interview process. The phenomenon at hand was mathematics teachers' perceptions of the usefulness of the senior high academic mathematics curriculum guides. The approach employed in the study drew from hermeneutic phenomenology where van Manen (1997) states

"hermeneutic phenomenology is a descriptive (phenomenological) methodology because it wants to be attentive to how things appear, it wants to let things speak for themselves; it is an interpretative (hermeneutic) methodology because it claims that there are no such things as uninterpreted phenomena" (p. 180). Phenomenology, by its very nature, is a recollection of past experiences. In the recent past, the mathematics teachers and myself were involved in an exciting process of revamping mathematics curriculum. As stakeholders, we were all interested in improving the mathematics curriculum guides.

Researcher's role

I am the Senior High Mathematics/Science Consultant for Prince Edward Island and in my role am responsible for the writing of the guides for PEI. In addition, I am responsible for implementing the new APEF mathematics curriculum, thus I am interested in teachers' opinions on the guides. Not only I, but the Department of Education, will be able to use the information from this study to improve the mathematics guides and perhaps transfer the methodology by which these guides were developed as a model for development of future guides in other curricular areas.

Permission was granted from both English school boards, and School Principals were asked to contact their high school mathematics teachers (See Appendices A and B). Participation in the study was voluntary and participants were informed that they were able to withdraw from the study at any time (See Appendices C, D, and E). Teachers' identities were protected by the use of pseudonyms and the names of teachers' schools were changed to insure the anonymity of the volunteers.

Data collection methods

The study was mixed mode in that there was a survey questionnaire component where teachers' opinions were solicited and interviews were conducted, which proved a rich source of data (See Appendices F and H). With the consent of each participant, the data from the interviews were electronically stored. The interviews focussed on how teachers make sense of their teaching experience The interviews were phenomenological in nature as the participants have directly experienced the phenomenon of interest; that is they have lived experience (van Manen, 1997).

Participants were clear on my role as researcher and there was no deception or hidden agenda. The time required to complete the survey and to take part in the interview was made clear to participants before they agreed to participate in the study. The interviews were open-ended by design, but I felt that it was important to be able to explore other themes, as they emerged. There were a number of open-ended questions that permitted participants to expand on their responses or digress if they wished and I found that digression was more the norm than the exception.

Data management strategies

The survey data was compiled in tables and graphs. The data were housed in both electronic and hard copy formats in a secure location. The interviews were categorized and coded. I coded the interviews for more efficient analysis of categories, themes, and patterns.

Data analysis strategies

The structural synthesis phase of the study permitted the survey data to be compiled in the form of tables and graphs, which allowed for patterns to be discerned. Statistical analysis, including calculation of mean and confidence interval, were performed using a Texas Instruments Graphing Calculator (TI-83+). A detailed step-by-step procedure, including calculator screens, is shown in Appendix G. The interview transcripts were read carefully, and coded for categories, themes, and emerging patterns. The responses of all participants were grouped together by question to facilitate coding for themes and patterns. For example one theme that emerged through the interviews was the perception that participants had of the curriculum writer. Although specific questions on the teacher perceptions of the curriculum writer were not asked, many participants comments specifically on that topic. Typically, qualitative research reveals themes that were not part of the original focus of the research. When using inductive reasoning, a researcher analyses data searching for themes or emerging patterns from which conclusions or recommendations may be drawn. This process of compiling data in a logical format allowed patterns to be discerned.

Trustworthiness

The trustworthiness of qualitative research depends on four factors: credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985). The first component of trustworthiness to consider is credibility. Credibility addresses the issue of the manner in which the research was conducted. For example, was the research carried

out in a logical and orderly fashion? Further, the credibility of qualitative research has three facets: rigorous methods, credibility of the researcher, and belief by the researcher in the value of qualitative inquiry in general (Patton, 2002). Rigorous methods were utilised through the use of triangulation by using a survey, an interview, and narrative of my experiences as a mathematics consultant. Participants who agreed to participate in the study signed a letter of informed consent and completed a survey. Further, fourteen of the survey participants agreed to participate in an interview conducted via email. As well, the interviews had a combination of fixed (closed) questions and open-ended questions. Patton (2002) states "In qualitative inquiry the researcher is the instrument. The credibility of qualitative methods, therefore, hinges to a great extent on the skill, competence, and rigour of the person doing fieldwork" (p. 14).

My belief in the value of qualitative research cannot be overemphasized. For example, if a teacher in the classroom demonstrates a lack of interest in the subject being taught, students will sense this very quickly and troubled times may lie ahead for that teacher or class. Similarly, if the qualitative researcher does not demonstrate a belief in the value of qualitative research and competence in conducting qualitative research, then the participants will be able to detect the researcher's shortcomings and the validity of any data collected may be suspect.

I believe that the findings of the study could be transferable and applicable in many other areas of curricula and to other educational institutions, as well the gaining of peoples' perceptions of curriculum guides in other areas of study can be investigated effectively using similar qualitative means. However, decisions regarding the

transferability of these findings will rest with the reader of the research.

The interview questions probed participants' perceptions towards the usefulness of the guides in a reflexive manner and not simply a reflective manner (Cole and Knowles, 2000). Coles and Knowles (2000) state that

> Reflective inquiry is an ongoing process of examining and refining practice... whereas Reflexive inquiry, on the other hand, is reflective inquiry situated within the context of personal histories in order to make connections between personal lives and professional careers (p. 2).

Thus, even though the frequency that a curriculum guide is used may decrease with teacher familiarity with the subject area, a teacher will not forget the degree to which the guide aided in the initial transition to the new APEF curriculum.

In Chapter Four, I will share an 'epoche' where I give a description of my own experience in the development and implementation of the academic mathematics curriculum guides. This bracketing phase is in a sense my baseline data. In the data analysis chapter, I have conducted "phenomenonological reduction" (Marshall and Rossman, 1999, p. 113) where theming the data allowed for separation according to categories, themes, and emerging patterns. Finally, in a 'structural synthesis' phase, these categories and emerging patterns were analysed for teacher perspectives on the guides use and usefulness.

Limitations

Decisions made in research design inherently create limitations and some of the possible limitations of this study are discussed below.

My close involvement as the writer of the mathematics curriculum guides could be perceived as a possible source of bias. It could be argued that my knowing all PEI mathematics teachers on a first name basis could have influenced only, positive feedback from the research participants. Throughout the development process, teachers were always free to voice constructive criticism. Criticism was maintained on a professional level with the goal of developing useful curriculum guides for students and teachers.

The majority of participants were mathematics majors, many of whom were well versed in new methodologies and assessment practices as espoused by the many National Teachers of Mathematics documents. The concerns that PEI mathematics teachers expressed relating to the direction that APEF was taking in regards to new resources must have been prevalent in order for the PEI Department of Education to take action. At the time, I was a mathematics teacher at a local high school and was not privy to the degree of dissent with the APEF documents, but I would assume that it must have been widespread enough for the Department of Education to take such a drastic measure as pulling out of the resource development project. The mathematics committee was comprised of mathematicians that were recommended by their respective principals. It would be safe to assume that their principals would have perceived them as successful mathematics teachers. Some of these committee members may have had a vested interest in keeping the status quo by not recommending a new textbook which utilized a radically new

approach to teaching.

Another limitation of the study is that teachers who opposed the new mathematics curriculum did not participate in the survey. The opinions of the teachers that did not participate in the study could have provided suggestions on how the guides could have been provided.

A final limitation of the study is the broad age ranges used in questions one (years of teaching experience) and six (age of participant). These questions could have been improved by either presenting the same ranges for each question, or simply asking respondents to provide their own numbers.

Chapter Four

Development Process of the Mathematics Guides

The Mathematics curriculum guides were developed by following the English Programs Division's mandate found in the School Administrators Education Handbook published by the Prince Edward Island Department of Education (2003a). For the purposes of clarity, the policy is outlined below from the 2003 Handbook.

Course Development/Update Procedure

1. The Department of Education assesses the effectiveness of existing school courses in consideration of the Province's educational goals and the needs of students. The following information is used as part of the assessment process:

    a. reports from teachers

    b. submissions from school boards/district

    c. submissions from community groups

    d. government studies and initiatives

    e. academic and professional literature in education

    f. the results of testing programs (eg. PISA, SAIP)

2. The decision of whether or not to proceed with development of a revision project is made by the department based upon:

    a. the result of the assessment

    b. the impact on other existing courses/programs

    c. recommendations from appropriate curriculum committees

d. approval of the appropriate Standing Committee if major changes are involved

e. fiscal considerations

3. The curriculum development work is carried out by an Ad Hoc Curriculum Committee in conjunction with a Department of Education consultant. Nominations to a committee are requested from schools within each board/district, and, if appropriate, from Holland College or the University of Prince Edward Island. The committee:

a. assesses strengths and weaknesses of the present course or program

b. determines, with reference to provincial education goals and any appropriate Foundation Documents, the outcomes for the new or revised course

c. evaluates instructional materials

d. provides input on curriculum guides

e. makes recommendations on pilot projects and in-service training for pilot teachers.

4. Based on recommendations from the Ad Hoc Committee and the Consultant, the appropriate Department of Education Coordinator:

a. submits a request to the appropriate Standing Committee for approval in principle and to the Director for final approval

b. consults with school boards to identify pilot schools and teachers

c. insures that pilot materials are ordered and that appropriate in-service training is carried out

5. The Department of Education monitors the progress of the pilot projects and provides information back to the Standing Committee. With this information the committee:

a. reviews the progress of the project and recommends discontinuing the project, continuing the project, or proceeding to implement a new or revised course

b. revises, as needed, the course of study to reflect any course changes

c. makes provision for in-service training and other supports which will ensure effective implementation.

The implementation of the procedure outlined above helps ensure that high quality, effective courses are available in the schools of the province.

The province of Prince Edward Island jointly with the other provinces in the Atlantic region agreed to proceed with developing a common Atlantic Canada mathematics curriculum. An Ad Hoc Mathematics Curriculum Committee was formed in the mid-1990's and proceeded to review material written by the publisher for the new APEF mathematics textbook.

The mathematics curriculum committee consists of a representative from each of the ten Island High Schools, the Chair of the Mathematics Department at the University of Prince Edward Island, a mathematics instructor at Holland College, and the provincial senior high mathematics consultant. Meetings were held at least once a month and

occasionally, when necessary, bi-monthly. In the years leading up to 1999, the APEF mathematics curriculum had been delineated in great detail with numerous specific curriculum outcomes (SCO's) developed jointly by the four Atlantic Canada mathematics curriculum consultants. The PEI mathematics curriculum committee had struggled for years with the direction that APEF was taking in textbook development. The perseverance of the Island mathematics teachers and the willingness of the Department of Education to respect the wishes of the teachers, the APEF textbook development project for PEI was abandoned. It would have been all too easy for Island mathematics teachers to give up on the process entirely. Future Island mathematics teachers may be thankful for a dedicated core of teachers that persisted in their efforts on the direction that mathematics instruction should take on PEI.

The mathematics consultant was to attend regional APEF meetings where the four Atlantic mathematics consultants discussed the SCO's and the subsequent curriculum that should follow from those outcomes. Many times through those meetings PEI was questioned for abandoning the textbook project. I had to defend the process that PEI was using against some strong criticism. In recent conversations with teachers from the other Atlantic provinces, a common opinion was that the APEF text was not practical for daily use in the classroom.

Another of my roles, as mathematics consultant, was to write curriculum guides specifically for PEI. Two alternative mathematics resources were piloted, resulting in the selection of resources different from those chosen in the other Atlantic provinces.

Beginning with the grade ten mathematics guide in the Fall of 1999, units were

written which the mathematics curriculum committee reviewed. The suggested revisions were made to the guides and the courses moved to pilot projects. The teachers involved with the piloted courses were in-serviced for each of the courses. Towards the end of each of the pilots, the teachers were brought together to review the curriculum and to determine the appropriateness of each curriculum guide. Suggestions for changes to each guide were proposed by the pilot teachers and the guides were then revised. Each course was then ready for implementation and the teachers involved in implementation were offered a series of in-services, where implementation issues were addressed. The time-lines for the pilot and implementation of the six courses were as follows.

