EXPLORING THE OVERLAP BETWEEN FAMILY LEARNING AND EXHIBIT LABEL TEXT AT AN INTERACTIVE SCIENCE EXHIBIT

by

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ABSTRACT

Visiting in family groupings, many parents and children attend museums expecting their visit to involve learning in some capacity. Families engage in learning experiences when they interact with exhibits designed by the museum. Museums are also responsible for the exhibit label text that accompanies exhibits, which can act as a key educative tool.

Using a sociocultural theoretical framework, this study assumed that learning is mediated by social engagement and that a family operates as a unique community of learners. It was also assumed that learning is mediated when a group of family members engage with and respond to settings designed by the museum. In these situations families interact with exhibit label text. This study investigated the ways in which family learning was mediated by exhibit label text.

Twenty seven families participated in the study, which employed an interpretive case study approach to data gathering. Each family was considered a singular case with its own unique expectations and agendas, which influenced their exhibit experiences. The exhibit experiences were investigated through an analysis of conversations between parents and children at the exhibit, during which one of four labels was on view. Pre- and post-exhibit experience interviews were conducted with parents who were asked to respond to different label text.

The outcomes of this study suggest that exhibit label text can act as a very effective research tool for the identification of family’s learning agendas and experiences. Three
key findings were noted: 1. Not all parents consider the same exhibit label text to be relevant to their family learning experience. 2. Parents value label text that prompts and supports their exploration of and conversation about the interactive science exhibit. 3. Parents also consider label text as a mediator of learning opportunities that extend beyond the museum visit.

Further recommendations for museum educators, exhibit designers, and researchers are addressed in the concluding chapter, including suggestions for future studies about both family learning and exhibit label text.
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JH
DEDICATION

For my children, Georgia and Gregory.
1 INTRODUCTION

This chapter outlines the area of research within which this study is situated. It defines the purpose of the research and the problem that was examined. In addition, it discusses the significance of the study as it relates to other research about museum learning. It also reviews the progression of the chapters of the thesis.

1.1 The area of research

This thesis is about an exploratory study that investigated the nature of family learning in museum settings, and in particular, families use of exhibit label text as one of the catalytic elements that shape emergent learning outcomes. Many studies have reported that families talk, discuss, observe, touch, interact, read and play together while interacting with museum exhibits. In addition, studies on visitor agendas indicate that families expect to do many of these activities when they attend a museum as a social grouping. The collaborative nature of their learning is a significant and under-investigated area of museum learning research. Moreover, supporting families’ learning activities is of interest to museums because families constitute a large part of their visitor demographic. This thesis argues that label text is an important component of exhibit design that is factored into the visitors’ (including the family) learning experience, and deserves more rigorous attention.

1.2 Situating the research study

A circuitous series of experiences resulting from working in the field of interpretive education, mostly at the Vancouver Aquarium in the 1990s, and a series of visitor observations at Vancouver’s Telus World of Science (Science World) inspired the author
to pursue this research study. In a particular case at the Science World, where the researcher made unobtrusive observations of visitor engagement with exhibitions, a common scene transpired with a school age boy enthusiastically trying to play with an interactive science exhibit. In this instance, he called to his mother when he could not grasp the point of the exhibit experience. His mother arrived and read the label, and together they tried a few more times to make sense of the exhibit. First the boy left and then the mother followed appearing perplexed.

From viewing this scene and others like it, the researcher became interested in understanding the nature of family learning in a museum setting and the ways in which museums can support the learning agendas of the family demographic through exhibit label text. After an initial review, it was clear that little research had investigated this area of study. In fact, quite a gap exists in research that addresses the nature of family learning and the practical aspects of exhibit label text development. While both family learning and exhibit labels have received some attention by museum learning researchers, the former to a greater degree, very few studies have addressed them both.

1.3 The problem

The existing research about learning in museum settings offer recommendations that relate to program delivery and the design of exhibits. Some of these recommendations relate to the family demographic (Briseño-Garzón, 2005; Moussouri, 2003) but few research studies (beyond evaluation studies such as Borun and Dritsas (1997)) have actually studied exhibit label text as it applies to the collaborative nature of family
learning. Although there is a growing interest (Bertschi, Benne & Elkins, 2008) in the field of museum learning research to investigate the overlap between exhibit label text and family learning, very little research exists. This study attempts to fill the void in the existing research by investigating family learning experiences mediated by exhibit label text in a museum context.

1.4 Purpose of the study

The purpose of this study was to gather a broader understanding of family learning mediated by exhibit labels using a sociocultural theoretical framework by investigating:

1. what families talk about at exhibits,
2. the families’ mediation of learning, and
3. the nature of family learning,
as they relate to and are informed by exhibit label text. These three areas of the investigation are at the core of the study’s three research questions that guided the study.

1.5 Significance of the study

This study falls within the domain of studies that examine learning outside of the classroom setting, specifically the learning that takes place in museums. This field of research is considered to be informal in nature as there is not a formal assessment process that grades or advances the learning of visitors; yet, much learning takes place beyond the confines of the classroom and museums are one such setting (Falk & Dierking, 2000). As a result, a significant amount of attention has been paid to this area of educational research in the last few decades, including an emerging and increasing number of studies

Although exhibit label text is a museum’s primary communication tool, it remains under-researched. Exhibit labels have been a part of museum communication for nearly a century (Hubbell Mackinney, 1993). However, they have not received much scholarly attention in recent years beyond the important work of Stephen Bitgood (e.g. Bitgood & Patterson, 1993), and studies by Minda Borun (e.g. Borun and Miller, 1980) and Pauline McManus (McManus, 1989) that have advanced the legitimacy of exhibit labels. In addition, few research studies about exhibit labels have investigated the personal perceptions of visitors.

This thesis is a unique, qualitative study which was designed to investigate family learning, a popular area of research, and exhibit label text, a topic very neglected by the current domains of research associated with museum learning.

1.6 Overview of the thesis

This thesis is comprised of six chapters and a series of appendices. Chapter Two includes a review of the study’s sociocultural theory as a relevant theoretical framework, which emphasizes the social nature of learning, the role of language in the learning process, and views the family as a community of learners who engage in shared learning experiences. It reviews literature that has investigated exhibit label text and is divided into four sections. The sections discuss: the nature of how families use exhibit labels, the nature of
exhibit label communication at interactive science exhibits, the nature of exhibit label
development and social learning, and a section that discusses visitor agendas and their
relationship to family learning in the museum setting. The chapter concludes with a
synopsis of the research.

Chapter Three discusses the methodology employed to gather data for the study. It
includes a discussion of the case study approach used to shape the research design as its
methodological framework. Further, the conceptual framework for the development of
the exhibit label text is reviewed. The data collection methods and procedures are
reviewed, which include a description of the interactive exhibit that was the setting of the
study. This chapter also includes a discussion of the validity of the findings in terms of
trustworthiness and credibility as well as its ethics and limitations.

In Chapter Four, conversational and interview data are summarized as part of a
descriptive analysis. The first research question is addressed in this chapter. It sought to
investigate what parents and children talked about when different label texts were present
during their exhibit experiences. The descriptions of the conversations that allowed the
researcher to compare the ways in which parents and children responded to the exhibit
label text and to the whole exhibit experience are presented. Through a cross-comparison
analysis of the conversational data and the utilization of the four exhibit labels, the
responses by families to the different exhibit label texts were investigated.
Chapter Five documents the synthesis of the descriptive data and attempts to answer the study’s two other research questions about the mediation of learning and the nature of family learning. The chapter is divided into two sections that address the findings associated with these research questions.

The chapter explores the emergent themes of learning at the Water Vortex exhibit, which indicated that learning is mediated by: 1. actions and observations, 2. conversation, and 3. scientific explanations. The nature of family learning, as it is mediated by exhibit label text, is also discussed in the context of: 1. its social nature, 2. the complexity of each family’s learning agenda, and 3. its extension beyond the museum experience. In each case, the relevant and associated exhibit label text is discussed.

Finally Chapter Six outlines conclusions and implications of the study and recommendations for further research.
2 LITERATURE REVIEW

2.1 Introduction

This chapter situates this research study within the area of family learning in museums. Family learning in museum settings has been the topic of some investigation over the past 30 years. Studies have investigated what families do, what they talk about and how they learn. In addition, some attention has been paid to the ways in which museums can support families as they engage in exhibit experiences. Although exhibit label copy has been identified as a tool used by families to support their learning (Briseño-Garzón, 2005; Diamond, 1986; Hilke, 1988), very little research has closely examined the ways in which label text factors into the family learning experience.

2.2 Overview

This chapter is divided into three major parts: 1) a theoretical framework used to frame and interpret the study; 2) a literature review, which provides a critical synthesis of studies that direct the reader to the field of study where family learning and exhibit label texts overlap; and 3) a synopsis of existing research.

The study employed a sociocultural learning theory which states that learning is mediated (Lave & Wenger, 1991; Vygotsky, 1986; Wertsch, 1991). It is the overarching framework of this study because of its relevance to understanding family learning. It assumes that families constitute social as well as cultural units (groups) and hence it is relevant to the specific research questions of this study. This perspective is especially relevant to investigations in the museum setting where social engagement is of primary
importance to a family’s visit agenda. It frames the study by placing the emphasis on the family as a community of learners who learn together through shared experiences and conversational dialogue (Lave & Wenger, 1991).

The literature review begins by discussing research studies that refer to the nature of how families use exhibit labels while visiting museums. A second section outlines the nature of exhibit label text communication with examples of studies set at interactive science exhibits. It illustrates that to date exhibit label text has been studied in these settings with the intent of understanding how museums can communicate scientific explanations or prompt visitors toward scientific exploration and experimentation. The third section discusses research studies that have investigated the social nature of influences on exhibit label development. The final section includes a review of research about visitor agendas, with a particular focus on studies about family learning.

This chapter closes with a synopsis of the research that directs the reader toward a growing interest in the examination of how label text can support family learning. The conclusion of this chapter argues that a gap exists in the body of research about family learning and exhibit labels, and how the latter can be a catalytic experience and a critical part in shaping the learning among social groups. The chapter further concludes that investigations of the ways in which exhibit label text is designed and integrated into families’ collaborative learning experiences at museums are important - especially toward understanding more educationally effective museum exhibits.
2.3 Theoretical framework

In the 19th and early 20th century, several sociologists and psychologists influenced the development of sociocultural theory, but the work of Lev Vygotsky is arguably the most well-known and influential (Falk & Dierking, 2000) and relevant to this thesis. Vygotsky argued that humans use symbolic tools to negotiate “relationships between ourselves and the world, therefore suggesting that the “human mind is mediated” (Lantolf, 2006, p.1, emphasis in original). Sociocultural theory assumes that human psychological development is mediated by physical and symbolic tools (Lantolf, 2006), which evolve over time as cultural representations such as language (Wertsch, 1998; Vygotsky, 1986). For example, learning is mediated through social interactions (including conversation) as well as written text (exhibit labels). Further, the work of one of Vygotsky’s students, Leont’ev, emphasizes that practical and intellectual activities do not occur in isolation (Cole, 1985).

Wertsch (1991) argues that sociocultural theory “recognizes the essential relationship between learning processes and their cultural, historical and institutional settings” (p.6). Moreover, according to Wertsch, this perspective has an underlying assumption that learning cannot be separated from an individual’s social and cultural influences. Further to this argument, Lave and Wenger (1991) suggest that groups of individuals who share a social and cultural identity become a community of learners, with novice members being drawn in from the periphery as they gain knowledge and skill.
Falk and Dierking (2000, p.46) state that because individuals in nuclear and extended families share a “set of beliefs, values, language, and customs” they become a community of learners. In a museum, the family brings to its museum experience a set of cultural values that shape and govern their subsequent experiences with each other and with the exhibits. Subsequently, each family applies their own unique set of expectations, agendas and motivations to their visit. While each family member creates their own perceptions of the exhibit components, they also seek to build collaborative understandings from the knowledge and experiences that they share with other family members (Allen, 2002; McManus, 1994).

Ellenbogen (2002) conducted a unique study that illustrates the idea of the family representing a unique community of learners. Using ethnographic methods, she investigated the ways in which one family incorporates museum visits into their learning culture and experiences. The study describes the Parker family, as a family of four whose two children are home-schooled. Ellenbogen outlined the learning agendas and expectations that the family has of their museum experiences. She also noted the unique reasons that influenced their general visit agendas, as well as the individual interests of each family member. A key finding of this study acknowledged that individual families approach their visit as a ‘community of learners’ and interact with the exhibits to fulfil their collective and individual learning agendas.
2.4 Learning is mediated by language

Consistent with sociocultural theory, it is the view of this thesis that language is a key mediator of learning as an integral part of social interactions (Lantolf, 2006; Wertsch 1991). Applied to the museum setting, it assumes that family members will converse about topics that are relevant to their shared and new experiences (Borun, 2002; Ellenbogen, 2002; Eberbach & Crowley, 2005). Furthermore, it is viewed that an exhibit experience is integrated into continuous conversations that may have begun at an earlier time, commenced again at the exhibit and possibly will be incorporated into future conversations (Ellenbogen, 2002; Crowley & Jacobs, 2002). Therefore, looking through a sociocultural lens, the family learning experience is seen as a social one and one that is in part mediated through conversation (Allen, 2002; Ash, 2004; Borun, 2002; Callanan & Jipson, 2001; Crowley & Jacobs, 2002).

An interesting example of a visitor study that employed sociocultural theory and visitor discourse is that of Allen’s (2002) study at the Exploratorium’s Frogs exhibition. In this study, visitors’ learning was explored at exhibits by asking the question: “Has this utterance advanced the dyad’s collaborative process of making meaning from the exhibition?” (p.263). Forty-nine visitor dyads participated in this study including adult dyads as well as parent-child dyads, if the consenting parent was present. The study identified five conversational categories; perceptual talk (identifying and sharing), conceptual talk (cognitive interpretation), connecting talk (prior knowledge and experiences), strategic talk (use of exhibits), and affective talk (expressions and feelings) – all of which suggests that visitors learn through their conversations with one another.
Several other studies have investigated the learning conversations between parents and children in museum settings. At the Children’s Discovery Museum in San Jose, California, Crowley, Callanan, Jipson, Galco, Topping and Shrager (2001) investigated the ways in which parents contributed to their child’s everyday scientific reasoning. They identified the ways in which parents assisted their children’s exploration and use of an interactive science exhibit (zoetrope) through conversation. When the conversations of 49 parent-child dyads were analyzed, Crowley et al. (2001) identified and described the explanatory conversations as causal (what is causing an interaction to occur), analogical (connections between zoetrope and related devices) and principled (unobservable scientific principles). Causal explanations were the most common, next analogical and finally principled. The researchers argue that the brief and incomplete explanations made by parents, termed ‘explanatoids,’ serve to provide children with relevant information that is in keeping with the interactive and collaborative nature of the exhibit experience.

In a similar study, Callanan and Jipson (2001) analysed 269 conversations in a variety of museum exhibits and 50 conversations at a video-based exhibit (Take Another Look at Change) at the Children’s Discovery Museum in San Jose, California. The study found similar evidence of parent-child explanatory conversations as described in Crowley et al. (2001). Parents and children were found to discuss causal connections (causal explanations) most often. In keeping with the findings of Crowley et al. (2001), abstract scientific reasoning (principled explanations) was least common. In particular, Callanan and Jipson noted that parents were interested in “helping (their) child to understand the
event as it … [was] happening rather than focus on more abstract reasoning” (p. 34). Callanan and Jipson paid particular attention to the analogical explanations. They extended Crowley et al.’s (2001) understanding of an analogical explanation by noting that parents naturally contextualize new information by linking exhibit experiences to other shared experiences and knowledge.

Eberbach and Crowley (2005) investigated the explanatory dialogue between parents and children at botanical exhibits at the Phipps Conservatory and Botanical Garden in Pittsburgh. The conversations took place at three types of botanical exhibits: model, virtual or living plants. The researchers identified four categories of explanatory talk, three of which were similar to those in Crowley et al.’s (2001) study. The fourth one was defined as a process explanation, which was noted as an explanation specific to the exhibit’s biological content.

The study reported that at exhibits with living plants parents and children had fewer explanatory conversations, whereas the less familiar model and virtual exhibits appeared to require the dyads to work harder to construct explanations. Further, they noted the importance of understanding the links between explanations and an exhibit’s ability to link to a visitor’s prior understanding of less familiar content; for example, the model exhibit prompted analogical explanations that linked to school experiences, but the dyads did not discuss school experiences at the other exhibits.
Finally, Ash (2004) study analyzed conversational data and investigated the questioning techniques used by parents as a mediating strategy for learning. Three families participated in the study, which was set at a bird diorama in the Natural History Museum of Los Angeles County. Parents appeared to mediate their child’s learning by asking questions that helped to build shared meanings and link to prior experiences. However, it appeared that not all questions opened up the conversations. Ash (2004) noted that genuinely open-ended questions “encourage more conversational activities… especially those that do not demand quick or predetermined answers” (p. 95). Ash’s (2004) study indicates that the use of responsive questions that invite reflection can be an effective way in which parent-child dialogue mediates learning.

