Through the teachings of the local marine life: A case study of students', student-teachers', teachers' and leaders' perceptions of Ocean Wise selected programming

by

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Abstract

Recently, the concept of ocean literacy (OL) has been described as a way forward to help communities and individuals develop a more holistic understanding of their influences on the ocean and the ocean's influences on their lives. Still, OL has not yet been fully enacted in the K-12 curricula in Canada and many environmental education programs are taking the lead to provide participants with this type of broader understanding. In this study, I provide a broad overview of OL initiatives as enacted by the Ocean Wise NGO (OW) and how these have influenced the diffusion of ocean literacy in British Columbia (BC). I selected a range of education programs for data collection including school visits to the Vancouver Aquarium, offsite mobile programming (with *AquaVan*), and teacher professional development programs, both onsite and with an online learning platform. Through an instrumental case study design, I combine qualitative approaches with observations, together with focus groups and interviews, and questionnaires to provide a broad view of activities from the perspective of program participants. In addition, I explore how the programs' approaches influence participants in becoming ocean literate. The results revealed that by providing locally referenced experiences with hands-on, the programs have positive impact in participants experiences and connection to the ocean. Although there are limitations in the delivery of ocean literacy, the selected OW programs play an important role on introducing key concepts of our relationship with the ocean and advancing ocean literacy in BC.

Keywords: Ocean Education; Ocean Literacy; Experiential-Learning; Place-Based Education; Marine Life; Ocean Conservation

Quotation

“Knowledge emerges only through invention and reinvention, through the restless, impatient, continuing, hopeful inquiry men pursue in the world, with the world, and with each other.” (Freire, 1974, p.58).

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My faith was the driving force and the foundation of my study and life but I would like to acknowledge that I have many wonderful beings around me that helped me to to go through this journey from the start to the end of my masters.

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List of Acronyms

BC	British Columbia
COLC	Canadian Ocean Literacy Coalition
IEL	Institute for Environmental Learning
OL	Ocean Literacy
OW	Ocean Wise Organization
PBL	Place-Based Learning
RIA	Research in Action
SFU	Simon Fraser University

Through the Teachings of the Local Marine Life

Humpback whale diving in the Salish Sea. Photo credit: Maria Cristina Lima de Albuquerque Maranhao

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"We must look to our teachers among the other species for guidance. Their wisdom is apparent in the way that they live. They teach us by example. They've been on the earth far longer than we have been, and have had time to figure things out." (Robin Wall Kimmerer, 2013, p.9).

Chapter 1.

Introduction

This thesis presents a case study and analysis of *the* different programs of *ocean literacy* provided by Ocean Wise, as an example of how the experiences of participants with their local marine life in British Columbia can foster ocean literacy. The general objective of my research is to describe and understand how ocean education programming can engage learners with place to cultivate ocean literacy, especially for K-12 students in public schools and teacher candidates from the teacher education programs of a comprehensive BC university. By examining the main role of *place* and *experiential education* in an ocean literacy context, I present my observations and interpretations of how the program utilizes local coastal areas to develop ocean literacy, that is, how program participants experience *place* – how they speak about their experiences and connection with ocean.

My Learning Journey with the Ocean

I love and belong to the ocean.

I have always felt very connected to salty water through a range of experiences in the ocean from learning how to swim, to survival. My relationship with the ocean started in the city where I was born: Vitoria, on the coast of Brazil, surrounded by a vibrant and threatened marine biodiversity. I like to spend my free time on the beach, and I was part of the beach soccer team for couple of years, partly as an excuse to be close to the ocean. On the beach it was easy to spot crustaceans, sea birds, sea turtles and schooling fishes. I remember once I was wondering how the crabs just appeared from the sand, my grandpa always showed them to us and would encourage us to touch it, he used to say, “don’t be afraid, they are nice buddies…just be gentle”. Growing up on the coast enabled a deep connection to the ocean and the marine life. When my grandma told me that she could see whales and dolphins in the ocean horizon decades ago, she cultivated in me a strong desire to see, know and understand these hidden (from me) animals from the sea. My curiosity, love and empathy for the natural world has driven me to become a passionate biologist and educator.

As a biology teacher in my hometown, I had most of my teaching experiences inside classrooms in order to follow the existing curriculum. Few programs and schools engaged students in outdoor learning environments. The recommended “stand-and-deliver” approach was seen to allow students to complete the university entrance exam, but it may have been disconnecting them (and myself) from a deeper understanding of life, biodiversity, land, and the ocean.

On coming to Canada for graduate study, I found that BC’s education system and philosophy seems to encourage teachers to go beyond the classrooms and explore the curriculum content through a deeper connection to “place.” During my master’s journey the “place-based education” (PBE) ideas of developing a sense of place through experiential learning moments among students in their communities and natural environments have resonated with the way I now understand and theorize about education. Personally, after moving to different cities/countries throughout my life, my sense of place extends to my connection to the ocean, where I feel home, whichever ocean is “the place.” The most meaningful recent experience I had in the ocean, as a whale-watching naturalist guide, further grounded my connections with the Salish Sea and the other species that rely on it. These ‘experiential moments’ on the ocean nurtured my passion, care and empathy for the marine life that enriches these waters.