September 1999	I started to write the mathematics guides
February 2000	Pilot Math 421A (grade 10)
September 2000	Implement Math 421A, pilot Math 521A (grade 11)
February 2001	Pilot Math 521B (grade 11, second course)
September 2001	Implement math 521A, pilot Math 621A (grade 12-college & university arts), pilot Math 621B (grade 12-university science)
February 2002	Implement Math 521B
September 2002	Implement Math 621A and Math 621B
February 2003	Pilot Math 611B (grade 12-trig, calculus course)
February 2004	Implement Math 611B

Mathematics teachers on PEI and the Department of Education became partners to develop and implement mathematics curriculum guides. As an experienced teacher, I was

able to bring a degree of credibility to the project and as well as a large measure of energy and know-how to the project. Throughout the entire process the Department of Education listened to and respected teachers' wishes. The entire project from the beginning was teacher-driven. When teachers made suggestions for changes to the guides, the mathematics curriculum committee respected those wishes and the changes were made. The Department of Education provided leadership and vision to facilitate these changes. Mathematics teachers on PEI should be commended in that they recognized current trends in mathematics reform in the areas of content, teaching methodologies, and assessment strategies and responded to those reforms enthusiastically and in a balanced manner. In the National Council of Teachers of Mathematics publication, Principles and Standards for School Mathematics (2000) the vision for school mathematics is stated.

> Imagine a classroom, a school, or a school district where all students have access to high-quality, engaging mathematics instruction. There are ambitious expectations for all, with accommodation for those who need it. Knowledgeable teachers have adequate resources to support their work and are continually growing as professionals. The curriculum is mathematically rich, offering students opportunities to learn important mathematical concepts and procedures with understanding. Technology is an essential component of the environment. Students confidently engage in complex mathematical tasks chosen carefully by teachers. They draw on knowledge from a wide variety of mathematical topics, sometimes approaching the same problem from different mathematical perspectives or representing the mathematics in different ways until they find

> methods that enable them to make progress. Teachers help students make, refine, and explore conjectures on the basis of evidence and use a variety of reasoning and proof techniques to confirm or disprove those conjectures. Students are flexible and resourceful problem solvers. Alone or in groups and with skilled access to technology, they work productively and reflectively, with the skilled guidance of their teachers. Orally and in writing, students communicate their ideas and results effectively. They value mathematics and engage actively in learning it (p. 3).

This NCTM vision was constantly in the minds of the PEI mathematics curriculum committee members, as the development of the curriculum guides progressed.

Chapter Five

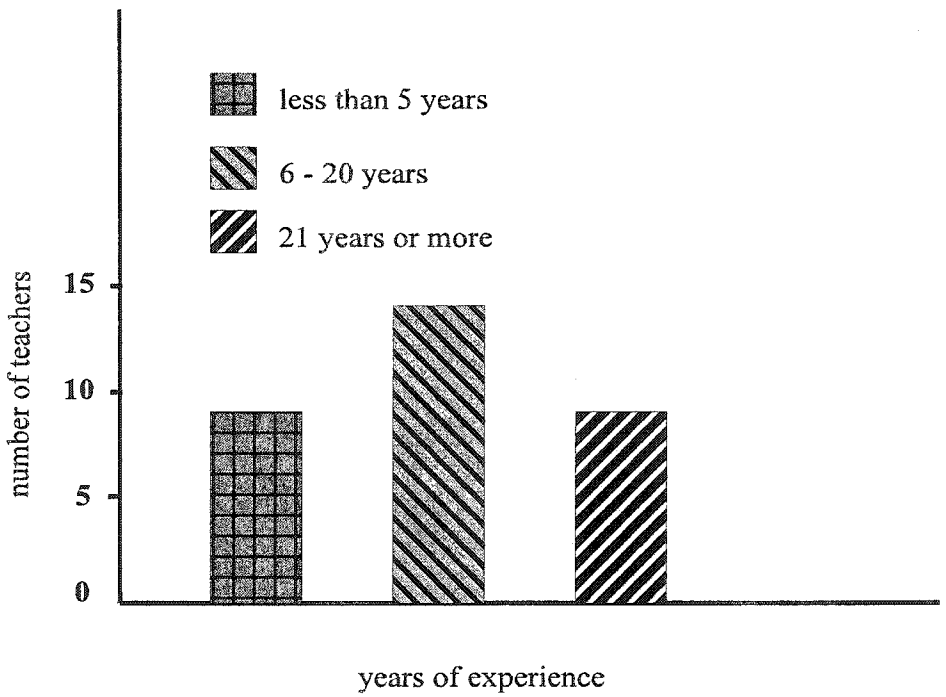
Survey and Interview Results

This chapter reports results from the research in two sections. The first section presents the data from the quantitative survey comprised of teacher demographics and teacher perceptions on the use of the mathematics curriculum guide and each of its component columns. The second section presents the results of the interviews, which investigated teacher perceptions on the usefulness of the new mathematics curriculum guide and on teacher involvement in the development of those guides.

Survey Results

Figure 1 indicates the years of experience of teaching mathematics for the participants.

Figure 1
Years of Experience



Thirty two out of a total of forty-eight mathematics teachers completed the survey. Figure 1 shows the years of teaching experience indicates an equal number of teachers in the early years of their careers, as compared to the teachers in the latter part of their careers.

Figure 2 indicates the mathematics training of teachers.

Figure 2
Mathematics Training of Teachers

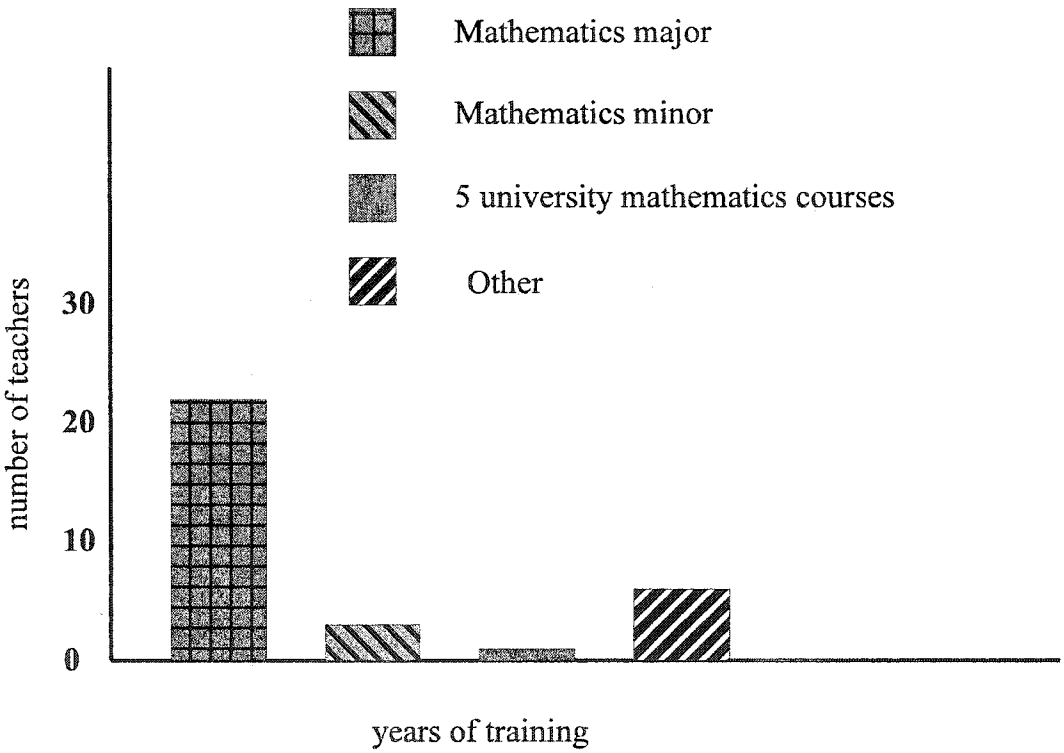


Figure 2 clearly indicates that the vast majority of participants had a major in mathematics which should indicate a high competence in mathematics understanding and possibly instruction as well.

Table 1 gives a breakdown of mathematics teacher ages and genders.

Table 1

Age of Mathematics Teachers

	25 or under	26 - 35	36 - 45	46 or over
Number of teachers	1	13	4	14
Numbers of males		5	3	8
Number of females	1	8	1	6

The largest group is in the 46 or over category indicating a possible shortage in a number of years, but the next largest group is in the 26 - 35 age range. These teachers potentially could be teaching for another 20 years or so. Interestingly, in the two younger age categories women outnumber men 9 to 5 indicating that more women are choosing mathematics teaching as a profession than are men. Just the opposite is true in the two older age categories, as men outnumber women 11 to 7. Are more women than men choosing teaching as a profession or is this simply something unique to the mathematics profession on Prince Edward Island? Figure 1 indicates that 9 teachers have less than 5 years of teaching experience. Table 1 shows that only 1 teacher is under 25 years of age while 13 are between 26 - 35 years of age. Taken together, we can deduce that of these 13 teachers between 26 - 35 years of age most of them are at the lower end of this age range.

Table 2 demonstrates the acceptance of the new mathematics curriculum by senior high mathematics teachers.

Table 2

Curriculum Change Perception

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
The new curriculum in senior high academic mathematics has been a welcome change.			5	16	11

The sample mean for Table 2 was $\overline{X} = 4.1875$ with a sample standard deviation of $S_x = 0.6927$. A 95 % confidence interval yielded a range of 3.9378 - 4.4372. As 27 of 32 participants either agree or strongly agree with the statement "the new curriculum in senior high academic mathematics has been a welcome change". It can be said with a degree of confidence, that the new mathematics curricula has been welcomed by senior high mathematics teachers.

Table 3 investigated teacher views on the helpfulness of column 1 (the specific curriculum outcomes) in the guide.

Table 3

Column 1 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 1 in the curriculum guide is helpful in determining what students are to learn		1	5	21	5

The sample mean for Table 3 was $\overline{X} = 3.9375$ with a sample standard deviation of $S_x = 0.6690$. A 95 % confidence interval yielded a range of 3.6963 - 4.1787. Mathematics teachers used column 1 in the guide. Before the introduction of these mathematics guides, Prince Edward Island mathematics teachers were not using curriculum outcomes to define their teaching activities. This may partially account for the mean for Table 3 being lower than the mean for Table 2. Nevertheless, 26 of 32 participants agree or strongly agree that column 1 in the curriculum guide is helpful in determining what students are to learn.

Table 4 demonstrates teacher perceptions on the helpfulness of column 2 in the academic mathematics curriculum guide.

Table 4

Column 2 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 2 in the curriculum guide is helpful planning teaching strategies for each unit.			3	14	15

The sample mean for Table 4 was $\overline{X} = 4.375$ with a sample standard deviation of $S_x = 0.6599$. A 95 % confidence interval yielded a range of 4.1371 - 4.6129. The table indicates that 29 of 32 participants agree or strongly agree that column 2 was helpful in determining what students are to learn.

Table 5 investigates the extent to which column 3 is used by participants when choosing assessment strategies for each unit.

Table 5

Column 3 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 3 in the curriculum guide is helpful in choosing assessment strategies for each unit			5	21	5

The sample mean for Table 5 was $\overline{X} = 4.0$ with a sample standard deviation of $S_x = 0.5774$. A 95 % confidence interval yielded a range of 3.7882 - 4.2118. The table indicates that 26 of 31 (1 participant left this question blank) participants agree or strongly agree that column 3 was helpful in choosing assessment strategies for each unit.

Table 6 indicates participants use of column 4 in the mathematics curriculum guide.

Table 6

Column 4 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 4 in the curriculum guide is helpful in choosing which problems students will do to meet the learning outcomes.			1	10	21

The sample mean for Table 6 was $\overline{X} = 4.625$ with a sample standard deviation of $S_x = 0.5536$. A 95 % confidence interval yielded a range of 4.4254 - 4.8246. The table indicates that 31 of 32 participants agree or strongly agree that column 4 is helpful in choosing which problems students will do to meet the outcomes.

Table 7 indicates the frequency of use of the mathematics curriculum guides by participants.