In summary, the studies discussed above framed by the sociocultural theory demonstrate exemplar cases of how the family acts as a community of learners and that the learning between and by family members is mediated by language. In the case of the family learning context, explanations and questions appear to factor into the way in which parents and children attend to their exhibit experience and engage in shared learning. These studies also demonstrate the importance of museum exhibit experiences with respect to their role in supporting dialogue as a “critical mechanism(s) for learning” (Eberbach & Crowley, 2005, p. 319).
2.5 Learning is mediated by exhibit labels

This section critically synthesizes and discusses thematically key research studies about exhibit label text as a mechanism that can support the learning opportunities of museum visitors. It aims to do this by addressing: 1. the nature of exhibit label use by families; 2. the nature of exhibit label text communication; 3. the nature of influences on exhibit label development; and 4. visitor agendas. In each section, attempts are made to review literature that is related to family learning circumstances but it also draws from a wider range of research on museum visitors and their responses to exhibit label text. Most of the research studies about exhibit label text have been conducted in science museums and interactive science centres but a few of the studies have taken place in other museum settings.

2.5.1 The nature of exhibit label use by families.

Families are observed to be busy and at time chaotic in their planning and communications (Hilke, 1988) due to the social demands of the multi-generational grouping. The studies in this section indicate that label reading is not the principle activity in which families engage. They indicate that the label reading by families is brief in nature, yet, an argument is made that labels do play a vital role in the learning experiences of this demographic.

Diamond (1986) conducted an ethnographic study of 28 families who were observed at the Exploratorium or the Lawrence Hall of Science (14 at each location). Each family had at least one child between the ages of 4 to 10 years of age. Among many
observations, Diamond noted that families appeared to read the graphics of 9% of the exhibits they visited. It was also noted that there was a “mutual exchange of information” whereby parents read and interpreted the label content, while children manipulated the exhibit and transmitted “information about the location, operation and description of the exhibit phenomena” (p. 153).

Similarly, McManus (1987) also observed the reading behaviours of family groups but in this case it was one demographic among four distinct visitor groupings. She noted that the different demographic groupings read graphics with different levels of intensity and longevity. After observing 1572 individuals in 641 groups at the British Museum, she observed that adult singles and couples were deliberate readers, while adult social groups and families did not appear to read label text thoroughly. This supports Diamond’s assertion that families read labels infrequently and that label reading was brief in nature. Yet, it was this demographic that McManus (1987) observed spending lengthy periods of time at an exhibit.

Hilke (1988) also conducted a study on the behaviours of family groups. He observed that label reading was one of five learning strategies used by family members. It was conducted at a large natural history museum and 132 visitors in 53 family groups participated. The results of the study indicated that families proceeded with quite a strong learning agenda, spending 86% of their time directed toward specific exhibits. While observing and touching made up of almost 80% of the learning strategies, reading and listening made up the remainder. The final recommendations suggest that exhibit activities, including label text, should work to support the efforts by families to explore
the exhibits on their own and make sense of the material by relating it to their own knowledge.

The label reading behaviour of families may be episodic and brief but a study conducted by Hirschi and Screven (1988) suggests that family members can be motivated to read more with the inclusion of questions in the title. The researchers observed 40 family groups (172 individuals) at five different exhibits at the Milwaukee Public Museum. They broadly defined a family as having at least one adult and one child below the age of 18 years. Questions were printed on white paper and taped above the label or on the exhibit, directing the readers to the rest of the label where the answer could be found. The findings indicate that when a label with a question was attached near or above the existing label, visitors seemed to spend a significantly greater amount of time at the exhibits, engaged in both non-reading and reading behaviours. However, it was noted that the question did appear to focus the reading of the label towards ‘the answer’ rather than further exploration of additional information and observations about the exhibit. Although in these studies the label reading behaviours of families were not observed to be frequent, Diamond (1986) considered labels to be a significant learning tool and included recommendations about label text development for this demographic group. Due to her observations that reading behaviour occurs in “educationally significant contexts” between family members, Diamond (1986) stated that “the degree to which graphics can be made understandable significantly influences learning at exhibits” (p. 153). Hilke (1988) also emphasizes that exhibit label text should be responsive to the interests and movements of the family group.
In summary, these studies (all conducted more than 20 years ago) suggest that special attention is required for the development of exhibit label text if it is to be effectively used by family groups. Yet, still very little research exists about exhibit label text and family learning. Studies that have addressed exhibit design and label text in the context of social learning of the family demographic are discussed in Section 2.5.3.

2.5.2 The nature of exhibit label text communication.

Exhibit label text is written to communicate information about a museum’s specific expertise or views about topics that relate to the objects in their collections and exhibitions. In general, there is an assumption that exhibit label text enables the transmission of information or potentially shapes a visitor experience. This study assumes that exhibit label text is an important component of a ‘museum’s agenda’, which Moussouri (2003, p. 478) defines as “a set of messages that the museum expects its visitors to attend and respond to and the behaviour it expects them to adopt during the visit.” Although other studies about exhibit label text exist, this section is limited to those conducted at interactive science exhibits, which is an exhibit type that is most relevant to this thesis. The first series of studies examines the communication of scientific explanations and the study in the second part investigates label text that emphasizes the exploration of scientific inquiry.
2.5.2.1 *Labels that emphasize scientific explanations.*

Borun and Miller (1980) investigated the cognitive and affective responses of adult visitors to four types of explanatory label content described as: how the display worked, scientific principles, relevant historical material and everyday applications of principles. Two hundred adults participated in the study, 50 adults used the exhibit with each label type. In a post-test, it was found that all label types contributed to cognitive gains, yet the visitors who read the ‘historical material’ and ‘everyday applications’ labels had the highest comprehension levels on the test; however, when reviewing all four labels, visitors preferred the ‘how the display’ and ‘scientific principles’ labels. Therefore, although they learned more from labels with more familiar content, the inclusion of difficult scientific content did not deter visitors from appreciating the subject matter.

In a study that involved the development of explanatory label text, Kanel and Tamir (1991) studied the effects of design and editorial changes made to original explanatory labels. The text of two interactive exhibits (one about air pressure and the other about stereoscopic vision) at the Open Eye Science Centre in Israel was re-written and edited by a popular science writer and the illustrations were made more interesting to youth. Over 1000 children (10 to 16 years) were observed and asked to complete questionnaires; and approximately 30 children were interviewed. The authors found that the editorial and aesthetic changes to the labels were linked to significant increases in the: 1. time that children spent at exhibits; 2. correct use of the exhibit; and 3. cognitive learning of the scientific principles illustrated by the exhibit.
Rather than studying general editorial changes, an iterative evaluation study conducted by Borun and Adams (1992) investigated the ways in which specific exhibit label text increases likelihood that visitors will learn the canonically correct understanding of gravity. It was part of another study (Borun, Massey & Lutter, 1993) conducted at the Franklin Institute Science Museum in Philadelphia, which involved the development of an exhibit designed to disprove a naïve notion about gravity. The purpose of the exhibit was to explain that the earth’s rotation and gravity were distinct forces.

Borun and Adams (1992) studied how the label text supported the exhibit’s pedagogical purpose and specifically investigated the content of the label. They tested several versions of the label on roughly 20 visitors for each draft and finally settled on the following text:

Separate and unequal forces.
If the earth stopped spinning, gravity would still hold us down.
Can you prove it?
(Use the on/off switches).  (Borun & Adams, 1992, p. 117)

The final revisions included looping the operating instructions with the explanatory concept to encourage the visitor to move back and forth from the label to the exhibit. Borun and Adams (1992) were satisfied with the draft of the label text when 75% of a sample group could report the scientifically correct definition of gravity. In this case, the study of visitor learning was interactive in nature as well, information-based and relied on visitors reading the label’s scientific explanation.
Specific to interactive science exhibits, these studies have investigated label text that emphasizes the communication of scientific content set out by the museum. Borun and Miller (1980), Borun and Adams, (1992) and Kanel and Tamir (1991) investigated the ways in which exhibit designs and label text can increase the cognitive gains made by visitors as they read and understand the exhibit’s intended learning outcomes. This emphasis differentiates these studies from the study in the next section that focuses on the visitor experience involving inquiry and exploration rather than understanding explanatory information.

2.5.2.2 *Labels that emphasize scientific exploration.*

In response to a growing interest in applying constructivist theory to exhibit design decisions, designers at the Exploratorium in San Francisco have been working on a series of exhibits that promote scientific exploration (Humphrey & Gutwill, 2005). Exhibit designers at the Exploratorium call them APE (active prolonged engagement) exhibits. The exhibit text label for APE exhibits (if labels are present at all) is oriented towards providing orientation to the operation of the exhibit and initial guidance that motivates engagement and prompts exploratory actions.

In a study of one of the Exploratorium’s APE exhibits, Gutwill (2006) investigated the preferences of visitors for questions and statements as a way in which to prompt increased exploration of the exhibit. He compared how visitors responded to three different label formats (questions-only, questions and suggestions, and suggestions-only)
for an interactive exhibit, *Spindrift*, at the Exploratorium. An example of Gutwill’s (2006) ‘question and suggestion’ label format that was preferred by visitors is as follows:

Can you get the largest ring to stumble around?
(Try gently rolling it.)

Can you get the smallest ring to roll for a long time?
(Try starting it sideways on the walls of the dish.)

Can you make shadows appear with the star-shaped ring?
(Try spinning it.) (p.5)

After viewing the exhibit with only one label format, 60 visitors were shown all three and asked to rank them. Gutwill (2006) found that a majority of participants preferred the labels that included both a question and an instructive suggestion (statement). The most common reason that visitors gave to explain their choices related to the amount of guidance provided by the label. Visitors stated that they were uncomfortable with the question-only format because it did not provide enough guidance when it was not paired with a suggested action. It is worth noting that the type of questions used in this study had ‘Yes’ and ‘No’ answers, therefore were closed questions. Further discussion of the use of questions (specifically open-ended questions) in labels will be addressed in the following section within the context of their impact on extending conversational dialogue.

The design of interactive science exhibits impacts the nature of the labels associated with the exhibit. The studies in this section suggest that exhibit labels can be designed to mediate learning through explanation or exploration, as it reflects the educational purpose.
of the interactive science exhibit. These studies reflect the continuum of approaches taken by museums when designing interactive science exhibits. However, they do not specifically address the role of exhibit labels in the context of social learning nor do they reference the family demographic. This area of research will be addressed in the next section.

2.5.3  **The nature of influences on exhibit label development.**

The studies that have been discussed in this literature review suggest that visitors do pay attention to exhibit labels. The previous section illustrates that the design and the labels of interactive science exhibits can direct visitors toward the learning of scientific explanations as well as they can guide visitors to explore and interpret exhibits for themselves. Further research suggests that labels can influence the social experience and the subsequent conversations of visitors when they engage in an exhibit experience with friends or family members.

Hohenstein and Tran (2007) conducted one of the only, if not the only study, to date that has investigated the ways in which exhibit label text affects visitor conversation. At a science museum in the United Kingdom, the open-ended guiding question “Why is this here?” was added to the labels of three exhibits: a Victorian workshop, a sectioned Austin Mini Cooper, and a rice bowl from the bombing of Hiroshima. Visitors were video-taped at the exhibits and 464 conversations were analyzed and described as: reflections, elaborations, observations and identifications. The study found that the added question
did prompt discussion of further open-ended questions and additional explanations, in two of the three exhibits.

At the ‘rice bowl’ exhibit, the guiding question did not lead to an increase learning conversations between visitors; however, at the ‘Mini’ exhibit, the guiding question prompted the most open-ended questions asked by visitors than at the other exhibits. The study concluded by recommending that guiding questions should match the complexity of the exhibit. Hohenstein and Tran’s study adds to the findings of Hirschi and Screven (1988) by suggesting that the inclusion of an open-ended question in an exhibit label can prompt further conversations and discussions.

In the context of the family demographic, a very limited number of studies have specifically addressed exhibit label text in relation to social learning but some have investigated the ways in which exhibit design factors into the family learning experience. The following three studies indicate that exhibits can be modified and altered to support the shared learning opportunities between family members. They also address the role of museum communications (oral or written) in the family learning experience.

The Family Learning Project identified and measured family learning at four exhibits in four different American museums by analyzing the conversations of 129 families (428 individuals) looking for evidence of five learning ‘performance indicators’ (Borun, Chambers & Cleghorn, 1996). The findings of this three-phased project indicate that exhibits can be modified so that they are more applicable to the learning experience of
families who visit science museums, zoos, aquariums and centres. In the second phase of
the study, Borun and Dritsas (1997) identified exhibit design features that facilitate
family learning.

As part of the assessment of design features that support family learning, Borun and
Dritsas (1997) conducted a series of 20 evaluations to test different versions of a label for
a sand pendulum exhibit at the Franklin Institute. It was evaluated to assess the label text
that supported a family’s enjoyment of the exhibit.

To motivate engagement, they found that questions offered a helpful “mode of entry” into
the exhibit. The final text for the pendulum exhibit also included statements about the
exhibit’s operation. This label text did not involve any explanations of the scientific
principles or phenomena. Similar to Gutwill’s (2006) study, it encouraged visitors to
experiment with the exhibit and to observe the consequences of their own actions. It was
generally reported that the exploratory nature of the exhibit and label text was supportive
of the social context of family learning in the setting and the creation of an enjoyable
social experience.

Crowley and Callanan (1997) also investigated the attributes of exhibit design that impact
the mediation of family learning. They conducted two studies at the Children’s Discovery
Museum of San Jose. The first study examined the conversations between parents and
children (see Crowley et al. 2001) and the second study investigated exhibit design
measures that can support these shared learning opportunities. The second study applied
the findings from the first study to the development of the science exhibit, ‘Map Your
Head.” 160 children and 93 adults viewed the first prototype of the exhibit. The study found that parents and children had different expectations of how to use and what to learn from the exhibit. The exhibit was re-designed so that parents and children could collaboratively engage with the exhibit within close proximity of one another and with the video components. When 205 children and 154 adults used a second prototype, their observations and conversations indicated that 84% of the children stayed in place so that their heads could be properly ‘mapped’ and in addition, more parents and children engaged in discussions of mapping concepts. This study suggests that spatial and instructive considerations can support the learning opportunities that occur when parents and children collaboratively engage in an exhibit.

In both studies modifications were made to the exhibits so that instructions were accessible to parents and children. Crowley and Callanan (1997) added voice-over instructions that helped parents and children to hear the instructional communications at the same time, while they were in same vicinity. Borun and Dritsas (1997) recommended that to be relevant to families label text should: include a question, be brief, be divided into small chunks, and be “engaging when read aloud” (p. 190). Both of these studies indicated that the efforts by the museum to communicate with families facilitated collaborative learning opportunities.

In a more recent evaluation case study about learning environments that support parent-child interactions, Bertschi, Benne and Elkins (2008) reviewed the development of an exhibit Animal Secrets at the Oregon Museum of Science and Industry in Portland. The
exhibition was biological in nature and was designed from sociocultural and constructivist paradigms. In an unspecified methodological design, they evaluated the effect of three components of exhibit design (environmental design, activities and labels) that are considered important to parent-child interactions. The exhibits and activities were designed to accommodate a range of play behaviours to promote imaginary play but the major intention was to encourage play and conversation between parents and children.

The third component in the exhibition was the incorporation of label text. Identification and title labels identified the names of animals and components of the exhibit. Invitational labels included informational text that could be modeled by parents in conversations, such as open-ended questions and science vocabulary. Explanatory labels detailed the rationale for interactive nature of the exhibit and encouraged parents to join in and follow along with the child’s imaginative play. Parents reported that they referred to identification labels and title labels most often, and then the invitational labels. Parents also appreciated that the labels prompted investigations of the exhibit with open-ended questions and statements that encouraged observation. In their concluding remarks, the authors call for more research into the ways in which museums can communicate with families, particularly parents.

Studies such as Borun et al. (1997) and Crowley and Callanan (1997) have investigated and identified the features of exhibit design that support learning by visitors in family groupings. They also support the notion that instructive communications (audio or label text) help to support social learning experiences. The evaluation study by Bertschi et al.
(2008) also indicates that exhibits and labels can be designed to support interactive play and shared learning opportunities for families. Furthermore, Hohenstein and Tran (2007) have specifically investigated the ways in which exhibit labels can support conversational dialogue between visitors who are engaged in social learning experiences.

It appears that family groupings and other visitors with social agendas can engage in learning experiences in response to a label’s components such as: questions, explanations, descriptions or instructions. However, it does not appear that a research study to date has broadly investigated the ways in which exhibit label text factors into these shared learning experiences between parents and children in a museum setting. This research dilemma is the core investigation of this thesis.