Table 7

Curriculum Guide Use

	1 Use the guide daily	2 Use once every 2 or 3 days	3 Use guide once a week	4 Seldom use the guide
Number of teachers	8	11	10	3

The sample mean for Table 7 was $\bar{X} = 2.2813$ with a standard deviation of $S_x = 0.9914$. A 95 % confidence interval yielded a range of 1.9238 - 2.6387. The table indicates that 19 of 32 participants use the guide daily or once every 2 or 3 days. Two of the three participants that indicated that they seldom use the guide wrote a clarifying statement indicating that the first couple of times through the course they used it on a daily basis. One of the participants that indicated that they seldom use the guide, did not have any in-service on the new curriculum and the use of the new curriculum guide. Of the ten participants that indicated use once a week, one indicated that they used the guide on a daily basis the first couple of times through the course. A second of these participants indicated that the first couple of times through the course they used the guide once every two or three days. Three of the participants indicated that they use the guide once a week and that they did not receive formal instruction on the new curriculum and the use of the curriculum guide.

Table 8 indicates participant perceptions on the guides allowing for adaption of teaching style to student needs and various situations.

Table 8

Adapting of Teaching Style

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Do the guides allow you, as a teacher, to adapt your teaching style to your students and situations?			6	19	7

The sample mean for Table 8 was $\overline{X} = 4.0313$ with a standard deviation of $S_x = 0.6468$. A 95 % confidence interval yielded a range of 3.7981 - 4.2644. 26 of 32 participants perceived that the guide allowed them to adapt their teaching style to students or situations.

Table 9 results on a participant's ability to teach without using the guide are shown below.

Table 9

Teach without using the Curriculum Guide

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Can you, as a teacher, teach mathematics using the textbook and its activities, without reference to the mathematics curriculum guide?	9	13	3	5	2

The sample mean for Table 9 was $\overline{X} = 2.3125$ with a standard deviation of $S_x = 1.2297$. A 95 % confidence interval yielded a range of 1.8692 - 2.7558. The table indicates that 22 of 32 participants strongly disagree or disagree with the statement that participants could teach mathematics using the textbook and its activities, without reference to the mathematics curriculum guide. Two of the participants that agreed or strongly agreed with this statement wrote a note stating that they believed that they could teach without the use of the guide, but that they would prefer not to do so.

Table 10 deals with participants' perceptions on the efficacy of the guide to facilitate new teaching approaches.

Table 10

Curriculum Guide serve as a Resource for New Teaching Approaches

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Does the mathematics curriculum guide serve the teacher as a resource for learning new teaching approaches?		2	6	17	7

The sample mean for Table 10 was $\overline{X} = 3.9063$ with a standard deviation of $S_x = 0.8175$. A 95 % confidence interval yielded a range of 3.6115 - 4.201. The table indicates that 24 of 32 participants agreed or strongly agreed with the statement that the mathematics curriculum guide serves the teacher as a resource for learning new teaching approaches. Two participants disagreed with this statement. One of these participants did

not take part in the interview process. This teacher is in the last years of a teaching career and seems to be resistant to methodological changes. The second participant that disagreed did participate in the interview but unfortunately was not provided with professional development on the use of the guide and the methodological changes involved in the new mathematics program. This seems to be an unfortunate disposition, as the participant is a teacher who has just begun a teaching career.

An analysis of variance (ANOVA) was conducted to determine if there was a relationship between the mathematics education of participants (Figure 1) and the frequency of use of the guide (Table 7). A strong correlation was shown to exist ($p = 0.007$) indicating that the participants that were mathematics majors used the guide significantly more frequently than the other groups (See Appendix G, Table 11).

A similar analysis conducted on the relationship between the number of years of teaching experience (Table 1) and frequency of guide use (Table 7) is shown to have no significant relationship (See Appendix G, Table 12).

Lastly, an analysis of the relationship between the number of years of teaching experience (Table 1) and teachers' perceptions of the helpfulness of the guide in planning teaching strategies (Table 4) reveals no significant relationship (See Appendix G, Table 13). A closer inspection of Table 13 shows that the vast majority of teachers, regardless of the number of years of teaching experience, perceive the guide to be helpful in planning teaching strategies.

Interview Results

Of the thirty-two participants that completed the survey, fourteen participated in the interview component of the study. The qualitative portion of this study is phenomenological and the phenomenon in question is mathematics teachers' perceptions of the usefulness of the senior high mathematics curriculum guides. van Manen (1997) states that "phenomenological reflection is not introspective but retrospective. Reflection on lived experience is always recollective, it is reflection on experience that is already passed or lived through" (p. 10). The participants in this study have lived experience, not merely second-hand knowledge. As well, the new mathematics curriculum has been in use for a number of years allowing for teachers to have had time for recollection and this study is timely because teachers can still recollect their lived experience with the new curriculum. In this section, the interview questions are presented one question at a time, along with the corresponding participants' responses and the participants' perceptions are initially presented without any interpretation on my part. Participants' perceptions, however are their own personal interpretations of the events in question. According to van Manen (1997) hermeneutic phenomenology "is a descriptive (phenomenological) methodology because it wants to be attentive to how things appear, it wants to let things speak for themselves; it is an interpretive (hermeneutic) methodology because it claims that there are no such things as un-interpreted phenomena" (p. 180). Participants responded to the nine interview questions and were willing to participate in the interview phase of the study and give quite detailed and lengthy responses to the questions.

(1) What effect has the introduction of these curriculum guides had on your teaching?

I wanted to explore the effects, if any of the curriculum guides on participants' teaching and the content that was covered in class. Respondents generally remarked that the guide was clear in its expectations of content to be covered to illustrate the effects. The following excerpts were selected from email conversations. Mary, a relatively new teacher, comments on the guide taking the guess work out of curriculum content decisions. John, a teacher with more than twenty years of teaching experience, comments on the uniformity of content coverage that the guide can bring to mathematics courses across Prince Edward Island. Marissa, a new teacher, perceives the guides have standardized curriculum across PEI. She brings a unique perspective in that she was educated in the "pre-curriculum guide era" in PEI. Lisa, a teacher with over thirty years experience briefly describes her use of the guide. Frank, describes his use of the curriculum guides with intense emotions. Jason, a teacher in mid-career, exhibits his dedication to being a life-long learner willing to learn new content and methodologies. Martina is confident that her course content is on par with what other teachers on PEI are doing. Alissa believes that the guides clarify both depth and breadth of content to be covered. Larry, an experienced teacher, has been exposed to new teaching approaches. Sam, a teacher in late career is the least enthusiastic of the participants to the changes that the guide caused on his teaching. Erin, a teacher relatively new to high school, feels that they have been essential in setting clear expectations.

As a relatively new teacher with four years' teaching experience behind me,

these guides could not have been developed at a better time. The 621A and 621B pilots were run during my first full year of teaching, and it certainly made life much easier having a guide with examples, problems, and resources with which to build my notes and to shape the course. Having such an organized and thorough curriculum guide, set up in much the same way that I would do things, meant that I was able to "survive" my first time through the course; knowing what came next and the topics of importance made my initial trip through the course considerably less stressful (Mary, email interview, Nov 28, 2003).

Because the guides were made for Island teachers by Island teachers at the request of Island teachers who rightfully opposed the implementation of an impractical program on a whole region, I have bought into the idea of using the guide faithfully (well, almost ...) and expect that other teachers in the province to be doing so as well. No longer do I expect any student on P.E.I. to be "lost" when he changes schools within the province and to a certain extent, within the country (John, email interview, Nov 27, 2003).

It is so nice to have a layout for what is recommended for each course as well as ideas about how to try to communicate the concepts. These guides have made my first year of teaching, as well as my practice teaching experiences, much easier and more comfortable. They allow me to feel that I am covering the material that I am supposed to. Now I think there is more continuity in the material covered throughout the Island. From a student perspective in the old curriculum, I can see how these guides have been designed to support the post secondary education of

our high school students (Marissa, email interview, Nov 13, 2003).

I refer to the guide on a regular basis. Often download parts of the guide to copy (Lisa, email interview, Nov 26, 2003).

I have found that the curriculum guides have been absolutely essential. I couldn't imagine teaching without them (Frank, email interview, Dec 12, 2003).

I have increased my knowledge in several areas of Mathematics and also been introduced to new teaching strategies (Jason, email interview, Dec 14, 2003).

The Math 621A and B guides were extremely helpful for me to plan my courses. It really helps me keep my course on par with other teachers, and helps keep the level of problems that students solve at the same level as others across the province (Martina, email interview, Dec 2, 2003).

With the new guides the expectations of depth and breath to which each curriculum item is to be covered is very clear. They are a great guide in preparing lessons as suggested teaching methods and activities are included (Alissa, email interview, Nov 24, 2003).

The guides have exposed me to different approaches to the material that I would have otherwise not considered. Also, the guides provide extra material right at my fingertips (Larry, email interview, Nov 20, 2003).

I have only been teaching at the high school level for 4.5 years, but since I have been here, I have found that the curriculum guides have been absolutely essential. I couldn't imagine teaching without them. They have been invaluable in that they have clear and concise expectations (Erin, email interview, Dec 13,

2003).

> It has helped me have an idea of where I should be time-wise with the new courses and the topics and depth needed to cover. The guides have influenced me to use calculators somewhat more, although I do not use them as much as the guides suggest. (Sam, email interview, Nov 24, 2003).

For the most part, participants perceptions of the guide's effect on their teaching was positive. The implementation of the new mathematics curriculum through the new curriculum guides has been a welcome change for senior high mathematics teachers and a common phrase heard at in-services was 'it's about time'!

During my twenty-five years of teaching, I never received any in-service in the subject area of mathematics, nor did the mathematics curriculum change over that time. Experienced teachers showed their enthusiasm for change at the in-services that spread to teachers new to teaching. The curriculum guides facilitated a smooth transition to the new curriculum by clearly and concisely providing suggestions for teaching methodology, assessment practices, and applicable resources. After all the interviews were completed, it was apparent that Sam exhibited less commitment to the use of the curriculum guides than the other participants. Sam's and Erin's responses stood out in that the other participants were quite enthusiastic about the helpfulness of the guide in expanding their teaching strategies.

(2) Could you give me a picture of how you use the guide to prepare your lessons in mathematics?

The following participants indicated that the curriculum guide was used either

daily or quite frequently for both unit and lesson planning. Mary bases her lesson planning closely on the guides. John, an experienced teacher, went a little off-topic and never did answer the question, but did express strongly how the guides have rejuvenated his teaching. Marissa, Erin, Mark, and Frank explain the degree to which they use the guide in lesson planning.

> For the 621A and 621B courses, and now the new 611B course, I sit down with the textbooks, guides, and a calculator, usually at least a couple of months ahead of time, and I create my course notes and class examples based upon the content and suggestions made in the guides. I work through the sample problems given in the guide myself, and those often appear as class examples later on; I also try some of the suggested problems and incorporate those into my notes as well. In short, my own notes are very much based upon the guides themselves (Mary, email interview, Nov 28, 2003).

> Without answering your question I would say that what has changed is not how lessons are prepared but rather the consistency with which lessons are prepared. I used to do exploration activities, extension activities, and real-life applications. Often though, these were done on a hit and miss basis. Pleading "too busy," "not enough time" , "couldn't find appropriate materials" and "I wouldn't dare do anything like that with that group", I managed to meet the needs of some of the students some of the time. The new curriculum guides force me to abandon my excuses and force me to take much of the abstract out of math. They have made me a better teacher (John, email interview, Nov 27, 2003).

I have the guide on my desk at all times. I refer to it daily (Marissa, email interview, Nov 13, 2003)!

I used the curriculum guide page by page, reading through the outcomes required, the examples given, making up new examples, looking up resources suggested, and finally, going through the suggested problems that were given as a guide (Erin, email interview, Dec 13, 2003).

I always read it unit by unit, and every unit is read through thoroughly before that unit is delivered to the class. It helps me make a map for my course, what I will teach in what order, and helps me plan how long I will spend on each topic (Mark, email interview, Nov 27, 2003).

I was very reliant on curriculum guides (and still am) particularly in my first year of teaching. I started planning the course by reading the entire guide. Then I took a close look at each unit individually. All individual lesson plans we directly related to the text, its suggests problems and resources (Frank, email interview, Dec 12, 2003).

The participants showed a reliance on the curriculum guides for direction in content, time-lines, teaching strategies, and assessment strategies. Thus, the curriculum committee was instrumental in creating a teacher-friendly curriculum guide that would be used and useful in a teacher's day-to-day life in the classroom. The guides are rooted in the classroom practices and are perceived to be a necessary tool for successful delivery of the mathematics curriculum.

(3) Have these changes led to a broadening of your teaching skills?

With the advent of the new mathematics curriculum and the new curriculum guides, I was interested in teachers' perceptions of how their teaching strategies were affected. The following teachers give an account of how senior high mathematics and the teaching of it has changed, dramatically in some instances. Mary perceives the guide has helped her answer the question 'Why do we have to learn this?' while Karen and Frank perceive the guide has facilitated the use of graphing calculators. Mark has enjoyed the increased dialogue among teachers. Martina has used the guide and in-services to add to her teaching strategies, while keeping some of her tried and tested methods. Sam, Lisa, and Erin, on the other hand, did not perceive that the guide has broadened their teaching strategies. Lisa perceived that her teaching skills were not broadened as a result of the introduction of the guides, while Lauren perceived that her skills were merely supplemented.

> Absolutely. The guides will often suggest approaches to problem solutions or applications of theory with which I may not be completely familiar or may not even be aware of at all. The dreaded question "Why do we have to learn this?" comes to mind; although this is *sometimes* not a welcome question from students (although it's amazing what that very question will do for a lesson plan when asked *just* at the right moment–like a Hollywood script!), it inevitably comes up every so often, and the guides have given me some new answers to that very question–both to share in class, and even an answer or two that was new to me. Being a good teacher doesn't just mean that you teach others ... it also means that you have to be

willing to teach *yourself* by being open to new ways of doing things (Mary, email interview, Nov 28, 2003).

Obviously, I have been exposed to new teaching strategies and these have been helpful. The guides have forced me to become more organized in my presentation because the guides are excellent at showing how one lesson follows from another and how that particular lesson will bridge the next. Specifically, I have been forced to learn how to use graphing calculators and computers in new ways and I, and my students, have benefited from the skills attained (Karen, email interview, Dec 20, 2003).

Definitely. In the introduction of the new guides , teachers had several opportunities to share ideas with fellow teachers. It has increased dialogue between schools. I have also been exposed to other ideas from the examples in the guides (Mark, email interview, Nov 27, 2003).

There has been quite a change in grade 12 curriculum guides since I have started teaching. I found they are helpful in my organisation of the course. They provide more guidance for order of not only units but also individual lessons. As well, there are many suggestions of how to relate lessons to life, how to offer a variety of types of lessons, and how to incorporate the graphing calculator. It definitely facilitates the process of making more interesting lessons, and stepping away from the "mold" (Frank, email interview, Dec 12, 2003).

I feel that these changes have had a positive effect on my teaching skills, since they allow me to view the material in a different way. This allows me to contrast

what I have done in the past with what I am doing now and adopt the new approaches, combine the new and the old, or keep what I have done in the past (Martina, email interview, Dec 2, 2003).

Other than the use of calculators in some areas, not much (Sam, email interview, Nov 24, 2003).

I feel that I have always been very organized and have always been prepared well for the courses that I have taught, so no... I don't think the changes have made much of a difference in my teaching skills (Erin, email interview, Dec 13, 2003).

I wouldn't say my teaching skills have been broadened by the changes but rather supplemented (Lauren, email interview, Dec 12, 03).

The teachers' comments clearly indicate that they perceive the curriculum guides have added to their teaching repertoire. A teacher-based curriculum committee ensured that the NCTM Principles and Standards for School Mathematics was the basis for change in direction in mathematics in PEI. By comparing Sam's responses to question one and three, it appears that Sam used the guide to determine content, depth of coverage, and time-lines but has not used it to expand his teaching strategies. Similarly, Erin uses the guides to determine expectations of course content with her response to question three demonstrating that she is quite content with the teaching methodologies that she presently uses. As several participants indicated, the guides can offer much more to teachers than simply content and time-lines. Curricular change happens slowly and these responses demonstrate the spectrum of change that is taking place within the mathematics teaching community on PEI.

(4) Has the development process of the guides afforded you with sufficient opportunities for input into the content of the guides?

Of the respondents whose comments are given below, two were on the provincial mathematics curriculum committee and I was also interested in the perceptions of non-committee members. In general, the opinion among participants was that input into the structure and content of the curriculum guides was both welcomed and valued. In particular, Alissa's comments were interesting in that she has taught in provinces other than PEI and has experienced the separation between board-level teachers and government consultants.

> I have a bit of a bias with respect to this question, as I have been a member of the senior high math committee for a couple of years now, and having seen, for example, the 611B guide as a work in progress (at least, the latter units), I can certainly say that I've had many opportunities for input (Mary, email interview, Nov 28, 2003).

> Yes!! And even now I am confident that a good suggestion or a valid complaint would result in a lesson being revised. I am impressed that the Department allowed a very dedicated committee enough time to do the job properly and that the ordinary teachers were given so much time for in-service. Mr Roper was the ideal leader. He incorporated everyone's ideas without gutting the heart and soul of the new program and refused to grumble when new suggestions required more sacrifices to his "free" time and family life (John, email interview, Nov 27, 2003).

During the pilot programs, the in-services were designed so that we could discuss the success and the pitfalls that we had encountered. I believe that we all had the opportunity to give input to the content of the guides (Lisa, email interview, Nov 26, 2003).

We are so fortunate here on PEI to have had many opportunities for input and been fortunate to have people at the department level who welcomed our input (Mark, email interview, Nov 27, 2003).

Definitely! I have had the opportunity to be close to the development most of the time. If I hadn't been involved in the process, I guess it would depend on the teacher at the school who was involved and how much they involved other teachers. But the process does lend for input from pilot teachers and others (Frank, email interview, Dec 12, 2003).

As a provincial senior mathematics committee member, it certainly did. However, since the provincial committee had representation from all English Prince Edward Island high schools, there was a direct link to all P.E.I. high school mathematics teachers. This clearly enabled all teachers to have a say, either directly or indirectly, at the Department level (Jason, email interview, Dec 14, 2003).

I am very pleased with the input that I was able to give. I feel very fortunate to be at the point I am in my career to be starting to teach these courses at the same time the guide is being implemented. The in-services are wonderful and provide a great opportunity to hear how other teachers are using the guide. I am also in a

small school and am constantly discussing material with the other math teachers at the different levels. If there are any concerns (another mathematics teacher) will address them or I can always give you a call. This is a wonderful opportunity that arises from being in a small school and small province. I am sure there are many teachers in other provinces that wouldn't even consider calling their Senior High representative at the Department (Alissa, email interview, Nov 24, 2003).

Yes. We got a draft version which we used for a month or two, then had time together with Ken at an in-service where we could suggest changes or additions. Ken was very quick to incorporate suggestions into the final version (Sam, email interview, Nov 24, 2003).

While two of the responses illustrated above were from mathematics curriculum committee members so they might be perceived to have a bias, the remaining four participants were not on the curriculum committee and still believed that their feedback was valued and utilized. This perception emerged as a common theme among interview participants. In fact their perception was accurate because teachers' opinions were always listened to, brought to the curriculum committee table and discussed, and those teachers with comments were given direct feedback, either from the curriculum committee member at their school or from the mathematics consultant directly. For example, at a recent grade ten science in-service in June 2004, two of the science teachers at the in-service who previously taught in a neighbouring province, voiced their praises to the entire assemblage of teachers for the degree of teacher-input that grade ten science teacher across PEI were having in developing the new grade ten science curriculum for PEI. I have always found

that teachers want to have a say in matters that directly affect their working lives. The Department of Education views their involvement in the curriculum development process as key to having a successful implementation process occur. I, as science consultant, do believe that I need teacher guidance and assistance in developing a new grade ten science curriculum for PEI that will meet the needs of students in the twenty first century.

(5) What are you looking for in the writing style and approach in curriculum guides?

The perceptions of teachers as to the writing style of the curriculum guides was an interest of mine as well. The following teachers' responses encompass a wide range of ages and teaching experience. A common theme in their responses is that the guide should be easy to read, clear, and concise. One teacher mentioned connections to the real world as being helpful while another teacher perceived the included problem and activity sheets to be an asset.

> I am looking for a style that is straightforward and easy to understand. I appreciate when terminology and formulas are set out. I also like the subheadings that separate concepts. They make it easy to reference what I am looking for quickly. I think the approach is good because it offers a variety of strategies (like developmental and a more traditional style). I also like how there are connections to where the math would be used in the real world. It might be nice to see some more elaboration on a topic like this as it tends to spark good discussion. Overall I am looking for a style that pairs with the textbook but is not identical and that is straightforward and allows for individuality (Mary, email interview, Nov 28,

2003).

> I look for a very simple, straight-forward, "no-nonsense" writing style, containing only the important, relevant information and no excessively technical jargon, for lack of a better word. If I can't follow or get "turned off" by a wordy, vague curriculum guide, then what can I hope to expect from the students? The guide must be hands-on, user-friendly, and both logical and consistent in terms of layout (outcomes - theory - examples - problems, basically the same from one page to the next); although I have seen few samples of other curriculum guides in my relatively short teaching career, the current senior high guides are very close to what I might envision as the "perfect math curriculum guide" (Karen, email interview, Dec 20, 2003).

> Easy to read. I like them to be clear enough that a first year teacher can rely on them to help him/her through the course. I really like the suggested resources and activities. The prepared problem sheets, activity sheets are really useful (Jason, email interview, Dec 14, 2003)!

> Writing style. Well it was good. Concise and direct. Just like a math teacher. The first time through a course you're really relying on the guide. You don't have time for verbiage - you just need help getting through your next lesson (Sam, email interview, Nov 24, 2003).

Participants generally perceived the writing style to be clear, concise, and 'just like a math teacher'. Teacher feedback obtained at the various stages of the development of the curriculum guides ensured that the guide would be as teacher-friendly as possible.Many of

these comments will be echoed later in the responses to question nine, 'What constitutes a good curriculum guide?' Shkedi (1995) reported that teacher-defined criteria of a good guide that,

> presents alternatives and offers freedom of choice, suggests pedagogical activities, offers an overview of the curriculum, structure, rationale, and purposes, offers content knowledge, is organized and systematic, presents material in a practical, useable manner, offers bibliographic assistance, lends itself to rapid implementation, relates to various types of situations, and presents instructional methods (p. 160).

Teachers in this study mentioned many of the same criteria as in Shkedi's (1995) study. It appears that teachers in both studies have very common sensical, down-to-earth expectations for curriculum guides if the documents are perceived to be useful. Most teachers specifically commented that they did perceive the writing style and approach in the curriculum guide to be appropriate and useful.

(6) Has the implementation of the new mathematics curriculum shown a close fit between the new resources and the guides? In what way was this achieved?

The featured teachers in this section share a common belief that the curriculum guides and the associated resources are closely aligned so that implementation is simplified. The teachers believed that the close alignment was brought about by collaboration between curriculum committee members, teachers, and the mathematics consultant.

> There is certainly a very close fit between the resources and the guides. I've

seen resources which outline topics to cover in a certain course, but make no reference to an accompanying textbook, or contain relatively few concrete examples/applications. That may be because the guide was written in advance of the choice of a textbook, or perhaps because the textbook changed somewhere along the way. Our guides were written specifically to match the textbooks: section by section, problem by problem. As mentioned in my response to the first question above, such precision made preparation for these math courses much less painful than it otherwise might have been–it leaves no margin for error or for guesswork, as problems and examples are chosen from a specific resource to meet specific outcomes (Mary, email interview, Nov 28, 2003).

In the courses that I have taught I have seen a fairly close fit between the guides and the resources. The suggested problems of course come from the resources, and I find that in most cases the strategies follow a similar or the same format as the textbook suggests. The guides usually extend the ideas in the textbook and look at other ways to assess and explain the concept. I find that the combination of the guides and the book is excellent and I rarely need to go in search of other resources (John, email interview, Nov 27, 2003).

It has been a very close fit...The input of the pilot teachers and the flexibility of the curriculum committee and the math consultant have all helped to achieve this goal (Erin, email interview, Dec 13, 2003).

Definitely. The guide was developed in conjunction with the resource as well as the curriculum we wanted included. The chapters that didn't fit , we developed

with additional booklets (Mark, email interview, Nov 27, 2003).