2.5.4 Visitor agendas.

Within this study’s theoretical framework of this study, the family is considered a learning community with a unique set of values, beliefs and perceptions (Lave & Wenger, 1991), which impact the family learning experience. Understanding what families intend to do (motivations and agendas) when they visit museums is considered important because it has been found that visitor agendas impact learning experiences (Briseño, Anderson and Anderson, 2007; Falk, Moussouri and Coulson, 1998; Moussouri, 2003). This area of research is relevant to this thesis because visitors are influenced by their socio-cultural values, which in turn impacts their responses to a museum’s agenda as it is communicated in exhibit design and label text. In addition, family’s visit is also influenced by their views about learning.
Agendas relating to learning and leisure have been identified as key aspects to the family learning experience in museum settings. Hilke (1988) argues that the social dimension of a museum visit is paramount to families who visit museums, although learning follows in short order. McManus (1994) acknowledges the reciprocal nature of enjoyment and learning and describes the interplay between these two agendas when families are engaged in a museum visit. The important point to note is that many families do attend museums with the intention to engage in learning activities and also expect to have enjoyable social experiences.

At the Smithsonian’s National Museum of Natural History, Falk, Moussouri and Coulson (1998) observed significant differences in learning outcomes between the visitors who had low and high entertainment and education agendas when visiting an exhibit about gemology. They found that if visitors (n=40) were engaged in an exhibit experience with strong intentions for enjoyment or education, they appeared to learn more about the exhibit’s content. Interestingly, a strong intention to seek out entertaining experiences resulted in high learning outcomes. The authors concluded that “most visitors see no apparent conflict between fun and learning” and “consider learning in a museum entertaining” (p. 117).

Moussouri (1997, 2003) studied the family demographic to specifically identify the family agenda and how it relates to the visit experience, especially how families responded to museum exhibits and the museum’s agenda for their learning. Set at three
hands-on museums in England, 86 family groups were observed and interviewed for the purpose of identifying and understanding their visit agendas. Five categories were thought to contribute to the family agenda, which were family profile, sociocultural patterns, personal context, social context and the exhibition itself. In addition to the entertaining and educative elements of the exhibits themselves, it was noted that the personal and social preconceptions of the visit contributed to the family’s visit experience and the ways in which visitors perceived the exhibit material.

Briseño-Garzón (2005) and Briseño, Anderson and Anderson (2007) investigated the agendas of family groups as they were experienced during their entire visit to the Vancouver Aquarium. Using a case study approach, Briseño-Garzón investigated the visit agendas of the adults in 13 family groups with regard to the visit. Supporting the finding of Falk et al. (1998), the results of the study indicated that there was a merging of recreational, social and learning agendas. Like Moussouri (1997), this work illustrates how prior experiences influenced the parents’ visit agendas. Further, they found that the adult’s personal entry agendas and impacted the learning experiences of the adults themselves as well as those of their children. In addition, Briseño-Garzón noted that exhibit label text was one method employed by families to support their learning agendas.

Specific to the child’s perspective, Anderson, Piscitelli and Everett (2008), investigated the learning agendas of children at the four different museums in Queensland, Australia. Three broad agenda categories were identified: content, mission and time. In each case, challenges were faced when children’s interests did not fit with the structure of the
program, even when child-centred practices were intentionally incorporated into the museum visit. However, Briseño-Garzón et al. (2007) found that similar tensions between the learning agendas of parents and children did not appear to exist. The conclusions of the study note the importance of being flexible and sensitive to the enthusiastic learning intentions and interests of children.

Finally, Schaulbe et al. (2002) conducted a broad study that investigated the beliefs about learning (as they influenced visit agendas) held by museum staff of the Children’s Museum in Indianapolis, as well as those held by parents of visiting children. They reported that two divergent beliefs about children’s learning emerged from the interviews with 32 parents. They were: 1) that the exhibit was best experienced by enthusiastic engagement of activity, and 2) that learning involved engaging with new scientific content that included some adult support for the development of a deeper understanding of the children’s experiences. Schaulbe et al. reported that approximately half of the parents fit into each category. The study discussed how the parents’ views and expectations of learning conflicted with the learning agendas set out for the children by the museum.

In conclusion, research in the area of visitor agendas is a very relevant aspect of this study because it provides contextual information about the construction of learning experiences of the family demographic. In particular, research suggests that families attend museums with a range of agendas but that at the core of their experience is a desire
for social experiences that involve learning. It is the assumption of this thesis that families draw upon exhibit label text to support these visit agendas.

2.5.5 Synopsis of the research.

This study’s theoretical framework argues that families act as communities of learners, with parents and children talking and learning together at museum exhibits. It assumes that each family attends to their museum experiences and their visit agendas in meaningful ways, which are often unique to their family (Briseño-Garzón, 2005; Ellenbogen, 2002). Within a sociocultural theoretical framework, this study links conversation with learning and assumes that certain aspects of a museum exhibit setting and label text will support such dialogue.

Studies reviewed in this chapter indicate that families spend a majority of their time interacting with exhibits and discussing their observations. Many studies have investigated these conversations and described the ways in which parents and children contribute to their learning through conversation (Allen, 2002; Ash, 2004; Crowley et al, 2001, Eberbach & Crowley, 2005). It has also been noted that families read exhibit label text to support their learning activities (Borun & Dritsas, 1997; Diamond, 1986; Hilke, 1988; and McManus, 1987). It is not surprising then that over several decades researchers have been recommending that special attention be paid to the development of exhibit labels that are frequently read by the family demographic. Yet, very little research exists.
Although, the design of interactive science exhibits for the family demographic has been studied in the context of supporting collaborative learning opportunities (see Borun, 2002 and Callanan & Crowley, 1997), limited attention has been paid specifically to how exhibit label text factors into social learning experiences. The label text of these exhibits has been investigated mostly with the intention of understanding its effectiveness to communicate scientific explanations (Borun & Miller, 1980; Borun & Adams, 1992; Kanel & Tamir, 1991) or to prompt scientific inquiry (Gutwill, 2006). In 1997, Borun and Dritsas conducted an evaluation to develop exhibit label text for families at a pendulum exhibit but very little research has been conducted since then.

In the last few years, it appears that there is a growing interest (e.g. Hohenstein and Tran, 2007) in the field of museum learning research to examine the role of exhibit label text as it relates to the social learning opportunities of visitors, particularly families (Bertschi et al, 2008). However, a research study has yet to examine the ways in which exhibit label text factors into a family’s social learning experience and the rich, varied and personal conversations between parents and children. This obvious lack of research that relates to both family learning as well as exhibit label text, prompted the researcher to propose an exploratory study that investigates the responses of family groups to interpretive label text.
3 METHODOLOGY

The literature reviewed in the preceding chapter points to a gap in the research studies that relate to family learning experiences as mediated by exhibit label text. The aim of the study was to fill this void. Therefore, to adequately address the broad research problem of this thesis, a case study approach (Merriam, 1998; Stake, 1995) was employed.

3.1 Overview

In this chapter, the methodology for this study is discussed. The formulation of the methodology was in response to the nature of the study’s research questions which involved the gathering of conversational and interview data from families that illustrated their responses to different label text.

This chapter begins by listing the research questions and defining and situating the methodological framework of this thesis. It continues by outlining the conceptual framework that was used to develop the label text that was on view at the exhibit during the study. Further, the chapter sets out the procedures and methods used to collect and analyze the data. It concludes with a discussion of the trustworthiness, ethics and limitations of the study’s findings.
3.2 Research Questions

1. What do parents and children talk about when different\(^1\) label texts are on view at an interactive science exhibit?

2. What is the nature of the families’ mediation of learning when they read and discuss the label text and engage with an exhibit?

3. What is the nature of family learning as it is reflected in the families’ responses to the label text?

3.3 Methodological framework

The research questions demanded that a qualitative study be undertaken to gain deeper insight about the nature of family learning. One part of the study was designed to investigate the conversations between parents and children, after which parents were asked to reflect on their exhibit experiences and their responses to exhibit labels. Both the conversational and interview data provided a greater understanding of family learning. A significant amount of rich and descriptive data was compiled and reported in the Chapter Four. However, the overall intent of the case study was interpretive in function (Merriam, 1998). The researcher was situated to “examine for meaning... and refine or substantiate those meanings” (Stake, 1995, p. 8) through the interpretation of the data. Chapter Five discusses the interpretation of the descriptive data.

\(^1\) The work of Crowley et al. (2001) was instrumental in shaping this study’s research questions. The findings of Crowley et al. indicate that the explanations discussed by parents at an interactive science exhibit fall into three categories (Causal, Analogical and Principled). Assuming parents are the frequent label readers in a family learning setting, these categories were considered a logical framework to use as the basis for the drafting of different label text. Therefore, natural conversational categories were reflected in the exhibit label copy. Further discussion of the conceptual framework used to develop the label text is discussed in Section 3.6.
3.4 Interpretive case study approach

This qualitative study was undertaken within the bounds of a case study approach. The key to this methodological framework is identifying the case, which Merriam (1998) describes as “a thing, a single entity, a unit around which there are boundaries” (p. 27). Due to the nature of investigating the family learning experience with exhibit label text, the physical setting of the exhibit bounds the case. However, this study, in contrast to most studies that have investigated learning experiences with exhibit label text, was qualitative in nature. The purpose of the investigation was to probe for “insight, discovery and interpretation” (Merriam, 1998, 28) to gain a broad understanding of the “significant factors characteristic of the phenomenon” (p. 29). The essence of the phenomenon under investigation in this study is bounded by the exhibit but is much more complex in nature because of the human activity that is at its core.

Stake (1995) refers to the case as an object (person or program) not a process and that it is a “specific, complex, functioning thing” (p. 2). In the context of this study, the family is the case under investigation. However, the experience of one case was not considered sufficient when the responses by families to different label texts were a significant component of the study. Therefore, a multiple case studies approach (Merriam, 1998) was employed. Stake (1995, p. 169) describes this methodology as collective case study, whereby several cases are studied within the same project.
Twenty-seven families were considered as individual cases. Representing the exhibit experiences of individual families was required to address the study’s research questions. In addition, the theoretical framework demanded that each family be identified as a distinct community of learners. The responses of each family to the different exhibit label texts allowed for comparative analysis. Comparing and contrasting human responses to different conditions is considered a useful and common research approach for quantitative and qualitative studies. Further, Palys (2003) refers to the method as a valuable way to qualitatively analyze data of multiple cases.

3.5 Hermeneutical approach to data collection

The nature of the desired insights dictated the use of a hermeneutic approach to data collection. The insights of each family case informed the probing strategies for the next interview, and also, the findings of Phase One informed the development and design of Phase Two of the study. For example, the original intent of the study was to study three exhibits and did not include a Phase Two. Further discussion of the recursive nature of the study is discussed in Section 3.9.7 about data collection procedures.

3.6 Conceptual framework for the exhibit label text

As a way to elucidate greater understanding of the family learning experience and attempt to make sense of label text by families at interactive science exhibits, the design of this study included the development of different types of explanatory label texts. Of particular interest to this study are the individual responses by parents and children to the different label content when they are learning collaboratively.
This study comprised two phases. It was originally proposed to examine family learning experiences with three label types in a one phase study. However, during implementation, it became necessary to introduce a second phase in which a combination of the three label types was utilized to elicit further conversational responses from families and to generate more interview data from parents.

The approach used in this study for the development of label text is similar to that used by Borun and Miller (1980, Part VI). Borun and Miller removed all of label text for a ‘Gravity Tower’ exhibit and then listened to visitor conversations and interviewed visitors to identify themes and content for subsequent exhibit label text. A similar approach was used in this present study, whereby the assumption for exhibit label development was that it would be informed by conversational themes between visitors.

Label text for Phase One of this study was based on the conversational categories that were identified by Crowley et al. (2001) at an unlabelled interactive Zoetrope exhibit. In their study, it was found that in addition to investigating the interactive nature of the exhibit, parents and children engaged in explanatory talk that was described as causal, analogical or principled in nature. Table 1 lists the label text (Causal, Analogical and Principled) that was used in Phase One. Table 2 lists the label text that was used in Phase Two of the data collection process. The development of label text for Phase Two (Combination Label) was informed by the data gathered from Phase One of the study. The label text used in Phase Two follows in Table 2.
The label text was drafted in consultation with Sandy Eix, Curator of the Eureka! gallery, at Telus World of Science (Science World), who wrote the original label text for the Water Vortex exhibit. In addition, the researcher noted the recommendations made in Beverly Serrell’s (1995) book, *Exhibit Labels: An Interpretive Approach*, which discusses practical advice about labels for interactive science exhibits.

Table 1. Conceptual framework for the exhibit label text for Phase One.

<table>
<thead>
<tr>
<th>Label</th>
<th>Definitions*</th>
<th>Examples of label text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causal</td>
<td>“X causes Y, or X needs Y to do Z”</td>
<td>The purple ball is caught in a spinning water vortex! As it moves down the drain, the water spins faster. Change the speed of the water as it spins around the tank. What is happening to the ball?</td>
</tr>
<tr>
<td>Analogical</td>
<td>“One thing is like something else”</td>
<td>The purple ball is caught in a spinning vortex – like a bath toy! As it moves toward the drain of the bath, the water spins faster. Change the speed of the water as it spins around the tank. What is happening to the ball?</td>
</tr>
<tr>
<td>Principled</td>
<td>“Literally or conceptually refer(s) to an organizing scientific principle”</td>
<td>The purple ball is caught in a water vortex! As the water spins down the drain, it moves faster and has less pressure. Change the speed of the water to change the water pressure. What is happening to the ball?</td>
</tr>
</tbody>
</table>


Table 2. Exhibit label text used in Phase Two

<table>
<thead>
<tr>
<th>Combination</th>
<th>Like a toilet, the water in this tank is flushing in a circular motion. It is flushing down the drain but is it not going to the sewer! Instead, the water is being pumped back into the tank at different speeds. As the speed of the water increases in the centre, its pressure decreases and it is pushed in a downward vortex. Change the speed of the flush. What is happening to the ball? What else does this exhibit remind you of? How is it the same or different?</th>
</tr>
</thead>
</table>

*Note. Please see Chapter Four for examples of label text used for each data set.*
3.7 Research design

The following diagram outlines the research design of this study. The design included interviews before (pre-exhibit) and after (post-exhibit) the exhibit experience at the *Water Vortex* exhibit. During the exhibit experiences one of the four label types was on view. Different labels were viewed and discussed in Phase One and Phase Two of the study. Further details of the methods and procedures are discussed in the following sections.

**Figure 1. Review of research design.**

**Phase One**

```
Pre-exhibit Interview# ➔ Exhibit Experience* at Water Vortex exhibit ➔ Post-exhibit Interview#
Label on view: Causal OR Analogical OR Principled
Labels discussed: Causal AND Analogical AND Principled
```

**Phase Two**

```
Pre-exhibit Interview# ➔ Exhibit Experience* at Water Vortex exhibit ➔ Post-exhibit Interview#
Label on view: Combination
Label discussed: Combination
```

* Parents held digital voice recorder during the exhibit experience
# Interviewer held the digital voice recorder during the interview
3.8 Methods

Data collection was undertaken in two ways: 1. conversations between parents and children at the study exhibit, defined as the ‘exhibit experience’ and, 2. interviews with parents were conducted before and after each exhibit experience. In addition, the exhibit experience and the pre- and post-exhibit interviews were structured and framed by the inclusion of different versions of explanatory label text. Therefore, the label text was a third vital component to the data gathering process.

3.8.1 Audio recordings of parent-child conversations - the ‘exhibit experience’.

Once the research project and its data collection methods were discussed with the participants and permission was granted, a brief pre-exhibit interview was recorded with a hand-held digital voice recorder. After which the researcher handed the voice recorder to the consenting parent who held it at chest level for the duration of the exhibit experience.

The Water Vortex exhibit was pointed out to the participating family and they were told to use it “as you would normally.” With the parent holding the voice recorder, the participants then proceeded to explore the exhibit and stayed until the last child had completed their investigation.

While they were at the exhibit, audio-recordings were made of the conversations of each consenting group. Audio-taped conversations were identified by numbers so that they could be aligned with personal information gathered when informed consent was granted.
during the pre-exhibit interview. Once the exhibit experience was complete, the same digital voice recorder was used to record the post-exhibit interview.

3.8.2 Observations.

As the participating group began to engage with the exhibit, the researcher unobtrusively observed their actions from a bench 20 feet away. The researcher could not hear what was being said but took brief field notes to identify general physical and emotional responses to the exhibit. Otherwise, the researcher waited for the family to finish exploring the exhibit.

3.8.3 Interviews.

The pre-exhibit interview gathered information about the demographics of the family group, their familiarity with Science World, their interest in science, and the parent’s views about his or her child’s learning in a science centre setting (see Appendix A). It was usually less than two minutes in length but it helped to verify the configuration of the family and to elucidate the parent’s pedagogical views, as well as familiarize them with the researcher who also conducted the post-exhibit interview.

When the family finished at the exhibit, the family and the researcher began the post-exhibit interview. It was either conducted at a nearby bench or while walking so that the parent could observe his or her children. The digital voice recorder was still turned on and the post-exhibit interview was recorded. The interview began with the researcher asking the parent to summarize what had happened at the exhibit. This review helped to
create a mutual understanding of the parent’s and child’s attitudes and interests while at
the exhibit.