It certainly has! It is clear that the curriculum is written with a certain resource in mind. It is not written for the resource however, which is good. But for every unit in every course there is direct reference to a resource (or more than one!). If there is no resource available to teachers then there is prepared material to supplement the guide. It is obvious that relating the curriculum material to the resources has been a priority (Frank, email interview, Dec 12, 2003).

Yes, it is easy to take the guides and suggested resources and follow through to achieve the goals. The SCO's give the big picture, the Elaborations - Instructional Strategies/ Suggestions help plant seed for planning while the worthwhile tasks lead variety for both instructional examples and assessment ideas (Jason, email interview, Dec 14, 2003)!

There has been a great fit achieved between the new resources and guides. This has been achieved mainly though the Suggested Resources column which tells you exactly what pages and problems to cover to achieve the outcomes. This makes things so much easier!! There are so many problems and so much material in these texts that, without the suggested resources and Instructional Strategies, a teacher could spend days on a section (Martina, email interview, Dec 2, 2003).

The curriculum guides and the resources used in the new senior high mathematics courses were designed to be closely aligned for ease of use. This was one of the principal focuses of the curriculum committee. Mary's response to this question seems to indicate that she feels that the curriculum guide is the source for all of her mathematics teaching-

related questions. This would be disappointing if it were a common perception of teachers. The goal is to have teachers realize that a textbook is but one resource that they should consult when designing instructional and assessment activities for a *course.* Similarly, the curriculum guide should not be perceived as the ultimate source, to the exclusion of all others, which teachers should refer to when answering curriculum questions. As the name suggests, the purpose of a curriculum guide is to serve as a guide.

(7) Describe how you were able to align the guide and the resource after in-servicing.

When I conducted the in-services for each course, the document that was the basis of each course was the curriculum guide. Teachers were led through it in great detail in order to illustrate how the outcomes might best be achieved and only then did I refer to the resources. I tried to model for the teachers that the course was determined by the curriculum guide rather than by the resource, and my interest in asking this question was to determine if teachers understood this relationship. These teachers' responses indicated that teachers still rely heavily on a textbook and think that it is "the curriculum". The curriculum guide was intentionally aligned closely with the resource so that teachers were certain as to what content was to be covered and to what depth.

To answer this question, I'm thinking back to the 611B in-service that I attended in town earlier this week. At the meeting, we went over the first couple of units in the new course and "ironed out a few wrinkles," so to speak. I had already gone through the first three units myself over the Christmas holidays, creating notes, examples, and so on as mentioned above. At the meeting, I was able to

refine those notes and clarify some things that I wasn't sure about; for example: how much of the trig equations should be done by hand versus via technology? Based on opinions around the table and on the experience of teachers already through the course once, I was able to get a good idea of how to proceed. That was just one of a dozen "minor things" that I wanted some clarification on, and now, having received that, I will go back to my notes and make additions and modifications as necessary. The in-services are so valuable in that respect–they are a means to see whether I'm on course with what I think I should do, and tell me how to change or modify some aspect of the course if I discover that I may be a little off course (Mary, email interview, Nov 28, 2003).

Each of the paired pages of the guide seemed to go with one section of the book, therefore it was very easy to follow along in a logical order (Lisa, email interview, Nov 26, 2003).

The guide is very clear to what resources and articular sections to refer to in each unit/topic. While reading through the guide, I am always reading the corresponding unit of the resource , which is outlined in the unit (Frank, email interview, Dec 12, 2003).

As with any new curriculum, I can feel overwhelmed with all the parts, the guides, resources, black masters etc. The in-service helped by giving me a sense of how to put the pieces together and work with them as a whole (Jason, email interview, Dec 14, 2003)!

After in-servicing, I was able to implement the extra resources found at the

end of each section in the guide at the appropriate times or coordinate them with the instructional strategies to deliver a more effective lesson (Martina, email interview, Dec 2, 2003).

Easy to follow and understand. The moving back and forth between different books and resources not in the regular text would have required immense time and this was avoided because the guide did that for us (Sam, email interview, Nov 24, 2003).

The participants in the interview perceived that alignment of the guide and the resource was close. One focus of the in-services was to closely relate the guide with the new resources, so that when teachers went back to the classroom their use of the curriculum guide would be integrated with the use of the resources. Teachers simply saw the curriculum guide as another resource that would better allow them to teach the curriculum. With most teachers of senior high mathematics in PEI having little past experience using provincially mandated curriculum guides, the focus of the curriculum guide development process was dictated by teachers on the curriculum committee and by pilot teachers with the idea of making it teacher-friendly and easy to use. After teachers have had experience with employing curriculum guides in their teaching of mathematics, it would be an interesting follow-up to revisit teachers' perceptions on what constitutes a good curriculum guide.

(8) What other mathematics curriculum guides have you read?

Senior high mathematics teachers on PEI have not previously had comprehensive curriculum guides for use and I was interested in determining their exposure to curriculum

documents from other jurisdictions. The following teachers' responses were representative of the responses from the sample.

None, other than those provided by the Department (Karen, email interview, Dec 20, 2003).

PEI/APEF 7-9 (Marissa, email interview, Nov 13, 2003).

I have read our old ones. I also have read some of the provincial guides for the Atlantic region. They are much more difficult to follow..not to the point (Erin, email interview, Dec 13, 2003)!

As indicated above, I haven't seen many other guides, other than the online ones that I occasionally come across when I'm browsing the Web. After all, I haven't been teaching all that long, and I'm not certain that I would be the best person to answer this particular question. However, I believe that the current curriculum guides are far superior to anything else that I've seen, for many of the reasons mentioned above, including ease of reading, logical and consistent setup, and the fact the guide was written to match a specific resource or set of resources (Mary, email interview, Nov 28, 2003).

As I was on the curriculum committee for a few years in the development stage , I had the opportunity to look at programs across Canada and we looked at Quebec , the Maritimes , and Ontario as well as Western Canada (Mark, email interview, Nov 27, 2003).

NB, NS, Ont, BC (Frank, email interview, Dec 12, 2003).

I read the curriculum documents in Ontario when I was teaching there in the

early '90s (Larry, email interview, Nov 20, 2003).

Many PEI senior high mathematics teachers were unfamiliar with the daily use of curriculum guides in their classrooms. Unless these teachers were on the mathematics curriculum committee they may not have examined any other mathematics curriculum guides, and this notion was revealed in the responses of the participants.

(9) What is a good curriculum guide to you?

I wanted to determine teachers' perceptions of what comprised a 'good' curriculum guide. The following teachers' responses to this question offers a picture of how the senior high mathematics guides were received by PEI teachers.

> To answer this question, I refer you back to my responses to both the previous question and the question on what I might look for in terms of style and approach. To summarize it all, though, I believe one sentence will suffice: the guide must continue to be useful throughout its shelf life, until the next revision or update rolls around. It must be useful for all of the reasons mentioned above, and it must be useful in the sense that if a teacher needs to verify something, he or she will actually go to the shelf, pull down the guide, and look it up ... at *any* time. From what I hear, sometimes, too many guides end up as paperweights or dust collectors on a shelf somewhere, opened when new but never looked at again. As long as a guide is useful, for the reasons previously mentioned, then it is good. I can whole-heartedly and honestly say that our new math curriculum guides are very useful and very well done, and will serve me well as an often-consulted resource in the years ahead (Mary, email interview, Nov 28, 2003).

A good curriculum guide is one that is user-friendly. It is one that is written for the teachers who will use it rather than those who critique it. It is one that often needs to be replaced because it is actually been used (Karen, email interview, Dec 20, 2003).

One that follows a logical order of presentation as one would teach the material. It provides us with numerous ways to instruct as well as assess. It provides us with suggestive topics of interest as well as suggested exercises to follow from the resource. It gives us the freedom to try new things while we teach the outcomes, but also shows us sites on the internet to move our teaching careers forward. Our senior high school curriculum guides in mathematics are the best I have read. I commend Ken Roper for his intellect and foresight in writing such a useful guide. It is teacher friendly (Erin, email interview, Dec 13, 2003)!!!!

A good curriculum guide is one that is very organized, logical in chronological order, gives many examples, gives other suggested resources, gives worksheets as extra, gives answers to the questions suggested, and has reasonable time lines for completion of the program. In short, the guides for the grade 11 and 12 programs NOW. Thanks, Ken (Lisa, email interview, Nov 26, 2003).!!

One that states the objectives clearly and then gives suggestions for achieving the objectives and where we can look in the resource for questions. It has to be something that can be easily fit into a lesson plan without doing a lot of research. What I like about the guide is that the consultant has already spent countless hours researching the topics and current teaching strategies and then has passed on this

information to us in the guides. If we are not up on a specific area , there are extra notes to help us out. As far as I am concerned , the work on this guide was exceptional (Mark, email interview, Nov 27, 2003).

Our current documents are great. I don't particularly care about the Outcomes, but you need to have some eduspeak in these documents. The outlines, suggested examples, chapter time lines, suggested homework have all been very useful to me. I wish all the courses I taught had such practical guides (Larry, email interview, Nov 20, 2003).

Given that many of the participants in this study had not previously used mathematics curriculum guides on a daily basis, their perceptions that the current guides are good is gratifying for me. They are quite pleased with the guides, which may allow for a good working relationship between the Department of Education and the senior high mathematics teachers in PEI when it comes time for the guides to be updated. The responses to this question augmented the participants' responses to Question Five regarding writing style and approach in curriculum guides. The responses were very similar to those in Shkedi's (1995) study. A collection of descriptors used by participants' of a good guide are: useful throughout its shelf life (Mary), user-friendly (Karen), logical order of presentation, numerous ways to instruct and assess, suggestive topics of interest, suggested exercises from the resource, freedom to try new things while we teach the outcomes (Erin), very organized, logical in chronological order, gives many examples, gives other suggested resources, gives worksheets as extra, gives answers to the questions suggested, reasonable time lines (Lisa), states the objectives clearly, gives suggestions for

achieving the outcomes (Mark), suggested examples, time lines, suggested homework (Larry). Teachers in this and Shkedi's (1995) study in Israel shared many common perceptions as to what constitutes a good curriculum guide. It would appear that teachers, be they in PEI or Israel, seem to want much the same features in curriculum guides.

I look forward to the evolution of future versions of these guides with respect to writing style and approach. I hope that as teachers in PEI gain familiarity with curriculum guides over the years, that teachers and the Department of Education and teachers can continue to collaborate to improve the mathematics curriculum guides.

Chapter Six

Discussion

Background

The K - 9 Mathematics guides, the K - 9 Science guides, and the K - 12 Language Arts guides were all developed by APEF. As a result, PEI teachers had minimal input into the content and format of these particular curriculum guides.

The focus of this research was on improving a program and suggesting a blueprint for future curriculum guide/program development. The development of the six academic mathematics curriculum guides was the first large scale attempt at provincially developed curriculum guides. The English Programs Division at the Department of Education mandated procedures for curriculum development/revision, as described in Chapter Four, were strictly applied. PEI teachers were instrumental in the development and implementation of the new mathematics curriculum and the curriculum guides at senior high. Teachers recommended major purchases involving manipulatives, graphing calculators, and texts. Teacher input was consistently welcomed and heeded. In-service schedules were devised by the curriculum committee, which frequently exceeded the provincially mandated two day in-service allotment for new programs. For example, many courses required and were granted four days of in-service. Curriculum consultants at the Department of Education are seconded teachers and maintain a close connection to the classroom, to teachers, and to students. Every request that the mathematics curriculum committee made, I discussed with my coordinator and the answer was always, 'Yes let's do it, or yes, let's buy it!' My role was very much as a facilitator simply helping the

process build momentum and excitement. Teachers were treated as the professionals that they are and I am very pleased to say that Island senior high mathematics teachers rose to the challenge, not surprisingly, and passed the test with flying colours.

Use of the Guides

The previous senior high mathematics curriculum guide was an 18 page document that covered all senior high academic mathematics courses and basically delineated the provincially approved resource and the chapters to be covered. Essentially, senior high mathematics teachers had little or no experience with using detailed curriculum guides mandated by the Department of Education. I was interested in determining teachers' perceptions as to the helpfulness of each of the four columns in the standard two page, four column layout. Shkedi's (1995) does not enlighten us on the format of the guides that the teachers in the study were using. The format of the mathematics guides that I wrote was predetermined by APEF and not open to change (see Appendix I). The contents of the four columns was however open for discussion around the mathematics curriculum table. The committee members insisted that of primary importance for the content of the columns was teacher-friendliness and usefulness. Participants' responses to Questions Nine through Twelve demonstrated that all four columns were perceived to be helpful in content choices, teaching strategies, assessment alternatives, and choices of specific problems to best address the outcomes.