The post-exhibit interview sought further insights from the family members (adults in
particular) about how different label types might influence their experiences. The post-
exhibit interview was semi-structured in nature (see Appendix B). It generally revolved
around the questions: “What did you talk about at the exhibit?” and “Why was that
important?” Additional prompts such as “Tell me more about that,” were used to probe
for comments by the participating parents about their role as a facilitator, interpreter or
teacher.

In Phase One, the last part of the post-interview involved a discussion that compared and
contrasted all of the label types. The researcher’s initial interview questions were: “Here
are some other labels. Which one catches your attention? Why?” These questions
sought out further perceptions held by parents about the information that they perceive to
be important when they collaboratively learn with their children. In the post-exhibit
interview of Phase Two, only the Combination Label (the one they had read during their
exhibit experience) was discussed with the parent.

This study’s methodological framework supports the requirement of gathering rich
descriptions of conversations between parents and children as well as personal reflections
about the unique context of each family’s exhibit experience. The data collection
procedures were aimed at eliciting the personal perspectives of the participants as a way
to shed some new light on the role that exhibit labels play in the museum experience of multi-generational groupings.

3.9 Procedures

The procedures and setting of this study emerged from the conceptual framework of the exhibit label text, including the choice of the specific interactive science exhibit that was used as the study’s setting.

3.9.1 Setting.

This study took place at Telus World of Science, Science World, in Vancouver, British Columbia, Canada. Science World has two floors of exhibition space. A small series of exhibits are in place on the main floor and four exhibition galleries are on the second floor, three galleries have permanent exhibitions and one gallery is dedicated to temporary exhibits. There is also an OMNIMAX theatre on the third floor of the building, which screens several different films throughout the day. Science World’s exhibitions include content about biology, environmental ecology, physics and chemistry; the content is all presented in interactive learning formats. Science World’s exhibits are designed for use by visitors of all ages, both individually and in small groups.

The specific gallery in Science World in which this research study was set was Eureka! the Mitchell Odyssey Foundation Gallery. Eureka! is one of three permanent gallery spaces at Science World. The gallery space houses large and small exhibits that involve the exploration of optics, kinetics and mechanics. The exhibits all have interactive
components that are accessible to children 5 years and up. *Eureka!* includes a separate and enclosed gallery area called ‘Kidspace,’ designed for families with preschoolers, as well as an area called ‘Contraption Corner’ where visitors can work on constructing and inventing different gadgets. The exhibit used in this study is centrally situated in the main gallery space.

3.9.2 The Water Vortex exhibit.

This study took place at the Water Vortex exhibit, which is located about 10 metres from the entrance of *Eureka!* in a central location.

**Figure 2. Photo of the Water Vortex exhibit**

Source: Katie McMahon
In this location, noise levels in the gallery can be high if the gallery is busy; both due to visitor conversation and the noises made by the exhibits. Visitors move easily between exhibits, often stopping briefly and then periodically settling in for longer explorations of exhibits. Adult family members are often seen interacting with their children at exhibits as well as standing or sitting at a distance observing their children. At the Water Vortex exhibit, adults usually stand beside their children.

The Water Vortex exhibit is a popular exhibit with family groups. It meets some of the ‘family friendly’ exhibit criteria set out by Borun and Dritsas (1997). Its design is multi-sided and accessible to family groups as they gather around the exhibit to observe a ball moving in a water column. One lever controls the exhibit and often it is the children who alter the position of the ball by changing the strength of the water’s velocity and pressure in the exhibit. However, the dramatic visual nature of the exhibit motivates other family members to discuss their observations and interactions. Visitors can observe changes in the vortex in a column of water from at least three sides of a Plexiglas cylinder while a ball is moving vertically at different speeds.

This exhibit was also chosen because it is similar to the Zoetrope exhibit described in Crowley et al.’s (2001) study, from which the conceptual framework for this study’s exhibit labels was drawn. The Zoetrope is an exhibit that illustrates how still images can be moved to make a continuous moving image like a cartoon. The Zoetrope and the
Water Vortex have cylindrical designs and involve spinning movements. They both have rich, visual components that prompt discussion and interactions.

The initial exhibit and in the end the only interactive science exhibit used for data collection was a Water Vortex exhibit. It was the original intention of this study to include three interactive science exhibits as the setting for data collection. At the three exhibits, visitor responses would have been investigated using three different types of labels and only three families were to have been observed and interviewed for each label. As the preliminary interviews progressed, it became apparent that a larger data set was required at the first exhibit Water Vortex and in the end all the data was gathered at this exhibit.

3.9.3 Layout of labels.

Three different labels were drafted for Phase One of the study and one label was drafted for Phase Two. The labels used in the study were inserted over the regular exhibit label but under a Plexi-glass cover. The labels were printed with black ink on 8 inch by 11 inch paper. The font was Times New Roman and the font size used was 36 in Phase One labels (Word count: ~42) and size 28 for the label used in Phase Two (Word count: 89).

3.9.4 Timeline.

This study was conducted in the spring of 2008 on three week days during Spring Break (March 26th and 27th, and April 1st) and five weekend days (April 6th, 12th, 20th and May 3rd and May 10th). These days were considered the most likely time of the week when
school age children and parents visited Science World together. Data was collected between 11am and 5pm.

### 3.9.5 Recruitment of participants.

Purposive sampling methods were used to recruit participants (Palys 2003). Prior to commencing the study, selection criteria were established. The researcher extended a verbal invitation for participation to families:

- that showed interest in exploring exhibits as a family group;
- that included at least one legal parent or guardian and one child;
- that included school age children (minimum 5 years); and,
- that intended on speaking English while exploring the exhibits.

Families that were excluded from the study were any groups:

- that did not have an interest in visiting the exhibits as a family group;
- that only included one adult who was responsible for mobile children who required close attention.

This kind of non-probabilistic sampling procedure allowed for the recruitment of parents and children who were interested in sharing exhibit experiences together, contributing to the study and were interested in its outcomes.

An additional aspect of recruitment involved an effort to interview roughly an equal number of mothers and fathers. In total, 16 mothers and 11 fathers participated in the study. Therefore, the researcher usually purposefully approached either the mother or the
father of a family unit or a specific family, specifically seeking out a mother or a father.

All family members who were interested in the exhibit were included in the study although many parents chose to explore the exhibit with only one child if another parent was present to care for the rest of the family. Even if both parents were present at the exhibit, only one parent was invited to participate in the pre- and post-interviews.

Once the researcher was introduced and the study was briefly described, if the visiting family was interested in hearing more about the study they were given a copy of a consent form to read and sign on behalf of themselves and their children. An assent form for the children was also drafted. The researcher kept the signed consent form and a second copy was given to the parent for their records. The consent form included information about the study’s purpose and procedures, confidentiality and the researcher’s contact information so that participants had the option to review the study results at a later date.

The acceptance rate by families was 70%. This is considered to be a high rate of acceptance given that participants were usually on a tight timeline and had to quickly assess the purpose of the project and their own comfort levels with the protocol and the researcher. Reasons for not being involved related to not wanting to interrupt the flow of the visit, not having time because of travel arrangements and not wanting to take away the focus on the time spent with out-of-town guests and family members. Most families who were interested in participating in the study usually agreed to be involved within a few minutes of being approached by the researcher.
The research study evolved into two phases of data collection and both phases took place at the Water Vortex exhibit. It was decided that a larger data set for each label would be of greater relevancy to answering the research questions. At the end of Phase One of the study, when 19 families had participated in the study, the researcher decided to conduct a second phase of the study. The second phase involved the development of a fourth label for the same Water Vortex exhibit. Therefore, in the end 27 families engaged with one exhibit and four different labels were used during the course of the study.

Table 3. Summary of recruitment for Phase One

<table>
<thead>
<tr>
<th>Exhibit Setting</th>
<th>Causal Label</th>
<th>Analogical Label</th>
<th>Principled Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Vortex</td>
<td>6 Families (WV1-WV6)</td>
<td>7 Families (WV7-WV13)</td>
<td>6 Families (WV14-WV19)</td>
</tr>
</tbody>
</table>

Table 4. Summary of recruitment for Phase Two

<table>
<thead>
<tr>
<th>Exhibit Setting</th>
<th>Combination Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Vortex</td>
<td>7 Families (WV20-WV27)</td>
</tr>
</tbody>
</table>

3.9.6 Participants.

Twenty-seven families participated in the study. In the chronological order by which the participating families were recruited, they were assigned a number starting at 1 and ending at 27. Each family was assigned a number from 1 to 27, prefixed with the code
WV (Water Vortex). For example, the fourth family was coded WV4. Appendix C summarizes the detailed accounts of each family.

In summary, twelve of the families were from the Vancouver Lower Mainland, six resided in the interior of British Columbia, two were from Alberta, four were from Washington State (USA) and one family was from Maryland (USA). In addition, two families were from Australia. An attempt was made to include an equal number of mothers (16) and fathers (11).

In Chapters Four and Five, mothers were coded as M, fathers as F, sons as S and daughters as D. Families were mostly comprised of one parent and one child but eight families included two children. Thirty-four children participated in the project. The oldest children were 13 years of age and the youngest child was 4 years old. The average age of the children was 7.9 years and the median was 7.5 years.

3.9.7 Data collection and analysis.

Data was analyzed in a manner that was in keeping with the qualitative nature of the study. It was gathered and analyzed in tandem, which allowed the data collection process to be “recursive and dynamic” and responsive to the emergence of new data (Merriam, 1998, p. 155). For example, at the start of the study it was not anticipated that the study would be extended to a second phase. The conversations between the parents and children, as well as the interviews with parents, were transcribed verbatim and then summarized. Chapter Four is comprised of the descriptive summaries of these
conversations and interviews. It also includes analysis of the data at periodic intervals when the label text was changed and a rationale for the progression to Phase Two.

The conversational data was coded into categories, which were investigated and reported to illustrate the ways in which the categories were interrelated. In other words, the analysis took the whole of the conversation, broke it down into smaller units of conversation to then see how the conversation helped to build a view of how the shared learning evolved into a full ‘exhibit experience’ (Stake, 2004). Comparisons between groups that viewed different labels were also part of the data analysis (Merriam, 1998). Once the conversations were coded, then it was possible to see how the conversations compared across the different experiences of the families who had viewed different exhibit labels.

The pre-exhibit and post-exhibit interviews between each parent and the researcher were also summarized and the responses of the parents to the label text as well as their associated perceptions of the exhibit experience were identified (Palys 2003). The perceptions of the parents brought contextual information to the families’ exhibit experience and their responses to the exhibit labels. In Chapter Five, the data was synthesized to address the study’s research questions.

3.10 Trustworthiness

Whittemore, Chase and Mandle (2001, p. 524) write that “qualitative research is contextual and subjective instead of generalizable and objective.” Therefore, the
assessment of its rigor is subject to different validity criteria than is applied to quantitative studies. Although, rigor is assumed to be of great importance to any research study, the descriptive and interpretive nature of this study does not allow for the direct application of the terms internal and external validity, instead the issue of trustworthiness is discussed in this section. Within the context of trustworthiness, Lincoln and Guba (1986) discuss the terms transferability and credibility. Efforts were employed to attain high levels of trustworthiness throughout the data gathering and data analysis procedures.

3.10.1 Transferability

Developing a protocol that could be exactly replicated in other settings so as to attain the same results was not the purpose of this study. This study sought to understand and investigate the relationship between interpretive tools and parent-child learning. It was specifically designed to investigate parent-child learning within the context of an interactive science exhibit. The data collection was subjective in nature and the perceptions of the participants are unique to the individuals and findings that were common to all these particular participants.

However, Lincoln and Guba (1986, p. 77) assert that if descriptive narratives are included in the results, then “judgements about the degree of fit or similarity may be made by others who may wish to apply all or part of the findings elsewhere.” It is believed by the researcher of this study that the methodological approach of using a variety of exhibit labels as the basis of observations, discussions and interviews would provide rich data about family learning in many museum settings. In addition, many of the broad
theoretical findings are relevant to the design and use of exhibit labels by multi-
generational groupings. Therefore, the transferability of the study is relevant to the broad study of family learning.

3.10.1 Credibility.
Several techniques were employed to check that the study’s findings matched the reality of the situation. Lincoln and Guba (1986) refer to ‘member checking’ as a way to ensure that the researcher’s insights are consistent with the views of the participants and not following the lead of her own personal biases. These biases were discussed openly at the start of the study and proved to be part of the reason for including a Phase Two in the research protocol. The interviews and conversations were transcribed verbatim which ensured that the voice of the participants was directly integrated into the results. A variety of data sources was used to gather information and triangulate the results. As well, it appeared that participants deemed the researcher trustworthy, which resulted in relaxed interviews and natural reporting of reactivity (Merriam, 1998).

3.10.1.1 Member checking.
Due to the exploratory and interpretive nature of the study and the qualitative methodology, data was collected and interpreted by the researcher. All of the parents and in some cases the children, in this study revealed their own personal perspectives to the researcher. Every effort was made to ensure that the views of the participants were incorporated into the data collection; however, the researcher was left to interpret and synthesize the results. Therefore, it is acknowledged that due to the researcher’s role in
interpreting the data, personal bias could threaten the validity of the data. To counterbalance this situation, the researcher reconstructed her perceptions with the participants’ involvement (Lincoln & Guba, 1986). She frequently paraphrased and summarized the thoughts and feelings of the participants while the interview was ongoing so that parents had time to augment and clarify their perspectives about the exhibit experience. As a result, the researcher’s findings were challenged and clarified.

3.10.1.2 Acknowledging the researcher perspective.

Further to the notion of personal bias of the researcher, the necessity of embarking on Phase Two of the study was in part to clarify the data that suggested results that opposed those consider sensible by the researcher. In Phase One, to the surprise of the researcher, there was great interest in text that related to scientific principles rather than analogical references. It was counter to the sense that the researcher held at the onset of the study. Throughout Phase One, results were discussed with the study supervisors about the data collection. Discussion of the bias was transparent and it was debriefed openly so that it could be acknowledged and then put aside to make room for new ideas.

3.10.1.3 Verbatim transcriptions.

Parent-child conversations as well as interviews were transcribed verbatim. Whittemore et al. (2001) describe this as a technique that can demonstrate validity in the data generating phase. The full transcriptions of conversations and interviews were summarized in subsequent data analysis for both Phase One and Two of the study in
Chapter Four (Results) and direct quotes from the transcriptions were incorporated into Chapter Five (Discussion).

3.10.1.4 Triangulation.

The use of multiple methods and sources is a well-referenced technique to ensuring the results of a study are credible (Lincoln and Guba, 1986; Mathison, 1988). Multiple methods of data collection were used in this study including observation of participants (with brief field notes), audio-recordings, and interviewing of participants. This array of techniques allowed for the perspectives of the participants, as well as the researcher, to contribute to the study’s findings. It was the intention of the study to reveal the participant’s authentic responses to the labels and exhibit setting. This study includes an analysis of each family’s dialogue while they were involved with a particular exhibit. In addition, participants had opportunities to talk about their perceptions and experiences immediately after engaging with the exhibit.

Mathison (1988) agrees that triangulation and use of multiple methods can strengthen the validity of a study but she also argues that the intention of the use of these methods is not only to seek out convergence. She states that different data collection methods can reveal inconsistent and contradictory results, which can well interpreted with both “empirical data… (and a) holistic understanding of a situation and general background knowledge about the class of social phenomena” (Mathison, 1988, p.17). The contradictory results of Phase 1 were investigated further in Phase 2.
3.10.1.5 Trustworthiness of the researcher.

The personality of the researcher can influence the interactions between the researcher and the participants (Punch, 1994). Following the methodological protocol of this study, the researcher had to quickly gain the confidence of the participants and establish a brief relationship with them in order to proceed with data collection. The researcher is female and was born and raised in Vancouver but has lived abroad and has many family relations who live outside of Canada. She is of a similar cultural background and age as many of the respondents and also has young children herself. The high acceptance rate of participants (70%) may indicate that the researcher was deemed trustworthy by the participants and increased the likelihood that they would be comfortable in revealing their thoughts to her about the research situation. In addition, none of the participants cut short their involvement in the study and if anything, the interviews proceeded into longer conversations than was originally intended.

3.10.1.6 Assessing for reactivity.

Although the inclusion of observation and audio-recording provided credibility to the study, it could be argued that participants may have been self-conscious of their experience since they had only a little time to get used to the presence of a recording device. Therefore, a participant’s natural and normal approach toward the exhibit may have been altered or stifled and they may not engage normally in their exploration of the exhibit (Palys, 2003). It is acknowledged that the non-naturalistic nature of the researcher’s intervention could be a threat to this study’s internal validity. It is also duly noted that the data collection protocol might be biased toward museum visitors who have
confidence with their verbal ability to synthesize information and to share their opinions in an interview setting.

Some reactivity was noted in most parent-child exhibit experiences. In several cases, it appeared that a family’s natural behaviours were exaggerated and often this was self-reported by the participants themselves. For example, chatty families talked for a longer period of time than they said that might usually and quiet families were quieter than normal. These observations and revelations were then discussed in the context of the interview and in the end provided opportunities for more in-depth discussions of the participant’s experiences. In each case, by interviewing before and after the exhibit experience and recording the exhibit conversation, the researcher could ascertain what would be each family’s natural approach to an exhibit experience.