Shkedi (1995) surveyed 43 elementary, middle, and secondary teachers. The teachers in the study were classified according to five subject areas: science and mathematics, humanities and social sciences, foreign language, arts, and general

elementary subjects. One of Shkedi's (1995) secondary questions was whether or not teachers used the curriculum guide. Shkedi (1995) found that 47% of teachers did use the guide, while only 37% of respondents indicated they needed the guide with only 33% of science and mathematics teachers indicating that they used the guide. Shkedi's study (1995) did not determine frequency of guide use but only whether the guide was used or not. When designing the current study I believed that more detail as to frequency of use would be helpful. In this study responses to question thirteen indicated that nineteen of thirty two participants use the curriculum guide on a daily basis or once every two or three days. Four participants stated that while they seldom use the guide now, the first couple of times teaching the course they used the guide daily. Three of the nine participants that used the guide once a week indicated that they had received no in-service on the use of the guide which may have been a determining factor in their lack of guide use.

Shkedi (1995) found that 83% of respondents did not see the teachers' guide as a resource for learning about new instructional approaches. In contrast, Table 10 reveals that 24 of 32 participants agreed or strongly agreed with the statement that the mathematics curriculum guide did serve as a resource for learning new teaching approaches. The other three columns of the guide were perceived by the majority of teachers to be helpful as well.

In this study a positive correlation was found between the mathematics education of participants and the frequency of guide use (Table 12). A strong correlation ($p = 0.007$) existed to show that mathematics majors used the guide significantly more frequently than the other groups.

Table 11

Mathematics education and frequency of guide use(Interview results)

	10 Mathematics major	1 Mathematics minor	1 5 courses in mathematics	2 Other
Daily use	2	1	0	0
Use once every 2 or 3 days	4	0	1	0
Use once a week	3	0	0	1
Seldom use	1	0	0	1

Table 11 indicates that mathematics majors were the largest group of participants in the interview phase of the study demonstrating their commitment to use of the guides.

The curriculum guides in many instances provides multiple teaching strategies which may allow for traditional teachers to maintain their traditional teaching practices. The mathematics curriculum committee believed that traditional teachers, if exposed to new teaching approaches, might test some of theses approaches in their classrooms. The mathematics committee believed that a curriculum guide that dictated a single teaching approach might collect dust in many teachers' closets. Curricular change, if it is to happen at all, is usually a gradual process and not a sudden cataclysmic event. Paradigm change, in teaching or elsewhere, does not happen overnight. The PEI mathematics curriculum guides were written to give teachers encouragement in adopting current teaching practices and not to alienate and distance teachers.

Shkedi (1995) indicated a positive correlation between years of teaching

experience and curriculum guide use. A similar analysis of the data in my study revealed no such correlation between years of teaching and curriculum guide use with teachers of varied years of experience using the guide equally (Table 13).

An analysis of the data found no correlation between the number of years of teaching experience and teachers' perceptions of the helpfulness of the guide in planning teaching strategies. In fact, Table 14 reveals that 29 of 32 participants agreed or strongly agreed, regardless of the number of years of teaching experience, with the statement that the curriculum guide was helpful in planning teaching strategies. Shkedi (1995), in contrast, determined that 83% of respondents stated that they could get along using the textbook and its activities, without using reference to the teachers' guide.

The Shkedi (1995) study was useful in providing ideas for research on the use of curriculum guides, but was not applicable to the PEI context as it existed. Modifications were required to allow for the participation of mathematics teachers alone. A number of other modifications were required to facilitate the collection of relevant data.

Usefulness of the Guides

What is perhaps more revealing is the interview results. Question one stated: What effect has the introduction of these guides had on your teaching? Participants stated that they downloaded parts of the guide from the internet for use in class, the guide gave time lines for them to follow, provided new teaching strategies. All 14 interviewees responded that the guide had positively affected their teaching.

In response to question three relating to broadening of teaching skills, nine responded that their teaching skills had been broadened with the introduction of the

guides, three replied that their skills had not been broadened, while one was a first year teacher and had no past history of teaching and could not comment on the question. Many positive comments that have been recorded in Chapter Five indicate the depth of teachers' perceptions and satisfaction with the professional development that they have experienced.

Shedki's (1995) research revealed that 27% of respondents saw the authors of the curriculum guides as removed from the world of teaching. Shedki (1995) reports one teacher stating "The planners have to come down from Olympus and see what their 'subjects want..." (p. 161). As well 48% of teachers in Shkedi's (1995) study thought that the authors had a negative opinion of teachers. Although I did not specifically ask the participants these questions, a number of responses demonstrated the positive perceptions that teachers had of the curriculum writer. The perceptions were that the writer respected teacher input into curriculum guide content and instituted suggested changes whenever and wherever possible. On a personal note, I never considered myself as the expert in writing curriculum and looked to teachers for feedback on ways to improve the usefulness of the curriculum guides. My belief is that for guides to be used they must first be useful. Both use and usefulness must go hand in hand in order for curriculum guides to be employed by teachers. If a resource is not useful, then I believe that it will not be used. This study considered both the use and usefulness of the guides using an integrated approach to research methodology.

Shkedi (1995) determined that teachers had little role in the development of the curriculum guides which they were asked to use. This was in sharp contrast to the mathematics curriculum guides developed on PEI where teachers were equal partners in

the development of the guides. In the responses to question four on teacher involvement in curriculum guide development, several participants in this study made specific reference to the fact that they used the guides because they were developed with the assistance of PEI teachers. Several participants commented specifically on the feedback that they were able to give and also that their feedback directly affected the content and focus of the guides. I believe that without teacher acceptance, use of the guide decreases as Shkedi's (1995) results indicated.

In relation to question nine on qualities of a good curriculum guide, Shkedi's (1995) responses respondents believed that a good curriculum guide was characterized by adaptability, content, organization, and ease of use as the most important qualities. In this study teacher comments on qualities of a good guide included phrases such as user-friendly, logical order of presentation, provides numerous ways to instruct and assess, provides suggestive topics of interest, gives freedom to try new things, gives worksheets and answers, gives other suggested resources, suggests reasonable time lines for completion of the program. Both studies revealed that teachers looked for similar qualities in curriculum guides. Shedki's (1995) results revealed that many "teachers saw the student text as a sort of teachers guide" (p. 163). In stark contrast, many of the teachers in this study perceived the curriculum guide to be essential to teaching a mathematics course.

This perception was shared by teachers with many years of teaching experience and new teachers as well. Several teachers that did not receive in-service on the new curriculum did not see the curriculum guide as necessary at all. A number of other teachers used the guide to a lesser degree after teaching a new course for a year or two.

The generally accepted notion that mathematicians are cold, calculating fish has certainly been convincingly dispelled relating to mathematics teachers on PEI. The passion with which many, many teachers spoke resonated loudly and clearly indicated the professionalism and zest that PEI mathematics teachers demonstrated by embracing the new mathematics curriculum and changes to teaching methodologies. PEI senior high mathematics teachers can be justly proud of what they have created. The breadth and depth of teachers' perceptions on both the use and usefulness of the guides were quite revealing and has made me believe that my years of hard work on this project have been valued.

Chapter Seven

Conclusion and Recommendations

Conclusion

The experience of Island mathematics teachers in relation to the implementation of the new mathematics curriculum has been outlined in Chapter Five. The discussion in Chapter Six will inform the reader's perception of the use and usefulness of mathematics curriculum guides for academic courses in high schools. The survey results demonstrated the use of the guides by PEI mathematics teachers and the interview responses reinforced the survey results. The interviews illustrated the depth of commitment that PEI mathematics teachers have to the curriculum guide and its usefulness.

My own experience over the duration of this project has been a gratifying one. I consider myself fortunate to have been able to contribute in some small way to the success of the project. My twenty-five years of teaching experience was taxed to the limit on many occasions, but I continued to learn in a meaningful way. I spent many hours reading current research on the latest trends in teaching methodologies, assessment, and new topic areas. This was a challenging and rewarding venture that enabled me to include many of those new ideas in the curriculum guides. An opportunity like this does not come along, for many, even once in a career.

I cannot say enough good things about the support that my superiors at the Department of Education gave to this project. It is certainly a credit to the commitment felt by the Department to do things right. This supportive atmosphere fuelled my desire to write the best curriculum guides possible. My many evenings and weekends spent reading

or writing mathematics was a pressure on my family life, but it was professionally rewarding.

Recommendations

My purpose in initiating this study was to obtain feedback on the degree to which the curriculum guides were being used and the perceptions of PEI teachers as to the usefulness of the guide. The results were surprising as to both the degree to which the guide is being used and the perceptions of PEI teachers as to the usefulness of the guide. The depth of passion exhibited by the participants in the interviews was a revelation to me.

One recommendation that I have for the Department of Education is that incoming consultants are made aware of the curriculum development procedures that have been mandated. This project has shown that the curriculum development process, as described in the *School Administrators Education Handbook*, works very well. One advantage that we enjoy on PEI is that we are so small here that we can make this process teacher-driven and thus increase the chances that teachers will accept the new initiative because they are the ones that are heavily involved in its development and implementation.

A second recommendation for the Department of Education is that new teachers coming into the teaching profession be afforded the opportunity to be in-serviced on curriculum that they teach.

A third recommendation is that incoming consultants be reminded that they are first and foremost teachers. As consultants, we must never forget our roots and our duty is to aid and assist teachers and students with all of the resources at our disposal.

A fourth recommendation is that future mathematics or science consultants have

graduate-level education in curriculum theory and instructional design.

Finally, some comments from teachers. One teacher recommended that more sample problems and solutions be included in the curriculum guides.
A second teacher recommended that the guides include more activities and worksheets at the end of each unit, that would possibly be submitted by teachers. Yet another teacher wanted to see more connections to where particular topics would be used in the real world. Lastly, a teacher recommended that each guide contain an appendix containing teacher-contributed activities.

Prospects for Future Research

- One area of future research could be curriculum guide use by these same teachers five years into the future. It would be important information to know if curriculum guide use remained consistent over an extended period of time.

- Future studies could examine the effect the curriculum guide has had on teacher teaching and assessment strategies.

- Another possible area of research could be to look at beginning teacher use of the curriculum guides. New teachers coming into the teaching profession may be more familiar with curriculum guides, due to being introduced to them in the education courses taken in university. It would be of interest to the educational community to identify perceptions of the usefulness of these curriculum guides of beginning teachers.

- Another study could determine if curriculum guide use has become part of the culture of teaching senior high academic mathematics in Prince Edward Island. If so, then I would consider my writing of theses curriculum guides a successful venture. My

goal was to write a series of curriculum guides that teachers would actually use and value as a resource necessary in the teaching of mathematics.

- There is the possibility of replicating the quantitative portion of this study by an external researcher.

- After the next rounds of curriculum guide development, it may be worthwhile to determine the perceptions of teachers on curriculum guide development, level of teacher involvement in the guide development, and what teachers perceive as the characteristics of a good curriculum guide.

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Appendix A

Request for permission for Thesis Research Project - School Boards

Dear

I am a graduate student in the Master of Education in Leadership and Learning program at the University of Prince Edward Island. I would like to request permission to conduct a study of teacher use of senior high academic mathematics curriculum guides in the province.

I have initiated this study for several reasons. In the past, teachers in the province have not used curriculum guides that were designed for outcomes-based education. In addition, knowing how teachers view and use these guides will be important in the successful implementation of the new mathematics curriculum. Recommendations from this research will be submitted to the Department of Education.

An integrated methodologies approach will be utilized, employing quantitative and qualitative components. Specifically, a survey and in-depth interviews have been chosen as the vehicles for this study. The survey component will elicit information on teacher demographics, frequency of curriculum guides use, and comments on the strengths and weakness of the guides. This survey will be sent to all senior high academic mathematics teachers in the province. As well, I propose to conduct in-depth interviews of one hour duration with several mathematics teachers in the province.