3.11 Ethics and limitations

3.11.1 Ethics.

Prior to the commencement of the study, a Human Ethics Application for Behavioural Study was submitted to and then accepted by the University of British Columbia’s Behavioural Research Ethics Board (BREB). Particular consideration was taken to ensure that the rights of the participating parents and children were properly considered and communicated. The Ethics Board reviewed all of the documentation that was associated with the study. Following the standards outlined by the University’s Ethics Board, the issues of confidentiality and security of the statements made by each
individual was described in the application and the consent form (signed by the participating parents). In addition, the study’s intentions were transparently described in a lengthy consent form, which also included information about recruitment of participants, their right to say no to inclusion in the study, and benefits of being included in the study. See Appendix D for a copy of the consent form.

3.11.2 Limitations of the study.

As much as it is a strength of qualitative research, studies such as these are confined by the interpretation of the data by the researcher (Stake, 1995). Therefore, this study is limited to the perceptions of the researcher and the comments of the participants as communicated to the researcher. The previous section includes an extensive discussion of the trustworthiness of the data. In addition, the findings of this study are limited by the setting. There are several kinds of interactive science exhibits, the Water Vortex being an example of just one.
4  RESULTS

4.1  Overview of data analysis and synthesis

This chapter primarily addresses the first research question: *What do parents and children talk about when different label text is on view at an interactive science exhibit?*

This research question demanded that rich and varied, brief and lengthy conversations between parents and children be captured, transcribed, analyzed, summarized and then coded. The descriptive data was coded into conceptual categories for further interpretive analysis (Merriam, 1998), and subsequently referenced in the remaining research questions (See Chapter Five).

In addition, the study’s theoretical framework required that each family’s exhibit experience be distinctly represented. Therefore, the responses of each family are reported individually. They are documented in chronological order, beginning with the first participating family (WV1) and ending with data from the last family (WV27). Each family’s conversation is followed by a summary of the comments and opinions voiced by parents during post-exhibit interviews, when they were asked to reflect on their exhibit experiences and responses to the label text. Their reflections about the label text produced respective data about each family’s learning agendas, analysis of which is also reported within this chapter.

The chapter is divided into four sections according to the four labels that were on view at the time of each exhibit experience, which were as follows: Causal, Analogical, Principled and Combination. Nineteen families participated in this phase. Six families
used the Causal Label, seven used the Analogical Label and six used the Principled Label. Seven more families participated in Phase Two at which time the Combination Label was on view. Data was gathered primarily from audio data (a digital voice recorder was held by the parents) as well as observations recorded by the researcher. The pre- and post-exhibit interviews were also recorded with a digital voice recorder.

4.2 Phase One

4.2.1 Exhibit experiences with the Causal Label.

A total of six families (WV1-6) used the Water Vortex with the Causal Label on view at the exhibit. They were observed and interviewed in this context. The text for the Causal Label is as follows:

<table>
<thead>
<tr>
<th>Water Vortex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find the lever that changes the water flow. Watch the white faucet. Change the speed of the water flow. What happens to the ball?</td>
</tr>
</tbody>
</table>

**WV1**

WV1 was a mother-daughter (10 years) dyad from Vancouver Island BC. The mother schools the daughter at home.

*Action to Observation to Explanation (Causal/Principled)*: They changed the speed of the water flow and discussed if it was the drain at the bottom or the air
above that was causing the water to move. The mother said, “Let’s try to figure this out.”

*Action to Observation to Explanation (Analogical):* When they slowed the water, the daughter compared the speed of the water to the water flow of a lake. Then, the mother defined a vortex as spinning air or water, giving examples of a drain or a toilet and the daughter added that it was like a whirlpool.

*Action to Observation to Explanation (Principled):* They increased the flow of the water and noticed that the ball was dropping. The daughter then made a guess as to why this was occurring: “I know that when it goes fast, the ball is heavier than everything else... and the pressure.” The mother sounded unsure of how to respond to this suggested notion and appeared frustrated that the label did not offer more scientific information.

*Post-exhibit interview:* Prompted by her daughter’s comments about buoyancy and pressure, the mother had turned to the label for a definition of a vortex and for more information about what forces create them. She said that she would have preferred a label like the Principled Label.

JH: Was there anything you were thinking about (during the exhibit experience) that you didn’t talk about?
M: I wish I could have explained (the visible phenomenon) better because I am not familiar with why the ball (moved) – where the pressure was coming from and what made the ball (move). The other labels are more explanatory.

This parent was interested in canonically correct science content because it was relevant to her role as a home-schooling parent experiences.

**WV2**

WV2 was a family from Prince George, B.C., which was comprised of a mother, father and two physically active sons, aged 5 and 9 years. All four family members participated in the exhibit experience and the mother was interviewed. As the sons began to play at the exhibit, the parents read the entire label aloud.

*Action to Observation to Explanation (Causal):* The parents paraphrased the label text suggesting that they try a certain speed and then quoted the label, saying, “See what happens to the ball.” Each time the sons were able to grasp the cause and effect of their actions.

*Observations to Explanation (Analogical):* The father asked the family, “What does this look like? Where do we see this at home?” One son answered, “It is like the bathtub.” The mother reiterated that they do see the same action in the bathtub drain.
Observation to Explanation (Analogical): Another son observed the phenomenon and described the drain as “sucking the ball in and then it stops…” (he changes the speed of the water) “then it blasts it up like a rocket!”

Post-exhibit interview: The mother of WV2 reported that she liked how the Causal Label provided a framework for an exploratory activity that seemed relevant to all family members. When asked how the label supported their experience, the mother reported that the open-ended question (“What is happening to the ball?”) was helpful for their collective conversation because it gave their experience a focus without giving them too much information right away.

WV3

WV3 was comprised of a father and a daughter (11 years) from Maryland, USA. The father is a professional scientist and his daughter appeared to be very scientifically literate. The father reported that his time with his daughter was about having fun and learning about science.

Observation to Explanation (Analogical): Their conversation at the exhibit jumped quickly into a discussion about scientific explanations because of their advanced prior knowledge. The daughter summarized that the exhibit’s main concept was to illustrate how a whirlpool works and she noted that at a particular speed the ball moves into the vortex. She later reported that she had been thinking of a poem about ships being sucked into whirlpools.
Observation to Explanation (Principled): When the daughter asked what force cause the water to spin around, the father pointed out the changing shape of the vortex which led them into a discussion about whether the water was pushing or pulling the ball. The father suggested that centripetal force was pulling the ball downward. He concluded: “Watch what is happening to the ball. By changing the speed, we are changing the force.”

Post-exhibit interview: When asked if the label supported his exhibit experience with his daughter, in contrast to WV2, this parent reported that the Causal label “didn’t help as much as the label at the bubble exhibit. It just said ‘Pull the lever and see if you can change the force.’” He reported that he wanted more scientific information. Then he was shown the three labels.

JH: Is there one that draws your attention or one that might have been helpful?”

F: I think the second one (Analogical) about the toilet bowl because you see it so much... it has to be something you can see every day.

The learning agenda of this parent was to teach his daughter about a scientific concept, but to also take into account an effective way in which to teach it.

WV4

WV4 was a mother and daughter (8 years) pair from the Vancouver Lower Mainland. They were at Science World to support the daughter’s interest in science. The mother reported that she herself did not have much interest in science or much confidence learning science.
*Action to Observation to Explanation (Causal):* In order to discuss the dynamic between the flow of the water and the motions of the ball, the mother asked many questions to help her daughter understand that the speed of the water was affecting the ball. The daughter struggled to explain how her actions were impacting the actions of the ball. Subsequently, the mother quoted the label text, ‘Fast’ and ‘Slow’ on the lever, to support her own observation that the speed of the water was changing the motions of the ball.

*Post-exhibit interview:* When asked which label attracted her attention, the mother made a clear choice for the Analogical label. She said that her daughter would be attracted to the image of a toilet. The mother suggested that the familiar reference to a toilet might have been a better entry point into the workings of the exhibit for the mother who had a limited understanding of physics and the daughter who struggled to talk about the cause and effect of the exhibit.

**WV5**

WV5 was a family group comprised of a father and two daughters (6 and 7 years old) from Calgary who had emigrated from Venezuela five years ago. Their reason for coming to Vancouver’s Science World was so that the girls could “spend time playing with science stuff. Learning and to have fun. Both.”

*Action to Observation:* The father noticed that the lever changes the speed of the water from “fast to slow.” One daughter remarked, “Slow is better! It is sinking!” The father wanted to speed up the water, while the daughter worried that if the water spun too quickly the ball would be sucked down the drain.
Action to Observation to Explanation (Causal): They put the speed of the water at mid-level to keep the ball in the middle of the water column. The father commented to his daughters: “The ball is moving with the current” and that by changing the speed then observing the ball, they were conducting an experiment.

Post-exhibit interview: When asked what was important about his exhibit experience, the father said: “You want them to learn things and focus on doing the activity...” When asked about an ideal exhibit label, he said “it should explain what the objective of the game is first and then after that explain how you might be able to achieve it, which I think is the case here.” Although he reported that he was very satisfied with his exhibit experience and the Causal Label, when he was shown all three exhibit labels and asked which one “might have been helpful” he said that he preferred the Principled Label. He suggested that when the children were older, it would be helpful to have access to more scientific information.

WV6
WV6 was a family comprised of a mother, a daughter (13 years) and a son (9 years) from the Vancouver Lower Mainland. They were at Science World to attend a home schooling workshop. The mother and father work in scientific fields and the children have strong interests in science-related topics. The mother reported that the kids are reserved by nature and not chatty in the noisy setting of the gallery. They waited for a while until the exhibit became available and then the mother read the label aloud. They tried to find the in-flow faucet as the label suggested but could not. The mother said that she was
surprised that the ball went all the way down to the bottom of the exhibit. There was a long stretch of silence and then the children indicated that they had had enough of the experience.

*Post-exhibit interview:* When asked about what an ideal exhibit label might be like, the mother suggested that it would be comprehensive and offer “a second layer that we could dig into” that would allow for a deeper learning experience rather than one that keeps learning at a superficial level. When she was shown all three exhibit labels and asked what label would support their shared learning, she said that the Analogical Label would “attract the kids’ attention” but that she liked the Principled Label “the most because it leads to the answer.” She added, “I would drive towards getting the concepts behind it rather than just a superficial – we are playing with it but we don’t know what it does. So, I would combine (the two).”

**Summary of Discussions at Exhibit with Causal Label (WV1-WV6)**

When the Causal Label text was on view at the exhibit, families discussed their actions and observations of the exhibit. The actions and observations made by the children and parents appeared to be the foundation of their conversations and led to explanations of the scientific phenomenon and analogical comparisons. In some cases, these conversations were prompted by the label text. Parents and children also added analogical and / or scientific references if those particular topics and speech patterns were within their framework of interest and within the scope of their prior knowledge.
Emergent from the post-exhibit interviews, it is apparent that there is a range of preferences for different label text. The Causal Label was only preferred by one family (WV2), while the rest of the parents voiced different preferences. These preferences appear to relate to the general visit agendas, and subsequently the unique learning agendas held by different parents and families. See Chapter Five for a further discussion of the findings about these emergent learning agendas.

### 4.2.2 Exhibit experiences with the Analogical Label

Seven families used the exhibit when the Analogical Label was on view. The text of this label is as follows:

**Water Vortex**

Find the lever that changes the water flow. Watch the white faucet at the bottom of the tank. The water is flushing like a toilet bowl. Change the speed of the flush. What is happening to the ball?

---

**WV7**

WV7 was a father and son (9 years) dyad from Washington State, USA. The father reported that the reason for their return visit was due in part to his satisfaction with the ways in which the exhibits cater to different learning styles. He said that his son “likes the visual and interactive” aspects of the exhibits.
*Observation to Explanation (Analogical):* The son read the label aloud and the father laughed and asked a series of questions that drew out the analogy between the content of a toilet and the purple ball in the exhibit.

*Observation to Explanation (Analogical):* The father then drew a comparison between the exhibit and one of his son’s school projects, which involved the creation of a liquid tornado in a jar.

*Post-exhibit interview:* During their short conversation, the father tried to engage in conversation topics that he thought would be of interest to his son. When he was shown the three label types and asked if one attracts his attention or would have been helpful, he reported that the Analogical Label worked well because “I think this is what he can visualize - something like a toilet.”

**WV8**

WV8 was a family comprised of a mother and two daughters (9 and 10 years) from Vancouver, B.C.. The children love Science World and visit regularly as members. In the pre-exhibit interview, the mother reported that what “they talk about here (at Science World), they talk about at home and at school.”

*Action to Observation to Action:* The pair discussed how far the ball moved up and down as they changed the speed of the water. They observed that it was sucked into the vortex. They described the water as shifting and wobbling when it spins slowly. They
investigated where to position the lever so that the ball was in the vortex and both were spinning.

*Observation to Explanation (Principled):* The mother concluded the conversation by asking again, “What is causing the ball to move?” Early in the discussion the elder daughter answered that it was the speed of the water and later she made a reference to gravity. At the end of their exhibit experience, she said: “The vortex pushes the ball when it spins. When it is slow then it doesn’t have as much power to spin because the water… the ball is floatable.”

*Post-exhibit interview:* This family’s conversation at the exhibit was extraordinarily long, over 10 minutes. The mother reported that they had spent a long time saying the same things over and over. When asked if they discussed the toilet reference, she commented that “We didn’t talk about the toilet image. We got it. We didn’t really need to talk about it.” When the mother was shown the three label types, she stated that she had more interest in the content within a Principled Label. She said, “You don’t know what is happening... Because I was trying to figure out the water flow. That (label text) would have been helpful.” This family’s learning agenda included quite a rigorous exploration of the exhibit and a desire for a deeper, more intellectual experience.

*Change of exhibit label text.*

The label text was altered at this point because it was noted that the participants had had difficulty finding the white faucet and it was a distracting part of the exhibit experience. The researcher also chose to change the analogy to that of a bath scene because of her
own discomfort in discussing the contents of a toilet and because she speculated that bathing is an experience that parents and children experience together. The Causal and Principled labels were altered as well because they were used during the post-exhibit interviews. However, the toilet analogy was used again in the Combination Label.

<table>
<thead>
<tr>
<th>Water Vortex</th>
</tr>
</thead>
<tbody>
<tr>
<td>The purple ball is caught in a spinning water vortex – like a bath toy! As it moves toward the drain of the bath, the water spins faster and faster. Change the speed of the water as it spins in the tank. What is happening to the ball?</td>
</tr>
</tbody>
</table>

WV9
This pairing was a mother and daughter (8 years) from Australia. The mother reported that the daughter loves science and “learning it in a fun way.” However, the mother reported that she has difficulty learning science concepts and was always told as a child that she was better at arts.

*Observation to Explanation (Causal):* The daughter read the label and the mother paraphrased the last line of the label by saying, “Let’s have a look. What is happening?” The daughter succinctly summarized the relationship between the ball’s motion and the speed of the water.

*Action to Observation to Explanation (Analogical):* The mother suggested that they speed up the water flow and the daughter said, “It goes down, but then it stops.” Their brief conversation then moved to comparing the ball to a bath toy and the vortex to an icicle.
Post-exhibit interview: When she was asked how the label contributed to their exhibit experience, she said, “I thought it was really well labelled. It led me to ask relevant questions. I am not scientifically minded so it was good that it gave such a clear explanation of what is going on.” When she was asked to read all three labels, she reported a preference for the Analogical Label. The Analogical Label supported her efforts to interact and learn with her child by providing the mother with scientific references that she could understand.

WV10

WV10 was comprised of a mother and son (4 years but looks older) from Washington State, USA. They had not been to Science World before and were visiting because they considered it an interesting outing on a rainy day but also because “it is fun to see (these exhibits).” The mother reported that her family does not “get very scientific” during their visit and that they “just want to have fun.” She considers it important for her children to “develop curiosity about the world.”

Observation to Identification to Explanation (Analogical): The mother opened the conversation by reading the title of the exhibit label text (water vortex) and noted that the vortex was similar in shape to his marble run.

Action to Observation to Explanation (Causal): She asked him what the lever was doing and he answered that it was making the water go faster. The conversation continued with the mother asking her son to comment on the ball’s motion when the water slowed down and then sped up.
Observation to Explanation (Analogical): The mother asked her son if the exhibit reminded him of what happens in the bathtub, but he was too busy laughing, changing the speed of the water and making zooming sounds to answer her.

Post-exhibit interview: When asked what an ideal label should say, the mother said that it should include a question to prompt discovery as well as an explanation. Then the interviewer asked her why an explanation is important. She added, “Well it is important for me, to help me teach whatever it is I am supposed to be teaching him. Because I might not understand it myself.” Like the comments of WV4 and WV9, this interaction suggests that parents seek out information that they themselves can understand and then discuss with their children. When she was asked to comment on all three label types, she preferred the Analogical Label.

WV11
This family group was comprised of a father and a son (6 years) as well as a daughter (3 years) who joined the group near the end of the exhibit experience. This Australian family had recently moved from Malaysia to Calgary. The father is an engineer with an interest in science education.

Observation to Explanation (Principled): The father paraphrased the label’s question, “What do you think is happening?” and the son answered, “The tornado is pushing it up and the tornado is pushing it down.” The father then clarified that the pushing action was linked to the spiralling of the water and noted that the ball was buoyant and would float if the water stopped spinning.
Observation to Explanation (Principled): Their conversation closed with a discussion about bubbles. The son observed that when the water spins quickly it pushes bubbles out. The father extended this idea by noting that the “water is spinning so fast that the air is coming out of the solution” and that “the pressure in the middle there is so low that the water is moving away and it is letting the air bubbles come out.”

Post-exhibit interview: The father was asked if the label had contributed to his exhibit experience. He reported that it had but “I would actually like to understand whether it is the flow rate or the density that was the biggest contributor.” Then he was asked if that was something he would have like to explain to his son. He responded by saying, “Yes, I think if there was a picture here he would have interpreted it quite easily.” When shown the three label types and asked what he thought of them, the father reported that he would have preferred a Principled Label.

WV12
A father and his two sons (7 and 11 years) made up this family group from Washington State, USA. The father reported that he places a high value on his children’s education and values the opportunity for his children to learn about physics.

Action to Observation to Explanation (Causal/Principled): This family’s exhibit experience was brief. The father read the label silently as the sons played with the lever. When their father asked them what was happening, both sons easily summarized the relationship between the speed of the rotating water and the movement of the ball.
However, when their father asked them why it occurred neither could answer and they did not investigate the question further.

*Post-exhibit interview:* The father was asked what an ideal label would look like. He said: “An ideal exhibit label would be one where it tells you what is going on and tells you why it is happening.” He added, “I think it is important for kids to understand why things are happening.” When he reviewed the three label types and was asked what he thought of them, he reported that the Principled Label would have been of interest to him because it discusses pressure.

**WV13**

This mother-daughter (13 years) dyad from Washington State, USA, had a brief exhibit experience.

*Action to Observation to Explanation (Causal/Analogical):* Only the mother spoke. The mother immediately read the label aloud and the mother noted how the ball changes position when the water speed changes. Her final comment was, “I guess that’s how come bathwater gets down the drain. At the end it speeds up too.”

*Post-exhibit interview:* When she reviewed the three labels, she commented that she preferred the Principled Label. She said, “They’re adding pressure to this one. That is a whole new concept to it. Nothing else is talking about pressure until this one.” The researcher clarified her comment by saying, “So, it would have taken you to a new depth?” And the mother replied, “It would make me think more about it. I would have
just walked away and not thought about it. But now I am thinking about pressure... more information leaves you with more to think about afterwards.”

**Summary of Discussions at Exhibit with Analogical Label (WV7-WV13)**

When the Analogical Label text was on view, conversations between parents and children were again grounded in their actions and observations of the exhibit. All but one parent referred to the Analogical Label content in their conversation, after reading the label aloud. It appeared that the analogical explanation helped some parents understand that when water is funnelled into a drain its velocity increases but their comments did not appear to be of interest to the children.

Again, the parents’ learning agendas were diverse in nature. Their responses to the label text helped to shape and clarify what they thought was important about their exhibit experience. For example, while WV7, WV9, and WV10 all considered the Analogical Label to have merits because it considered accessible content for children, WV8, WV11 and WV13 wanted the label content to be more challenging by including more canonically correct science. WV12 was interested in a discussion of scientific principles because the father considered it very important that children learn why scientific phenomena occur.
4.2.3  Exhibit experiences with Principled Label.

Six families (W14-19) engaged in exhibit experiences when the Principled Label was on view. The text was as follows:

**Water Vortex**

The purple ball is caught in a water vortex! As the water spins down the drain, it moves faster and has less pressure. Change the speed of the water as the water spins around the tank. What is happening to the ball?

---

**WV14**

This mother and son (9 years) dyad was from Washington State, USA. They were at Science World to celebrate the son’s birthday. The son had been home-schooled for more than a year and he was going back to public school in a few months. The mother reported that she teaches according to how her son learns. She said that she frequently asked him questions and often draws comparisons to their shared knowledge and experiences.

*Observations to Explanation (Causal):* After the son read the label, the mother said, “Can you describe what is happening to it?” She repeated a version of the term “What is happening?” four times throughout the dialogue. He commented that when the water “slows it almost catches the ball” and when it is fast, the water holds and spins it.
Observation to Identification to Explanation (Analogical): When the mother asked the son what a vortex was, he answered that it was “a spinning thing.” The mother extended this notion by asking if a vortex is always made of water. The son said that an air vortex could be made of wind, which can push leaves. The mother then retold a story of watching small tornados picking up leaves being blown toward her and her other son.

Observation to Explanation (Analogical/Principled): Later, the mother was reminded of another recent occurrence. She recalled part of a Science World show they had just watched that involved fire. The mother and son compared the movements of fire (a gas) with that of water (a liquid).

Observation to Explanation (Principled): They also discussed the shape of the vortex as thin when the water is flowing quickly and the mother asked why. They proceeded to attempt to understand the forces pushing and pulling the water and air, but they did not refer to the label that mentions pressure.

Post-exhibit interview: The mother preferred the Principled Label, which was on view during the exhibit experience. She spoke about the importance of building up a child’s vocabulary and not to use “baby talk” because any child is ready for canonically correct vocabulary. She added, “I think that if (children) repeatedly hear things then eventually they will grasp it and make the connection together. ‘Oh, I have heard this. I know this.’” This parent’s natural way of teaching her son was to help him make connections between what he knows and what he is trying to understand, in essence analogical explanations.
She did not need help figuring out what interested her son but desired label text that prompted increasingly sophisticated conversations about canonically correct science.

WV15

This parent-child dyad was comprised of a father and son (11 years) from Edmonton, AB. The father reported that his sons learned in different ways and that this son “is usually pretty good about figuring this out on his own” and “learns better through books” while his other son “learns better by doing.”

*Action to Observation to Explanation (Causal):* They read the label aloud at the beginning of their conversation and the father framed the experience by immediately suggesting, “Change the water. Change how fast it is going.” They remarked on how the ball spins faster when the spinning speed of the water increases and that it eventually stops spinning when it goes down to the drain.

*Observation to Explanation (Principled):* The son also quickly surmised, “The faster the water drains the more pressure it is putting on the ball” and attempted to integrate the scientific principle of pressure into his understanding of the exhibit.

*Post-exhibit-interview:* The father reported that he was drawn to the Principled Label because it seemed applicable to their exhibit experience. They used the causal question to launch their observations and the son used the Principled label content to understand how the forces of the water were affecting the ball.
WV16

WV16 was comprised of a mother and son (6 years) from Kelowna, B.C.. An 8 year old son joined them for a few minutes. The mother is a biologist with a high interest in science. She reported that she enjoys bringing her children to Science World because the “interactive components and hands-on activities keep them interested rather than me just explaining it to them. They can see it and touch it themselves.”

*Action to Observation to Explanation (Analogical):* Their conversation began with the mother reading aloud the last two lines of the Principled Label. She then said, “You are making the water go faster. What happens to the ball?” The son said, “It goes down.” The mother then pointed out the water at the drain of the exhibit and the son excitedly compared it to a tidal pool.

*Observation to Explanation (Principled):* Then, the mother and son began separate investigations. The son investigated how the exhibit works to create the phenomenon. Although the mother tried to persuade her son that it was the water flow that moved the ball, the son developed a hypothesis that the air at the top of the tank was pushing the water when the lever moved. At the end of his exhibit exploration he remarked, “Mumma! I have figured out something... I know how it works. When you put the ball in, air is pushing back... air bounces off the lid and his it and make it go...”

*Observation to Explanation (Principled):* Meanwhile the mother was trying to proceed with the cause and effect application of seeing if the ball would eventually float. The
older son joined his mother and brother and followed the mother’s idea of slowing the water to see if the ball would float.

*Post-exhibit interview:* Although her son was attempting to investigate the principle of pressure as it applied to the water vortex, the mother stated that she considered the Principled Label too complicated for younger children. She liked the bathtub analogue in the Analogical Label because it would help her explain buoyancy because bath toys float. She was naturally interested in label text that would help her to introduce a scientific concept by relating it to something her son would understand. She was also interested in a mechanical explanation.

**WV17**

WV17 was a mother and son (7 years) from Vancouver Lower Mainland. From her pedagogical perspective, family learning in a museum setting should be child-directed. Her time with her son at the exhibit was brief. During his visit the previous week, the son had played with the exhibit for a long time. The mother reported that after returning home, he had described the exhibit to his father in detail and compared it to a toilet. This time he got impatient when the ball did not move up and down quickly and left the exhibit after a few minutes.

*Post-exhibit interview:* The mother’s label preference was the Principled Label because it piqued her curiosity. She held this opinion not because she thought she could have explained it very well to her child but that it would lead to more questions and generate
curiosity. The Principled Label would potentially provide additional scientific vocabulary that she thought was appropriate because “this is Science World after all.” She thought the Analogical Label creates a bias and directs people’s thinking too much.

**WV18**

This parent-child dyad was comprised of a father and son (6 years) from the Vancouver Lower Mainland, who were having a ‘Guys Day’ at Science World. The father has a moderate interest in science but his son is fascinated by it.

*Observation to Explanation (Analogical):* After approaching the exhibit, the son immediately asked if the exhibit was a tornado. The father suggested that he read the label to find out.

*Action to Observation to Explanation (Causal):* They discussed what happens to the ball when the water slows down and then speeds up. The father asks why that was happening and they commented on how the water was pushing the ball.

*Observation to Explanation (Analogical):* Then the father asked: “What is that spinning like? What does that remind you in the house? Like a toilet, right?” The son did not answer; he had finished with the exhibit.
Post-exhibit interview: This father stated his preference for the Analogical Label. His reason for this choice was that it reflected what came to his mind when he saw the exhibit.

WV19

This participating family was unusual in that the father and son (8 years) began the exhibit experience together; however, part way through the exhibit experience, the son asked his dad to get his mother (who had been standing out of hearing range) so that he could show her the exhibit too. Therefore, the son’s conversations with both of his parents were recorded and a part of the exhibit experience. Both parents are professional scientists and the father has a doctorate in physics. The father was the primary parent who was interviewed.

Action to Observation: The son’s conversation with his father began when the son asked, “How do you make that do that?” The father suggested that they read the label and pointed out where the drain is and how the lever worked.

Observation to Explanation (Causal/Principled): They then proceeded with a rallying dialogue of questions and answers. The father asked questions about what happens to the ball when the speed of the water slows and speeds up; would the ball float if the water stopped spinning; and followed it with a clever question about what was holding it down. The son said it was the spinning water that was holding it down.
Explanation (Mechanical): Then, the father directed the discussion to include an exploration of the exhibit’s mechanics. He asked: “I wonder how they make it spin like that?” The son found the inflow tube and the outflow of the drain, remarking that the when the water is pumped in and drains out the ball is sucked downward.

Action to Observation to Explanation (Principled): At this point, the son asked the father to get the mother. The son showed his mother that he could move the ball down to the drain and that the ball stops spinning when it reaches the drain. Then he started to move the ball up to the top of the exhibit. Then, like the father, the mother asked: Can you turn the water off? What might happen to the ball if the water stopped? The son said that it would float.

Post-exhibit interview: The father stated a preference for a combined Analogical and Principled Label. He reported that in order to discuss the exhibit he must figure out what is happening and then think about “what is reasonable to get across in a certain period of time – and then what is the right vocabulary. (And in order to do that,) I have to have a model for what the child understands.” When a parent understands what their child knows, he suggested that a parent could increase the sophistication of the vocabulary. He thought the “metaphor of the bath is a great idea. And then talking about pressure is a good idea” but argued that it was quite an intellectual leap for children to make in the context of this particular exhibit.
Summary of Discussions at Exhibit with Principled Label (WV14-WV19)

Six families viewed the Principled Label. The only dyad to directly refer to label text of the Principled Label was the father and his 11-year-old son (WV15). The father reported that his son has an aptitude for figuring things out by referencing books so it seemed appropriate that he also use the label text to interpret his understanding of the exhibit. For the most part, the responses to this label were similar to the Causal Label. Again, families typically discussed their actions and observations, with some families attempting to develop scientific explanations and analogical comparisons.

4.2.4 Summary of Phase One and progressing to Phase Two.

The parent-child conversations in Phase One of this study were analyzed to assess what label text was used by parents during their exhibit experiences and what they considered useful when discussing the three label types in the post-exhibit interview.

Throughout Phase One, parents prolifically used the instructive statements and the open-ended question, which were included in all three labels during their exhibit experiences and the core of the Causal Label. It appeared that parents and children discussed their actions and observations, which in turn led to explanatory conversations. Many conversations about the exhibit’s phenomenon emerged directly from the actions and observations made by parents and children.

Six of the seven families who viewed the Analogical Label integrated the text into their conversations. It is possible that because the subject matter was easy to understand,
parents were quick to try and discuss it. However, children did not engage in further
discussions about the analogical material in the label but were more likely to discuss
spontaneous recollections of familiar object and occurrences. Only one family (WV15)
discussed the label text of the Principled Label that was on view when six families
engaged in exhibit experiences.

Yet, the Principled Label was the most popular with parents when they were interviewed
after their exhibit experience, regardless of what label had been on view. Of the 19
parents who were interviewed, nine parents were drawn to the Principled Label and two
parents considered it worthwhile to have text from the Principled Label combined with
Analogical Label. Although many parents considered the reference to pressure
applicable to their situation, they found it hard to directly integrate them into their
conversations. Seven parents favoured the Analogical Label and those who saw the label
on view found it easy to discuss. Table 5 for a summary of the data.

Table 5. Summary of responses to the three label types used in Phase One

<table>
<thead>
<tr>
<th>Label Type</th>
<th>Label Text discussed during exhibit experience</th>
<th>Preference for label as discussed in the post-exhibit interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causal Label</td>
<td>6 of 6 families</td>
<td>1 of 19 families</td>
</tr>
<tr>
<td>Analogical Label</td>
<td>6 of 7 families</td>
<td>7 of 19 families</td>
</tr>
<tr>
<td>Principled Label</td>
<td>1 of 6 families</td>
<td>9 of 19 families</td>
</tr>
<tr>
<td>Analogical/Principled Label</td>
<td>n/a</td>
<td>2 of 19 families</td>
</tr>
</tbody>
</table>
All but one parent (WV2) reported that they were looking for more explanatory content than what was present in the Causal Label. Therefore, a critical finding of this study is that a Causal Label (which included instructions and a question prompting exploration and actions) did not fully meet the needs of nearly every family that engaged with the exhibit.

In addition, three parents (WV3, WV11 and WV19) used mechanical questions and explanations in their conversations with their children. Additional queries by parents (WV1, WV8 and WV16) suggested that this was a potential explanatory approach for an exhibit label to be investigated.

Therefore, it was considered a worthwhile effort to investigate how parents responded to a label that included all three explanatory approaches as well as information about how the exhibit worked. This new Combination Label was drafted and then viewed and discussed by eight families in Phase Two of the study.

### 4.3 Phase Two

The results of Phase One provided interesting insights that suggested that a further investigation using a label with a combination of explanatory content might further inform the study’s results. Therefore, the study proceeded to a Phase Two of data collection to investigate whether more complex label content revealed and clarified anything further about the mediation of learning between parents and children at
interactive science exhibits. Eight families (WV20-WV27) engaged in exhibit experiences when the Combination Label was on view.

Water Vortex

Like a toilet, the water in this tank is flushing in a circular motion. It is flushing down the drain but is it not going to the sewer!

Instead, the water is being pumped back into the tank at different speeds. As the speed of the water increases in the centre its pressure decreases and the water is pushed in a downward vortex.

Change the speed of the flush.

What is happening to the ball?
What else does this exhibit remind you of?
How is it the same or different?

The results in Phase Two informed the results of Phase One in three ways. Firstly, the data revealed further evidence that the conversational categories (Actions, Observations and Explanations), which were identified in Phase One, were again recognized even when a label with combined explanatory content was on view. Secondly, it was observed again that instructive statements, labels on the lever and open-ended questions were used in conversation to mediate learning and appeared to support the natural structure of familial conversation. A second open-ended question was included in the Combination Label and further data was gathered about the nature of questions and their use in social learning. Thirdly, results from the post-exhibit interviews conducted in Phase Two further informed the understanding of responses by parents to the content of Analogical and Principled Labels. Because several explanatory styles were included in the Combination Label, parents were asked to comment on the label as a whole rather
commenting on their responses to different label types which was the case in Phase One.

The data from Phase Two is further discussed and incorporated into the remaining research questions which are the focus of the next chapter.
5 DISCUSSION

5.1 Overview

The results of the study were interpreted in response to the three research questions, and were consistent with the reviewed literature relating to family learning mediated by exhibit label text. The previous chapter addressed the first research question which sought to describe and analyze what parents and children talked about at the Water Vortex exhibit when different label text was on view.