The study involves conducting the survey, and tabulating the survey results. Then a purposeful sample of four to six teachers will be chosen to participate in in-depth interviews. This qualitative data will be transcribed and analysed allowing for the writing of a thesis which will assist the Department of Education in determining better ways to provide teacher support. Pseudonyms will be used for participants and names of schools involved in the study.

Following the completion of the study, I will share my findings with all interested educational partners on P.E.I., including a copy of the proposal, the Review of the Ethic Board's approval, and all documentation associated with the research included with this request.

I appreciate your consideration of this request and look forward to your reply.

Sincerely,

Ken Roper

Appendix B

Request for permission for Thesis Research Project - Principal

Letter to Principals of Senior High Schools

Dear

I am a graduate student in the Master of Education in Leadership and Learning program at the University of Prince Edward Island. I would like to invite your participation to conduct a study of teacher use of senior high academic mathematics curriculum guides at your school.

I have initiated this study for several reasons. Senior high mathematics teachers in the province have never used a curriculum guide and have not been familiar with outcomes-based education. Knowing how teachers view and use these guides will be important in the successful implementation of the new mathematics curriculum. Recommendations from this research will be submitted to the Department of Education.

An integrated methodologies approach will be utilized, employing quantitative and qualitative components. Specifically, a survey and in-depth interviews have been chosen as the vehicles for this study. The survey component will elicit information on teacher demographics, frequency of curriculum guides use, and comments on the strengths and weakness of the guides. This survey will be sent to all senior high academic mathematics teachers in the province. As well, I propose to conduct in-depth interviews of one hour duration with several mathematics teachers in the province.

The study involves conducting the survey, and tabulating the survey results. Then a purposeful sample of four to six teachers will be chosen to participate in in-depth interviews. This qualitative data will be transcribed and analysed allowing for the writing of a thesis which will assist the Department of Education in determining better ways to provide teacher support. Pseudonyms will be used for participants and names of schools involved in the study.

Following the completion of the study, I will share my findings with all interested educational partners on P.E.I., including a copy of the proposal, the Review of the Ethic Board's approval, and all documentation associated with the research included with this request.

I appreciate your consideration of this request and look forward to your reply.

Sincerely,

Ken Roper

Appendix C

Letter of Information for Thesis Research Project

Dear

I am a graduate student in the Master of Education in Leadership and Learning program at the University of Prince Edward Island. I would like to invite your participation to conduct a study of teacher use of senior high academic mathematics curriculum guides in the province.

I have initiated this study for several reasons. Knowing how teachers view and use these guides will be important in the successful implementation of the new mathematics curriculum. Recommendations from this research will be submitted to the Department of Education.

An integrated methodologies approach will be utilized, employing quantitative and qualitative components. Specifically, a survey and in-depth interviews have been chosen as the vehicles for this study. The survey component will elicit information on teacher demographics, frequency of curriculum guides use, and comments on the strengths and weakness of the guides. This survey will be sent to all senior high academic mathematics teachers in the province. As well, I propose to conduct in-depth interviews of one hour duration with several mathematics teachers in the province.

The study involves conducting the survey, and tabulating the survey results. Then a purposeful sample of four to five teachers will be chosen to participate in in-depth interviews. This qualitative data will be transcribed and analysed allowing for the writing of a thesis which will assist the Department of Education in determining better ways to provide teacher support.

If you agree to participate in the survey component of the study, your participation will entail completing a survey involving a time commitment of approximately 20 minutes. The survey participants will be asked to volunteer in an in-depth interview. Four or five of these volunteers will be purposefully selected to participate in the in-depth interviews. The in-depth interview will be a commitment of 45 minutes to one hour at a time and location of mutual convenience.

The researcher will ensure participants' confidentiality be maintained through the use of pseudonyms for the teachers' names, along with the names of the schools where the teachers teach. With respect to securing anonymity of the participants, only the Directors of the Eastern and Western School Boards, the principals of the senior high schools of PEI, and the researcher (and assistants, if any) will be aware of the identity of those participating in the survey. With respect to the interviews, only the researcher(and assistants, if any) will be aware of the names of the participants. In addition, the researcher will store data in a locked filing cabinet. Letters of consent will be obtained and secured in a similar manner. Research data will be destroyed after the thesis has been completed. A hard copy of your interview's transcript will be provided you in which you may suggest any changes due to transcription inaccuracies. You have the right to withdraw from the study at any time and you have the right to refuse to answer any question you are not comfortable with. All raw data will be destroyed after the thesis is completed.

This study will be shared with my Thesis Advisory Committee and two members of my thesis committee. The resulting thesis will be published in hard copy and microfiche, which will be housed at the Robertson Library. An informed consent form is enclosed if you choose to participate in which case you may retain a copy of the signed form.

I appreciate your donation of time to this study which should aid Island mathematics teachers and students. If you have any questions, please feel free to call me

Sincerely,

Ken Roper

Appendix D

Informed Consent Form(Survey Component)

Title: Use and Usefulness of Mathematics Curriculum Guides in Prince Edward Island

I, _____, hereby give my consent to participate in the survey component of a research study focussing on the usefulness of the academic senior high mathematics curriculum guides. The purpose of this research is to determine the degree to which the afore-mentioned guides are being used and the usefulness of said guides. Permission to conduct this research has been obtained from both Western and Eastern School Districts of Prince Edward Island.

I understand that information provided will be used in a research study and shared with the researcher's Thesis Advisory Committee. I understand that the study involves answering a survey that will take 20 minutes.

I understand that my participation in this study is entirely voluntary, and that if I wish to withdraw from the study, that I have the right to do so and I understand that I have the right to refuse answering any question I am uncomfortable with. I understand that a pseudonym will be used for my name and for the name of the school where I teach.

I understand that the thesis resulting from this work will be published in hard copy and microfiche, which will be stored at the Robertson Library on the campus at University of Prince Edward Island. A copy of the thesis or executive summary is available upon request.

I understand that I may keep a copy of this signed Informed Consent Form.

Signature of participant _____

Signature of researcher _____

Date _____

I wish to receive a copy of the research results: _____ yes _____ no

Appendix E

Informed Consent Form(Interview Component)

Title: Use and Usefulness of Mathematics Curriculum Guides in Prince Edward Island

I, _____, hereby give my consent to participate in the in-depth interview component of a research study focussing on the usefulness of the academic senior high mathematics curriculum guides. The purpose of this research is to determine the degree to which the afore-mentioned guides are being used and the usefulness of said guides. Permission to conduct this research has been obtained from both Western and Eastern School Districts of Prince Edward Island.

I understand that information provided will be used in a research study and shared with the researcher's Thesis Advisory Committee. I understand that the study involves participation in a tape recorded interview, which will last approximately 60 minutes.

I understand that my participation in this study is entirely voluntary, and that if I wish to withdraw from the study, that I have the right to do so and I understand that I have the right to refuse answering any question I am uncomfortable with. I understand that a pseudonym will be used for my name and for the name of the school where I teach.

I understand that the thesis resulting from this work will be published in hard copy and microfiche, which will be stored at the Robertson Library on the campus at University of Prince Edward Island. A copy of the thesis or executive summary is available upon request.

I understand that I may keep a copy of this signed Informed Consent Form.

Signature of participant _____

Signature of researcher _____

Date _____

I wish to receive a copy of the research results: _____ yes _____ no

Appendix F

Survey Questionnaire On Curriculum Guide Use
In Prince Edward Island High Schools

The goal of this survey is to determine to what extent the curriculum guides are used in Prince Edward Island High Schools by teachers to deliver the academic mathematics program.

PART A - TEACHER INFORMATION

For questions 1 - 7, please place a check mark in the space provided beside the best response(s) to each of the following questions.

1. Including this year, how many years have you been teaching mathematics at the high school level?

_____5 years or less
_____6 - 20 years
_____21 years or more

2. Which of the following statements best describes your education?

_____a major in mathematics
_____a minor in mathematics
_____at least 5 term university mathematics courses
_____other, please specify _____

3. Please indicate which of the following courses comprise your 2002 - 2003 teaching assignment, including courses taught in both semesters.

_____MATH 421A
_____MATH 521A
_____MATH 521B
_____MATH 621A
_____MATH 621B

4. What is the average class size of each of the above courses? If two sections of MATH 421A are taught, average them.

_____MATH 421A
_____MATH 521A
_____MATH 521B
_____MATH 621A
_____MATH 621B

5. What is the enrollment of your school?

_____under 250
_____250 - 499
_____500 - 749
_____750-999
_____1000 or more

6. What is your age?

_____25 or under
_____26 - 35
_____36 - 45
_____46 or over

7. What is your gender?

_____Female
_____Male

PART B - TEACHER ATTITUDES

For statements 8 - 16 circle the number that best reflects the following descriptors:

1 - Strongly Disagree
2 - Disagree
3 - No Opinion
4 - Agree
5 - Strongly Agree

8.	The new curriculum in senior high academic mathematics has been a welcome change.	**1**	**2**	**3**	**4**	**5**
9.	Column 1 in the curriculum guide is helpful in determining what students are to learn.	**1**	**2**	**3**	**4**	**5**
10.	Column 2 in the curriculum guide is helpful planning teaching strategies for each unit.	**1**	**2**	**3**	**4**	**5**

11.	Column 3 in the curriculum guide is helpful in choosing assessment strategies for each unit.	1	2	3	4	5
12.	Column 4 in the curriculum guide is helpful in choosing which problems students will do to meet the learning outcomes.	1	2	3	4	5
13.	Which statement best applies to your use of the curriculum guide. _____ I use the guide on a daily basis _____ I use the guide once every 2 or 3 days _____ I use the guide once a week _____ I seldom use the guide					
14.	Do the guides allow you, as a teacher, to adapt your teaching style to your students and situations?	1	2	3	4	5
15.	Can you, as a teacher, teach mathematics using the textbook and its activities, without reference to the mathematics curriculum guide?	1	2	3	4	5
16.	Does the mathematics curriculum guide serve the teacher as a resource for learning new teaching approaches?	1	2	3	4	5

Appendix G **Tables**

Table for Figure 1

Years of Experience

	Less than 5 years	6-20 years	21 years or more
Number of Teachers	9	14	9

Table for Figure 2

Mathematics Training of Teachers

	Number of Teachers
Mathematics major	22
Mathematics minor	3
5 University mathematics courses	1
Other	6

Table 1

Age of Mathematics Teachers

	25 or under	26 - 35	36 - 45	46 or over
Number of teachers	1	13	4	14
Numbers of males		5	3	8
Number of females	1	8	1	6

Table 2

Curriculum Change Perception

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
The new curriculum in senior high academic mathematics has been a welcome change.			5	16	11

Table 3

Column 1 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 1 in the curriculum guide is helpful in deter-mining what students are to learn		1	5	21	5

Table 4

Column 2 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 2 in the curriculum guide is helpful planning teaching strategies for each unit.			3	14	15

Table 5

Column 3 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 3 in the curriculum guide is helpful in choosing assessment strategies for each unit			5	21	5

Table 6

Column 4 Helpfulness

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Column 4 in the curriculum guide is helpful in choosing which problems students will do to meet the learning outcomes.			1	10	21

Table 7

Curriculum Guide Use

	1 Use the guide daily	2 Use once every 2 or 3 days	3 Use guide once a week	4 Seldom use the guide
Number of teachers	8	11	9	4

Table 8

Adapting of Teaching Style

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Do the guides allow you, as a teacher, to adapt your teaching style to your students and situations?			6	19	7

Table 9

Teach without using the Curriculum Guide

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Can you, as a teacher, teach mathematics using the textbook and its activities, without reference to the mathematics curriculum guide?	9	13	3	5	2

Table 10

Curriculum Guide serve as a Resource for New Teaching Approaches

	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree
Does the mathematics curriculum guide serve the teacher as a resource for learning new teaching approaches?		2	6	17	7

Table 11

Mathematics education and frequency of guide use(Interview results)

	10 Mathematics major	1 Mathematics minor	1 5 courses in mathematics	2 Other
Daily use	2	1	0	0
Use once every 2 or 3 days	4	0	1	0
Use once a week	3	0	0	1
Seldom use	1	0	0	1

Table 12

Mathematics education and frequency of guide use

	Mathematics major	Mathematics minor	5 courses in mathematics	Other
Daily use	7	1	0	0
Use once every 2 or 3 days	9	0	1	2
Use once a week	5	2	0	2
Seldom use	1	0	0	2

Table 13

Years of teaching experience and frequency of guide use

	< 5 years experience	6 - 20 years experience	more than 21 years experience
Daily use	3	3	2
Use once every 2 or 3 days	3	5	4
Use once a week	2	5	2
Seldom use	1	1	1

Table 14

Years of teaching experience and helpfulness of guide in planning teaching strategies

	< 5 years experience	6 - 20 year experience	more than 21 years experience
1(Strongly Disagree)	0	0	0
2(Disagree)	0	0	0
3(No Opinion)	1	1	1
4(Agree)	4	6	4
5(Strongly Agree)	4	7	4

Appendix H

Analysis of Survey Questions

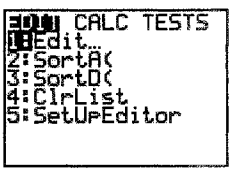
Analysis was completed using a Texas Instruments (TI-83) graphing calculator. To demonstrate the ease of calculation various calculator screens are shown below demonstrating the step-by-step procedure for question 8 in the survey.