The two remaining research questions are addressed in this chapter. The first section of this chapter identifies the ways in which parents and children mediated their efforts to learn about the exhibit together. The second section discusses the broader nature of family learning. In both cases, these research topics were informed by the responses of parents and children to the four different label text versions used in this study.

5.2 Research question two:

What is the nature of the families’ mediation of learning when they read and discuss the label text and engage with an exhibit?

5.2.1 Introduction.

Sociocultural theory emphasizes the important links between the social interaction and the construction of knowledge (John-Steiner & Mahn, 1996; Vygotsky, 1986; Wertsch, 1991). When taking into account the social interactions and the role of exhibit label text, it was evident that many families (particularly parents) used the label text to guide,
organize and structure their learning experiences. Therefore, in addressing this research question, three characteristics of the learning experience at the Water Vortex exhibit were identified.

Firstly, while the context and detail of the conversations were unique to each dyad, most families were motivated to understand more about their own actions and observations. In other words, the nature of how learning was mediated by the families was directly related to what they were doing and seeing. Secondly, it was noted that label text supported the family as a community of learners by providing a guide for conversation. Finally, label content also appeared to mediate learning.

5.2.2 Learning is mediated by actions and observations.

Sociocultural theory suggests that social and physical constructs mediate of learning and prompt human activity (Lantolf, 2006). Described as activity theory, Leont’ev argued that practical and intellectual experiences are intertwined (Cole, 1985). Such is the case with interactive science exhibits which are designed to motivate visitors into physical activity as well as intellectual exploration (Schauble et al., 2002). In this study the Water Vortex exhibit was the setting for significant physical and intellectual activity in which families engaged. Regardless of what label was on view, the conversational data suggests that the family learning experience was rooted in actions and observations.
5.2.2.1 Actions.

The children of the participating families did not hesitate to reach for the control lever and change its position. They were usually the first to manoeuvre the exhibit’s lever that controlled the speed of the rotating water in the cylinder. This observation concurs with Diamond (1986) and McManus (1988) who also noted that at interactive exhibits children were first to engage with the hand-on components. In most cases, the children were moving the lever before the parent had a sense of what the exhibit was about.

As the children engaged with the exhibit, parents began to read the label aloud or silently. Label reading appeared to be a substantial part of the moment when most parents were attempting to understand his/her child’s actions, which involved moving the lever between fast and slow speeds of the water. As Hirschi and Screven (1988) noted, each family had a ‘designated reader.’ The findings of this current study and others (Diamond, 1986; Hensel, 1987; and McManus, 1988), found that the parent was often the person who initially read the label, paraphrased the message or asked the child to read.

This study concurs with the findings of Borun and Dritsas (1997, p. 189) who reported that instructions were an important component of the family learning experience because they offered an efficient “mode of entry into the experiential process.” The instructive statement (“Change the speed of the water…”) appeared to provide many parents with information about how to use the lever that controlled the water’s speed. The instructions appeared important for the initial engagement of the exhibit experience but following the initial reading of a label the term “change the speed” was rarely referred to again.
Once the instructive statement was read, most family members paraphrased their understanding of how to use the exhibit with comments like: “Make it spin faster.” “Slow it down!” “Move it to fast!” Therefore, the text on the lever that stated ‘Fast’ and ‘Slow’ speeds was used more frequently by parents as a way to ensure that their children understood that the lever controlled the water speed. Some parents (WV1, WV2, WV5, WV11, and WV19) noted the speed at the beginning of the dialogue in the first moments of their exhibit experience. Other parents (WV4, WV24) referred to it later on in the conversation in an explanatory context to reinforce that the speed of the water is affecting the ball.

5.2.2.2 Observations.

Flowing from an understanding of the physical interactivity of the exhibit were discussions of observations. Many parents and children collaboratively discussed their observations of the purple ball, the movement of the water, and the subsequent dynamics of how the ball and water interacted. They observed the ball changing position and the water vortex changing shape when the speed of the water is altered. One father (WV19) described the investigative process as “gathering empirical evidence.” This sentiment concurs with Crowley et al. (2001, p. 725-6) who found that parents help children to “select and encode relevant evidence” and to “generate evidence.”

The process of gathering evidence in Crowley et al.’s (2001) study was considered to be a significant and complex part of the parent-child interactions in part because of the various
ways in which the Zoetrope exhibit could be operated. The Water Vortex only had one lever to pull and push and the physical interactions were simple to enact and discuss. Yet, the visual nature of the exhibit frequently prompted rich and varied discussions. The action-oriented exhibit experience was highly child-centred however, discussions of the actions and observations were often framed by the parent with the help of the exhibit label text that refered to instructions and questions.

5.2.2.3 Explanations.

Explanatory conversations emerged from the families’ discussions of their actions and observations. They were categorized in the same categories described by Crowley et al. (2001). Many family members spontaneously developed Analogical explanations. They compared the water vortex to other things that had similar physical features or movements. Children tended to enthusiastically refer to the water vortex as concrete things such as: a tornado (WV11), a tide pool (WV16) or a whirlpool (WV1, WV3) when they were talking about the exhibit. The son (WV2) pretended that the ball was a rocket blasting upward as the water slowed. Parents compared the exhibit to things that related to shared memories: a fountain (WV7); a marble run (WV10); and a science experiment (WV7).

Buoyancy, force and pressure were common topic of Principled explanations. When observing the water’s spin slowing down, several families (WV1, WV8, WV16 and WV19) watched the ball move upward and they discussed whether the ball would reach the surface and whether it would float as a result of the buoyant nature of the ball. A
father (WV19) extended his discussion of buoyancy to the force of the spin by asking his son (8 years) if he knew what was holding down the ball. The daughter WV3 (11 years) and WV8 (10 years) discussed centripetal force and the buoyancy of the ball after observing that the ball moved upward when the water slowed down.

Other children suggested that the downward force of the vortex was caused by gravity (WV8 and WV21) and pressure from the top of the tank (WV1, WV8, WV14 and WV16). In one case (WV16), the parent and the child conducted parallel discussions about the scientific phenomena that they were observing. While the son was speculating on the downward pressure of the water, the mother contemplated the buoyancy of the ball. The mother attempted to support her son’s exploration of the exhibit but in the end they had separate investigations in each other’s company.

Crowley et al. (2001) reported that in their study parents initiated most of the explanatory conversations. In contrast, in this current study children were just as likely to initiate discussions of scientific concepts as they applied to the exhibit experience. Many advanced higher-level explanations emerged out of discussions that emphasized the examination of what the children were doing and seeing.

5.2.3 Learning is mediated by label text that supports conversation.

Building on the Lave and Wenger’s (1991) notion that families are communities of learners, Ellenbogen writes that they are “accustomed to interacting and learning together, and they are equipped with an extensive array of personal and cooperative
learning strategies that facilitate the museum learning experience.” Throughout their exhibit experiences, parents and children engage in conversation and utilize their familiar learning strategies. One common learning strategy used by parents to mediate the social learning experience is the inclusion of questions in conversation.

Within the context of exhibit labels, Borun and Dritsas’ (2007, p.190) study recommended that label text be “engaging when read aloud” and this study supports their findings. Hohenstein and Tran (2007) found that the inclusion of a guiding question within a label can stimulate further questions and explanations. Similarly, this study found that parents readily used the label text “What is happening to the ball?” to prompt further discussions with their children. It appeared that it was used effectively because it matched an existing conversational discourse between family members, as described by Ash (2004). For example, the following conversation took place between a mother (WV10) and son (4 years old). The mother paraphrased the label’s question to help her son understand what they were observing.

Mother: Yeah, look how fast it is going. And look what happens when it slows down!”

Son: It goes up.

Mother: That’s right. So what to you think is going to happen to the ball when you make it go faster?”

Son: It goes down.

In another example, after having read the label, a mother (WV9) and daughter (11 years) discussed their observations and paraphrased the label’s question.
Mother: Let’s have a look. What is happening?

Daughter: Well, what is happening is that the ball is going up because the water is going slowly and it is making the vortex disappear.

The father in dyad WV11 asked, “What is happening?” several times over and then several more times he used it as a statement in his conversation with his son (6 years). Further, when his daughter (3 years) arrived the father paraphrased the question as a statement and the son responded.

Father: You explain to Tama what is happening.

Son: There is a pipe here causing the water to go that way. The water is sucking it down. When you push it faster it goes down more and when you push it up, it goes upper more.

In Phase Two of the study, a second open-ended question (“What does this exhibit remind you of?”) was added to the exhibit label. Every parent in Phase Two of the study paraphrased this question. Initially, it appeared to be a very effective question for parents to ask their children as they continued their conversation. The children’s answers ranged from drains to tornados to whirlpools. However, six of the eight parents persisted on asking the question until their child gave ‘toilet’ as an answer, which was also included in the label. It appeared that parents were compelled to force the spontaneous, open-ended nature of the question to conform to the label text’s suggested analogical comparison.

Hirschi and Screven (1988) note that although questions in a label may contribute to further discussion of an exhibit by group members, they also have the propensity to focus the reader on finding an answer to the question. In comparison, it is likely that parents
kept to the open-ended nature of the question “What is happening?” because there was not a direct answer to the question within the label. Therefore, this study acknowledges that when questions are included in an exhibit label, the associated label content should be carefully considered (Gutwill, 2006).

These findings are consistent with the work of other researchers who have argued that the inclusion of open-ended questions in exhibit labels supports the collaborative and social learning experiences of families (Berstchi et al, 2008; Borun & Dritsas, 1997) and museum visitors in general (Hohenstein & Tran, 2007). In addition, this study asserts that the inclusion of open-ended questions in label text help to mediate learning by providing a natural and familiar conversational tool.

5.2.4 Learning is mediated by scientific label content.

The data also suggests that scientific label content factored into the family learning experience in this study. Several studies have noted that although label reading by families is brief in nature, label content is also important to the learning experiences of this demographic. Studies on family learning (Diamond, 1986; Hilke, 1988; McManus, 1987) report that families do read and interpret and paraphrase label content. In her study about family agendas, Briseño-Garzón (2005) also notes label text a source for cognitive learning. Prior studies about scientific label content have investigated its effectiveness to teach visitors about a scientific principle (Borun and Miller, 1980; Borun and Adams, 1992; Kanel and Tamir, 1991). However, in this study, label content appeared to support social learning.
With social learning in mind, almost all parents stated that scientific label content (either Analogical or Principled) was important to family learning experience. Almost all parents who viewed analogical label content referenced the label text or integrated it into their conversations. Several parents (WV4, WV7, WV9, WV10 and WV18) commented that the reference to an analogy was a visual link that they could easily interpret and talk about with their child. Yet, at the same time two scientists (WV3 and WV19) reported that analogical content might help them to simplify their vast knowledge on a subject and make it more relevant to their children. They considered analogical label content to be relevant information for children and easy for parents to discuss while at the exhibit.

Other parents emphasized that the analogical label content allowed them to communicate to their children that shared common life experiences can be viewed through a scientific lens. For example, when one mother (WV25) was asked to explain why she discussed the toilet analogy with her son, said that she appreciated being able to “think about something (flushing a toilet) that we have in common and that we (both) see everyday.” This finding is consistent with the work of Crowley et al. (2001) and Eberbach and Crowley (2005), as well as Callanan and Jipson (2001, p. 43) who reported a general tendency for parents from many socio-cultural backgrounds to “contextualize new concepts and experiences by relating them to familiar topics.”

Although three of a possible 14 families (WV14, WV15 and WV23) directly incorporated the principled label content into their conversations, many parents considered it valuable
to the family learning experience. Prompted by their own interests and their children’s enthusiasm for their exhibit experience, many parents (WV1, WV6, WV8, WV11, WV12, WV13, WV17 and WV19) reported that they looked to the label text for more information about vortices and what forces create them. For example, after an exhaustive conversation about the cause and effect of the exhibit’s components with the Analogical label on view, a mother (WV8) reported that her family did not need analogical content to support their learning. She said that what they really needed was more principled scientific information that would enrich their extensive observations about the water flow.

Bertshi et al. (2008) refer to the frequent use by parents of the identification and title labels and their use of supplying vocabulary. Similar findings were observed in this study. The title of the Water Vortex exhibit was read and discussed by 12 families. Identifying a water vortex and using it in conversation was of interest and well within the grasp of almost half of the participating families. A mother (WV14) spoke about the importance of building up a child’s vocabulary and not to use “baby talk” in exhibit label text because any child is ready for canonically correct vocabulary. She added, “I think that if (children) repeatedly hear things then eventually they will grasp it and make the connection together. ‘Oh, I have heard this. I know this.’”

Several parents (WV23 and WV24) suggested that they did not expect to completely understand the scientific concepts in the labels; however, they were interested in trying to discuss scientific words and ideas with their children when possible. These statements
made by parents support the nature of Crowley et al.´s (2001) term *explanatoids*, which they describe as brief and incomplete explanations. Also emphasizing the incomplete nature of scientific conversation at an interactive science exhibit, a father (WV24) said, “canonically correct science is an important reference but understanding it in its completeness is not important.” He continued, “There are a hundred ways to talk about science, and this (scientific label text) is an entry into that.” In addition, several parents (WV1, WV5, WV6, WV8, WV15) also commented that exhibit experiences were linked to in-school learning. Therefore, it appears that families value Analogical and Principled label content as it is perceived to directly and indirectly act to mediate learning.

### 5.3 Research question three:

What is the nature of family learning as it is reflected in the families’ responses to the label text?

#### 5.3.1 Introduction.

This final section is an overview of the nature of family learning as it is informed by the responses of families to exhibit label text. Research studies have shown that families attend museums expectations of their “complex leisure experience” (Falk et al., 1998, p. 118). While Hilke (1988) argued that social agendas are of primary concern to families, others have argued that families attend museums with a mix of social, learning and recreational agendas and that these agendas are fulfilled during the visit (Briseño-Garzón, 2005; McManus, 1994; Moussouri, 2003).
5.3.2 Family learning is social.

The idea that an element of the family’s museum learning experience is social is well documented (Hilke, 1988; McManus, 1994; Moussouri 1997). Moussouri (2003) also reports that the social context of a family’s visit is of great importance to the family members, especially children. Several parents commented on the value that they or their children place on spending time together.

JH: It sounds like you were exploring together.

M (WV9): I have noticed with Lucy that my being a part of it is really important to her. Other kids are also important to her too. She prefers to have me or her dad there reacting with her. She is happy to do things on her own but likes to have us there too.

Another parent made similar comments about the value she placed on the social context of their visit.

JH: What was memorable or important for you?

M (WV10): To me the memorable part of all these experiences is to discover things with him or to watch him discover things.

I: So both observing him and spending time together.

M: As parents, we don’t get to spend as much one on one quality time with our kids as we wished we could. Whether we have an educational experiences or not it is the time we spend with our kids.

Further, this study indicates that parents seek out label text to support the social nature of the exhibit experience. At the commencement of the exhibit experiences, parents appeared to look for ways in which to merge the actions of their children with their shared observations of the exhibit.

JH: Was there anything in particular about the label that helped you?
M (WV27): I only read the first paragraph and then my son started to get interested. It provided me with enough information to explain to him what was going on and get started.

Many parents expressed very positive opinions about the nature of the open-ended questions as they related to social experiences. While Gutwill (2006) found that visitors responded negatively to questions that were not followed by further instructions, parents in this study viewed open-ended questions as a component of social learning.

For example, a mother reported that the label text, particularly the questions, helped to commence the social experience.

M (WV23): The questions spark some conversation. I think that is what I especially like. You have read this and then I was asking my son questions and if he didn’t come up with a point then I could add what I thought.

These findings support the notion that families do not rank their social agendas and learning agendas but that there is interplay between them (McManus, 1994; Briseño-Garzón, 2005). Specific to this study, it appears that label text supports the merging of social (spending time together) and learning (discussing the exhibit content) agendas during an exhibit experience.

A mother added that the questions offered options for expanding the social experience, creating more opportunities for learning.

M (WV25): ...So, when we come to a place like this, I like them to ask questions because it means that they are exploring.

JH: And how does a label help with that?
M: I like the open-ended questions because it helps to present some questions that you will ask a child that will hopefully stimulate them to ask more questions as well.

In conclusion, parents viewed social experiences as an important component of their exhibit experience. They reported that they appreciated exhibit label text that supported the social nature of their visit to Science World.

5.3.3 Family learning is represented by a range of complex learning agendas.

Framed by sociocultural theory, the family is seen as a learning community with a unique set of values and beliefs (Ellenbogen, 2002; Falk & Dierking, 2000; Hilke, 1988; McManus, 1994). These diverse values and beliefs can translate to a range of visit and learning agendas for their museum experiences (Falk, Moussouri & Coulson, 1998; Moussouri, 1997; Briseño-Garzón, 2005). Other studies indicate that children hold personal learning agendas as well (Anderson, Piscitelli & Everett, 2008). Likewise, as a community of learners, each family applies their own unique learning agendas to their exhibit experiences.

Ellenbogen (2002) studied the ways in which one family acted as a community of learners with individual and collective learning agendas, using the museum as a resource. She discussed the learning agendas of various family members and identified them across time and context. In contrast, the results from this study represent vignettes of the museum visit of 27 families, capturing a brief glimpse of their visit and learning agendas. The responses of three families who participated in the study illustrate the range of learning agendas held by families attending Science World.
In the dyad of WV1, it was the daughter’s reference to pressure that caused the mother to seek out more information from the label. She wanted to find out more information in order to scaffold her daughter’s thoughts about the concept of pressure as well as the ball’s density. The mother would have preferred a Principled Label for her exhibit experience. As an experienced home-schooling parent, she was confident in her ability to synthesize the label content and apply it to the conversation. She was looking to the label to help her understand the scientific content.

The parents of WV2 did not have any difficult questions or comments from their sons and did not naturally engage in any discussion about scientific principles. Their visit agenda involved socializing with friends. The children and the parents each developed different analogical comparisons. They enjoyed exploring the cause and effect of the exhibit together as a family of four. They achieved their goal of learning together and the mother considered the Causal Label appropriate for their use and their collective learning agenda.

The WV3 dyad immediately engaged in a scientific discussion about the forces that relating to the cause and effect of the Water Vortex exhibit. Initially, the father voiced frustration that the label on view (Causal) did not include references to scientific principles. As a scientist he had a strong interest in discussing the relevant science concepts with his daughter. However, he liked the potential of an Analogical Label because it referred to an everyday object that could be used to introduce and simplify the exhibit’s scientific phenomenon which he already knew a lot about.
Further examples of the intricate nature of family learning emerged from Phase One of the study extending the findings of Schauble et al. (2002) who reported a narrow range of parents’ engagement of learning at interactive science exhibits. Four parents who considered the contents of the Principled Label to be relevant to their learning experiences at Science World engaged in a range of learning experiences: active learning (WV5), child-directed learning (WV 17), information-based learning (WV 12), and constructivist learning (WV14).

Interestingly, of the parents referred to in the previous paragraph all, but the homeschooling parent (WV14), did not state that they would be involved in teaching the scientific concepts. However, the parents who reported that they valued being involved in explaining and introducing science concepts to their children were drawn to the Analogical label content. As was previously discussed in Section 5.2.4, references to the Analogical Label led to discussions of the value that parents’ place on their own involvement in the scientific explanation, be it by parents with novice or expert scientific literacy.

These results indicate that family learning involves a complex combination of learning experiences and therefore a family’s expectations of their exhibit experience is not necessarily straightforward, and neither are their responses to exhibit labels. Based on their beliefs about learning and their expectations of their visit, sometimes the learning agendas matched the exhibit label text and in other case it did not. Ellenbogen (2002) and Moussouri (2003) discuss the potential for tensions that exist when the family’s
learning agendas contrast with the museum’s agenda. Findings of this study suggest that similar tensions exist in relation to exhibit label text and these results indicate nascent definitions of the learning agendas associated with family learning.

5.3.4  **Family learning extends beyond the museum visit.**

During the interviews several parents discussed the potential of integrating exhibit label content into future conversations. Research studies have pointed out that family members integrate the content of museum learning experiences into other family activities (Borun, 2002; Briseño-Garzón, Anderson & Anderson, 2007). Particularly, Ellenbogen (2002) illustrates how the family acts as a learning institution, whereby the museum visit is the setting for one segment of a longer conversation about an evolving set of references relevant to the family.

This study also indicates that the information of a label text extends beyond the exhibit experience. As was discussed in previous sections, some parents (WV1, WV5, WV6, and WV14) considered their visit to Science World to have natural connections to formal school-based learning. Other parents considered their museum learning experiences to relate to their family learning experiences at home. For example, three parents (WV4, WV11, and WV16) suggested that an analogical reference would be what their child would remember of their exhibit experience and the source of future conversations. Interestingly, two of these parents did not view the Analogical Label during their exhibit experience and one only briefly mentioned it at the beginning of his family’s exhibit experience. Yet, it was considered beneficial in this context.
One father (WV11) who had engaged in a lengthy conversation at the exhibit, which investigated the forces of the vortex and the buoyancy of the ball, asserted that what his son would recall was the briefly mentioned comparison to the bath scene.

JH: So you anticipate that he will talk about something again.

F: Absolutely.

JH: Will it involve you and him and other family members?

F: He might link the bathtub thing. When the water goes down the drain, he might stick a toy in it. He might do that.

JH: Did he talk about the bathtub?

F: I just read the label.

These suggestions and those by (WV21, WV24, WV25, and WV27) suggest that the label’s analogical content or references to familiar objects would be what they could discuss at a later date. Although the Analogical Label was referenced but not extensively discussed, it appears to be recognized as a way in which family’s mark and identify their exhibit experience. The opinions of these parents indicate that they considered that analogical content would provide context to the exhibit experience and would be integrated into future conversations.

These results support the findings of Piscitelli and Anderson (2002), who identified that children’s positive recollections of their museum experiences related to exhibits with content that was familiar to them. In their studies, based in Australian museums, they found that the decontextualized content of a science centre is not as easy for children to remember as the exhibits in the natural and social history museums. However, the results
from this study indicate that providing context to an interactive science exhibit through label text does not appear to be straightforward in its relevancy to children’s immediate exhibit experience.

There were some indications that the analogical label content was not relevant to the children or their learning agendas which were often based more on their actions, observations and subsequent explanations. The parents paraphrased the label’s analogy but rarely did it prompt a further conversation. It is possible that the application of a verbal analogy to a visual exhibit may have been too abstract for younger children and too simplistic for older children. See Chapter Six for further conclusions and recommendations.
6 CONCLUSIONS

6.1 Conclusions

Working within a sociocultural framework, this study assumed that each family came to their exhibit experience with a unique set of visit agendas, relied on their familial relationships to build learning experiences and had personalized responded to the exhibit label text. Building from this theoretical framework, three key finding emerged from this study.

The first key finding of this study was that by using exhibit label text as a research tool, more details about the range of visit agendas were identified. The visit agendas were partially unveiled through the use and discussion of the label text by the family. By responding to the Causal, Analogical, Principled and Combination labels, parents were given a framework to assist them articulate what they valued and expected of their family’s exhibit experience and their perceptions of exhibit label text. A range of responses and details emerged from the data. As a result, this study suggests that one type of label does not meet the needs of all families.

A second key finding was that families broadly valued label text that introduces the activity of the exhibit and provides key phrases for use in conversation. The Causal Label was primarily comprised of an open-ended question and an instructive statement, which were also components of the other labels. These parts of the label text appeared to provide families with a firm foundation for their exhibit experiences, which were rooted in actions and observations. These questions and statements helped families to launch
and extend their collective exhibit experience, in part perhaps because it matched existing parent-child discourse. However, only one parent of 27, considered the Causal Label adequate for their family’s exhibit experience.

Therefore, a third key finding of this study was that parents not only look to label text to support their immediate exhibit experience, but they also consider it as a link to other potential learning experiences. Almost all of the parents interviewed in Phase One, were drawn to the Analogical or Principled labels. In each case, the parent had reasons to favour one label over another based on their personal perceptions. Analogical label text was valued because it was easy to understand by all family members and that it reached beyond the museum visit to other family experiences. Principled Label was considered valuable because it provided new vocabulary and challenging concepts for parents and children to think about although perhaps not always at the time of the immediate exhibit experience. In other words, one was valued because it linked with what was familiar and memorable and the other was valued because it provided new topics to potentially discuss.

In conclusion, this study attempted to understand family learning as mediated by exhibit label text. In the end, each provided information about the other. Understanding a family’s response to a range of exhibit label text provides more information about the development of relevant exhibit label text, and in turn a more detailed understanding of the visit agendas of families. Moussouri (2003) and Ellenbogen (2002) argue that by understanding these agendas, museums can more effectively respond to the family’s
learning experiences. This study argues that attention to exhibit label text is a vital way in which a museum can understand and then engage with families.

6.2 Implications and recommendations

The broad, exploratory nature of this study lends itself to general recommendations for further research into family learning and exhibit label text. This investigation has illustrated that exhibit labels are a very relevant component of a family’s museum experiences as well as being a valuable research tool that can be used to investigate museum learning experiences. The study of exhibit label text is a neglected area of research in museum studies and it is recommended that it be examined as both a research tool and a research subject in the context of museum learning research.

These findings indicate that exhibit label text can be used to identify and describe the learning agendas of families or other specific demographic groupings. Museum educators need to be aware of the diversity of learning agendas that family groups bring to their museum visit. By understanding the specific nature of these agendas, museum staff can capitalize on visitors’ existing interests and subsequently optimise the learning experiences for parents and children. It is recommended that further examination of these agendas, as they are or are not reflected in exhibit label text, would certainly illuminate a greater understanding of tensions that exist between the learning agendas set out by the museum and those expected by the family.

The findings of this study were oriented toward the perceptions held by parents and their views of family learning. Children were not interviewed although their involvement in
the conversations during the exhibit experiences was considered and integrated into the research findings whenever possible. The findings indicate that young children appear to benefit from the inclusion of label text that supports exhibit exploration, such as instructions and open-ended questions. However, it would be worthwhile to closely studying the ways in which additional label text factors into the learning experiences of children.

For example, parents discussed the broader scope of the family learning experience and very favourably viewed the inclusion of Analogical and Principled label text. Although the content of Analogical Label made sense to adults and was favourably reviewed by parents, its specific analogy appeared to be of less interest to children. It is possible that the abstract nature of discussing but not seeing an analogical comparison does not match up with the immediate learning agendas of young children. Therefore, it is recommended that further research investigate the responses of children to other ways in which labels can refer to analogical references. For example, the incorporation of an open-ended question into a label might prompt analogical reasoning (valued by parents) without including a specific analogue.

It is also recommended that further investigations be made into the inclusion of scientific vocabulary and concepts, which were seen as an essential component of exhibit label text by a large group of parents. Parents discussed the inclusion of this label text as vital component of scientific learning and did not want canonically correct scientific principles omitted or simplified. Although many families discussed scientific principles, the
Principled label text was infrequently discussed. These findings suggest that further research into the relevant scientific principles to use in the label text would be of value to museum educators.

In addition, it is recommended that more attention is required regarding the ways in which Principled label text is integrated into and relevant to family learning beyond the museum visit and the connections to in-school learning. Further, it is possible that the placement of the label text is important to the family learning experience. The placement of label text that relates to broader family learning experiences might be best placed in a different location than that which addresses immediate exhibit exploration.

Interactive science exhibits have received significant attention as settings for research about museum learning. The few studies about exhibit labels have been set in these locations. It is highly recommended that the findings of this study be applied and tested at other museum settings, such as modern art museums and galleries. In these settings, parents and children might also benefit from exhibit label text that effectively mediates learning about abstract ideas and images.
REFERENCES


Appendices

Appendix A – Pre-exhibit interview questions

Date: ____________________________
Group #: _________________________
Recording Code: _________________

Pre-exhibit interview:

<table>
<thead>
<tr>
<th>Family member</th>
<th>Relationships &amp; age of kids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

M – Mother  F – Father
S – Son  D – Daughter

Have you been at SW for a while?

Are you from Vancouver? Where?

Have you been to Science World before? Y / N

How often do you visit?

Are you visiting with anyone else today?

What is the main reason for your visit today?
Learning / Exposure to science
Entertainment / Have fun

Describe your interest in science: Low  Medium  High

Do you have strong values or approaches to your child’s learning in this setting?
Appendix B – Post-exhibit interview questions

Date: __________________________
Group #: _________________________
Recording Code: __________________
Label on view: ____________________

Post-exhibit interview:

What happened? What did you talk about?

Had you talked about any of this before? What was new? Familiar? What was your role?

What was important/memorable for you? Was that the same for your kids? What drew everyone into the conversation? Was that something you both wanted to explore?

Did you use the label? How did it contribute to your exhibit experience? How did it contribute to your learning? your teaching? your children’s learning? What do you think an ideal exhibit label should say?

Here are some other labels for this exhibit. Which one attracts your attention? Why?

#1: It directs your exploration. What did it lead to? #2: Did you talk about this particular situation? What other ones – bath, drain, tornado? Why is this familiarity important? #3: Why do you think it is important to learn scientific concepts? Are you learning them together or are you more familiar with these concepts?

How do you teach this scientific principle?

Is there anything else you would like to share about your exhibit experience?
Appendix C – Detailed accounts of each family

<table>
<thead>
<tr>
<th>Group #</th>
<th>Label on view</th>
<th>Label details</th>
<th>Parent</th>
<th>Children (age: yrs)</th>
<th>Providence</th>
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<tr>
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<td>Causal</td>
<td>Mother</td>
<td>D (8)</td>
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</tr>
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<td>WV5</td>
<td>Causal</td>
<td>Father</td>
<td>D (6, 7)</td>
<td>Calgary, AB</td>
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</tr>
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<td>D (13) S (9)</td>
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Appendix D – Parental consent form

Understanding Family Learning Mediated by the Label Text of Interactive Science Exhibits

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The data gathered in this research will be used in Jennifer Hall’s graduate degree thesis, which is a document that is accessible to the public at large.

Sponsor:
This study has not received any funding or sponsorship from granting agencies or corporations.

Purpose:
The researchers of this study want to understand the ways in which parents and their children learn together at interactive science exhibits. We want to know what information parents and children find helpful and how exhibit labels can support their joint learning experiences.

You are being invited to take part in this research study because you are visiting the science today with school age children; you are speaking English at the exhibits; and because you have said that you have an interest in exploring the exhibits in this gallery as a family group.
Study Procedures:
To participate in this study, your family will be asked to spend some time at the Water Vortex exhibit in the Eureka Gallery. It is up to you and your children to decide how much time you will spend at the exhibit. On average, families with school age children spend 3 to 5 minutes at the Water Vortex exhibit.

You (the parent) and your child(ren) will be asked to figure out what is going on in the exhibit. You are free to explore the exhibit, as you normally would with your family group.

Your conversations about the exhibit will be recorded with a microphone that you (the parent) will hold. If you agree, your microphone will be turned on prior to your time at the study exhibit. Only your conversations at the exhibit and in the interviews will be used in the data collection. You also have the option of turning on the microphone as you approach the exhibit.

The co-investigator will observe how long you spend at the exhibit and will write down a general description of what the different family members are doing. The co-investigator will not be able to hear your conversation at that time but will listen to the recorded conversation later. When you decide to leave the exhibit, the co-investigator will interview you (the parent) about your experience. The co-investigator will also ask you to comment on some additional label text.

During the interview (between 5-10 minutes), you will be asked to reflect on your experiences at the exhibit. You will be asked to comment on what you talked about and what you found to be important about the exhibit. You will be asked to comment on the information that was provided and to comment on two other versions of the same label that have include slightly different explanations. You will not be tested or quizzed about any specific scientific concepts.

Potential Risks:
There are no known risks associated with this research study.

Potential Benefits:
Participation in this research study could potentially enrich your understanding of the collaborative learning that takes place between you and your children. Recommendations, about the development of exhibit labels for museum exhibits, made by the investigators at the conclusion of the study could also benefit the museum education community who prepare exhibitions for museum visitors.

If you are interested in receiving copies of the final thesis or additional published documents that reference this research, please provide the co-investigator with your contact details at the end of the post-visit interview. Should you wish to access the findings of this study at a later date, please contact Dr. David Anderson.

Confidentiality:
The identity of your family members will be kept strictly confidential by the investigators in this study. Only the investigators will have access to the data from this study in the form of audio recordings and observation field notes. All documentation will be identified only by code number and kept in a locked filing cabinet. Subjects will not be identified by name in any reports of the completed study. After transcription
and analysis of the recorded audio data is complete (not more than 2 years after the completion of data collection), the audio recordings will be destroyed physically.

Only the investigators will listen to the audio recordings. However, we may use some of your and your child’s verbatim verbal comments and discussions (with any identifiers removed) to elucidate the findings of the study in forums such as a graduate thesis, scholarly conferences, and journal articles. In all cases your and your child’s names and identities will be kept confidential by the use of a pseudonym.

Compensation:
As a token of appreciation for taking time to assist with this research study, we would like to offer you a small gift from the gift shop.

Contact for information about the study:
If you have any questions or desire further information with respect to this study, you may contact: Dr. David Anderson, Department of Curriculum Studies, UBC, telephone: (604) 822 2086 or Jennifer Hall, telephone: (604) 684 7974.

Contact for concerns about the rights of research subjects:
If you have any concerns about your or your child(ren)’s treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

Consent:
Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time without consequence. Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this study.

Please check [✓] the boxes below:

[ ] I am the legal parent or guardian of the children in my care today.*
[ ] I give my consent to my child(ren)’s participation in this study.*
[ ] I understand that conversations and interviews between the members of my family and between members of my family and the co-investigator will be recorded on audiotape.
[ ] I understand that the co-investigator will observe my family and write some notes while my family is engaged at the study exhibit.

____________________________________________________
Subject’s Signature     Date
(Subject: Parent #1* / Parent #2 / Additional Adult – circle one)

____________________________________________________
Printed Name of the Subject Signing Above