Table 4

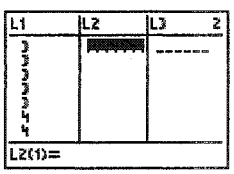
Curriculum Change Perception

	4 Strongly Disagree	Disagree	5 No Opinion	1 Agree	2	3 Strongly Agree
The new curriculum in senior high academic mathematics has been a welcome change.			5	16		11

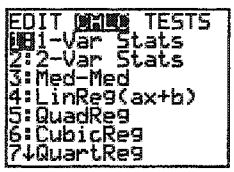
On the calculator press **STAT** which shows this screen.



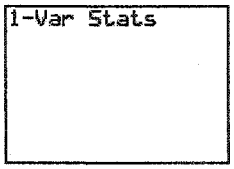
Press **ENTER** and enter the data. Table 1 data is shown.



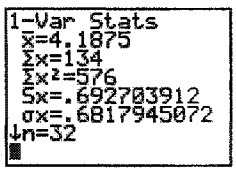
Press **STAT** ▸ cursor over to **CALC**



1: 1-Var Stats is highlighted, press **ENTER**



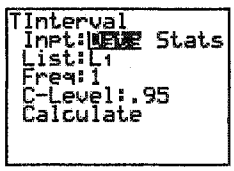
now press **ENTER** again



Shown are the mean $\overline{X} = 4.1875$ and the sample standard deviation $S_x = 0.6927$.

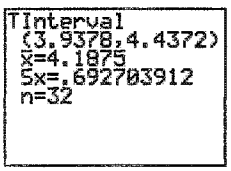
Press **STAT** ▸ ▸ (cursor over to **TESTS**)

Now press **8: T-Interval**



We can see it is going to use the data in $\mathbf{L}_1$ with a confidence interval of .95.

Cursor down to **Calculate** and press **ENTER.**



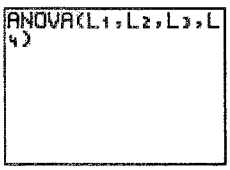
Combining the data in Figure 1 (Mathematics education) and Table 7 (frequency of guide use) into one table yields Table 12.

Table 12

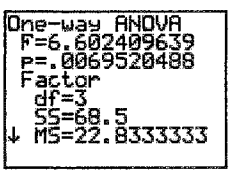
Mathematics education and frequency of guide use

	Mathematics major	Mathematics minor	5 courses in mathematics	Other
Daily use	7	1	0	0
Use once every 2 or 3 days	9	0	1	2
Use once a week	5	2	0	2
Seldom use	1	0	0	2

Once the data has been entered into the lists in the graphing calculator, press **STAT** ▸ ▸ **TESTS** and choose **ANOVA** and enter $\mathbf{L_1}$, $\mathbf{L_2}$, $\mathbf{L_3}$, $\mathbf{L_4}$.



Press **ENTER**



The result shown is $p = 0.007$ ($p < 0.05$) which means that there is a significant relationship between mathematics education and frequency of guide use.

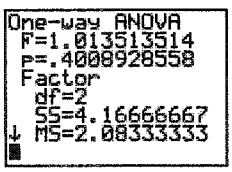
Combining Table1 (Age of mathematics teachers) and Table 7 (frequency of guide use) yields Table 13.

Table 13

Years of teaching experience and frequency of guide use

	< 5 years experience	6 - 20 years experience	more than 21 years experience
Daily use	3	3	2
Use once every 2 or 3 days	3	5	4
Use once a week	2	5	2
Seldom use	1	1	1

Using the graphing calculator

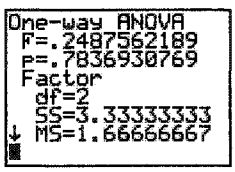


demonstrates that p = 0.4 which means that there is not a significant relationship between the number of years of teaching experience and frequency of guide use. Combining Table 1 (years of teaching experience) and Table 4 (helpfulness of guide in planning teaching strategies) gives Table 14.

Table 14

Years of teaching experience and helpfulness of guide in planning teaching strategies

	< 5 years experience	6 - 20 years experience	more than 21 years experience
1(Strongly Disagree)	0	0	0
2(Disagree)	0	0	0
3(No Opinion)	1	1	1
4(Agree)	4	6	4
5(Strongly Agree)	4	7	4

The graphing calculator shows 

$p = 0.78$ which clearly indicates that there is no relationship between the number of years of teaching experience and the degree to which teachers perceive the guide to be useful in planning teaching strategies. In fact, a closer inspection of Table 12 reveals that most teachers, irregardless of the number of years of teaching experience, perceive the guide to be helpful in planning teaching strategies.

Appendix I

Interview questions

1. What effect has the introduction of these guides had on your teaching?

2. Can you give me a picture of how you use the guide to prepare your lessons in mathematics?

3. Have these changes led to a broadening of your teaching skills?

4. Has the development process of the guides afforded you with sufficient opportunities for input into the content of the guides?

5. What are you looking for in the writing style and approach in curriculum guides?

6. Has the implementation of the new mathematics curriculum shown a close fit between the new resources and the guides? In what way was this achieved?

7. Describe how you were able to align the guide and the resource after in-servicing?

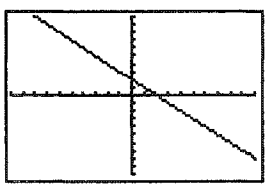
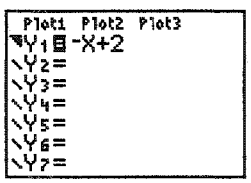
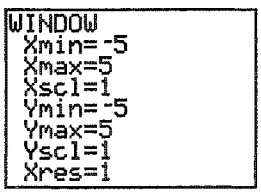
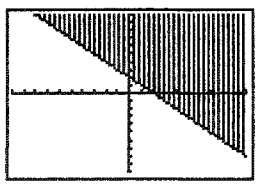
8. What other mathematics curriculum guides have you read?

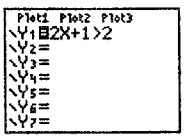
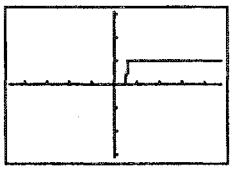
9. What is a good curriculum guide to you?

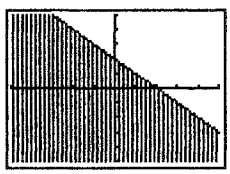
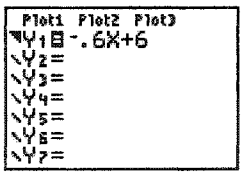
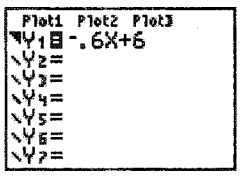
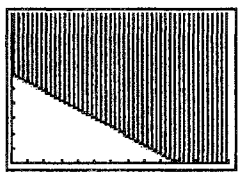
Appendix J

Sample curriculum guide layout

A two page, four column layout is the standard used by APEF. Shown below is a sample two page layout. Curriculum has three facets: what must be taught, how that material must be taught, and how the assessment of student understanding of the material could be carried out. The first column lists the specific curriculum outcomes. These outcomes delineate what is to be taught. The second column contains elaborations on teaching approaches and various methodologies that might be employed in helping student learn the content required as laid out by column one. It also may contain information on real world applications and information that may help the teacher hold student interest in the topic. The third column includes suggestions for assessment and instruction where alternate forms of assessment are suggested when appropriate. Column four lists possible resources that may be used to assist students in understanding the material covered. The mathematics curriculum committee was mandated to adhere to the APEF curriculum guide format. The first column sco's were pre-determined around the APEF table but the content of the other three column was left to the discretion of the committee.

SCO: By the end of grade 11 students will be expected to:	Elaboration- Instructional Strategies/Suggestions
A1 relate sets of numbers to solutions of inequalities A7 demonstrate and apply an understanding of discrete and continuous number systems C12 solve linear, simple radical, exponential and absolute value equations or linear inequalities C29 investigate, make and test conjectures about the solutions to equations and inequalities using graphing technology	**1 - Dimensional Inequalities (2.1)** Invite students to investigate only a few of the algebraic problems. Use the TI-83 to re-enforce the students' understanding of the topic. Initiate a discussion to allow students to review describing inequalities, both in words and in symbols. They should also investigate the different appearances of discrete and continuous inequality graphs. **2 - Dimensional Inequalities (2.3)** Students will not have seen this topic in Junior High so a teacher can't assume it is a review. Spend some time on a few of the basic problems in MathPower 11 p.75 # 1-34 or Math 11 p.348-351. *Try to extend the student's experience into the Application Problems where the problems are more real world.* Challenge students to find a connection between the three mathematical conditions: <, > and = and the points on the Cartesian Plane. A helpful idea might be to draw a line on the blackboard and ask students to examine the number of different regions (sets of points) formed. Hopefully students discover the 3 regions formed. As well, students may discover that when an equation is graphed, the points that satisfy the = condition are on the line. The points on either side of that line(called the *Boundary Line)* exist but have not been considered to date. Each of these other two regions will satisfy the inequality conditions > or <. If the inequality is written in *slope-intercept form* then students may be able to do a few problems and intuitively make a deduction that the > region is above the *B. Line*(or to the right of it for a vertical line) , the < region is below the *B. Line* (or to the left of it for a vertical line) *example* $x + y > 2$   $x + y = 2$   Once the $-x + 2$ is entered, cursor over to the left of the Y_1 and press **enter** until the shaded triangle shown is displayed. This represents > region, while the lower triangle that can be displayed by clicking **enter** once more represents the < region.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
1 Dimensional Inequalities (2.1) *Pencil/Paper/Technology* Solve algebraically and graphically $2x + 1 > 2$ On the TI-83 y = screen enter **2x + 1 2nd test:3:> 2**   press **zoom 4:Decimal** now press **Trace** and cursor along to do a Boolean test or simply enter various x values and press **enter** Another possibility would be to look at the Table of Values.	**1- Dimensional Inequalities** MathPower 11 p63 #25-49 odd *Applications* MathPower 11 p.63 #51, 54-56, 60 *Note to Teachers:* *When graphing 1-Dimensional Inequalities, the TI-83 use Boolean algebra(If... then statements that are either true or false). If true then y = 1, if false then y = 0.* **Problem Solving** **p.67 # 1,2,3,5,7,9,10**

2- Dimensional Inequalities (2.3)
Journal
With the accompanying graph, get the equation of the *B. Line* and state the inequality that describes the shaded region. Write a real world situation where this might apply.
 
Applications
A store makes $100 profit on every pair of downhill skis sold and $60 on every pair of ski boots sold. The store's target is to make at least $600 a day on sales from these 2 items.
a) write an inequality that describes the situation
b) what are the constraints(restrictions) on the variables
c) graph the inequality
constraints
b = # boots sold $b \geq 0$
s = # skis sold $s \geq 0$
objective quantity
$60b + 100s \geq 600$
 
 	
	2- Dimensional Inequalities
	MathPower 11 p.75 #1-21 odd, 29-33 odd,42
	 
	
	 
	Problem Solving
	p.79 #1,2,7