My interests, experiences and passion were the driving force for my research and this thesis topic. By combining them, I started my journey to find educational programs that explore the ocean with a more place-based approach, by bringing the local sea life to students’ awareness and connection.

Relationship with Ocean Wise Conservation Association

My supervisor for this presented master’s thesis is David Zandvliet, who also is associated with the Canadian Ocean Literacy Coalition (COLC) as a marine educator and researcher working to advance ocean literacy in Canada. My interests were found in his work after one year of my studies and an opportunity to explore ocean literacy too. He is also founder of the Institute of Environmental Learning (IEL), which has several partnerships with environmental education programs and Ocean Wise Conservation Association (OW) is the one organization that addresses ocean education. Thus, a

relationship with Ocean Wise was facilitated because I am a member of the institute as a graduate student. This partnership facilitated this unfunded research.

1.1. The Ocean

The ocean plays a major role in defining key features of the Earth and is home to between one and two million different species. Humans' relationship with the ocean goes beyond a simple source of food and resources. For example, the enormous mass of water around the globe influences the planet's climate, weather, biodiversity, and ecosystems. Currently, our ocean system is threatened by many unsustainable human activities, such as plastic pollution, overfishing and increasing levels of carbon dioxide, causing ocean acidification and changes in water temperatures (IUCN, 2019). Efforts to reduce and change human activities and consequences are urgent and crucial. As expressed by Silvia Earle (1995), "ocean[s] . . . provide the cornerstone of the life-support system for all creatures on our planet, from the deep-sea starfish to desert sagebrush. That is why the ocean matters. If the sea is sick, we'll feel it. If it dies, we die. Our future and the state of the oceans are one (p.xii)". Changes in the way humans consume and explore ocean's resources are pivotal to bring hope for humans and non-humans' survival.

While practical solutions are being discussed and implemented, environmental awareness through ocean education should be the first step to mitigate human impacts on the environment and ocean system. According to UNESCO (2019), changes in the way we think and understand our relationship with the ocean can be addressed by a focus on ocean literacy - defined as: "an understanding of the ocean's influence on you and your influence on the ocean" (McPherson et al., 2018). There are seven Essential Principles that define an ocean literate child as they progress from Kindergarten through to Grade 12 (NOAA, 2020) discussed with more details in the next chapter.

Education is the most important tool available to support the growth of ocean literacy, yet most North American schools do not include ocean literacy as part of their learning outcomes (Guest et al., 2015). In Canada, only Nova Scotia and Prince Edward have ocean education as compulsory courses. In British Columbia (BC), the K-12 curriculum does not present any specific subject to address the ocean issues, concepts, and principles (BC's Curriculum, 2021). Nonetheless, Canada pursues an ocean literate

society contributing to the recent UN ocean decade (Glithero et al., 2020) and the Canadian Ocean Literacy Coalition (COLC) was created to advance ocean literacy in Canada. COLC aims to “better understand Canadians’ varying relationships with the ocean and to examine how ocean literacy (OL) is understood and practiced across different regions and sectors” (COLC, 2019). Bringing an ocean literacy approach to schools can engage learners in experiences around marine ecosystems and may impact our personal connections to the ocean. These connections can motivate individuals to become ocean literate and to act on behalf of the ocean (Ocean Literacy, 2019).

Studies show that direct experiences with the ocean may empower individuals with knowledge and motivation so that they can become truly ocean literate (McPherson, 2018). Experiences with the ocean may provide meaningful reference points when exploring ocean topics so that knowledge becomes associated with behaviour change and a more caring attitude towards the marine environment. It is combining the ocean literacy with experiential learning framework as explored by Kolb (1984) that I understand that learning is a process grounded in experiences by transactions between the person and the environment (Kolb, 1984).

Place-based ideas about learning as central to experience in the ocean literacy context have not yet been described in the literature. The notion of a place-based education as described by Sobel (1993; 1996) and others that expanded these ideas (Grunewald, 2003; Hutchison, 2004; Orr, 1992, 1994; Thomashow, 1996; Woodhouse & Knapp, 2000) connects theories of experiential learning, contextual learning, problem-based learning, constructivism, outdoor education, Indigenous education, and environmental education. In addition, for the BC context, place-based learning framework is a central idea in BC’s curriculum and framework for environmental education (BC Ministry of Education, 2007).

In addition to the Western scientific society, Indigenous people of the Pacific Coast (and abroad) have always had an intimate relationship with the land and ocean, centuries before place-based learning and ocean literacy terms were theorized. In my literature review and discussion chapters I try to reconcile both terms with Indigenous knowledge from the Coast Salish Peoples with both of these terms. Few studies and theories include Indigenous ways of knowing in both frameworks and we as educators and scientists should address this gap for the future research and programming.

Connecting ocean literacy to an experiential and place-based learning framework, my thesis aims to contribute to the broader agenda on ocean literacy in British Columbia (BC) and across the country. In addition, to critic and reinforce the importance of braiding Pacific coast Indigenous knowledge in ocean literacy in the BC context. Indeed, meaningful collaborations among ocean/marine educators, researchers and communities are the foundation for promoting a healthy ocean (Fortner, 2019).

While the BC curriculum lacks a compulsory course that centres the ocean as the main subject, in the province, several environmental educations programs incorporate ocean education through hands on experiences extending the classrooms to outdoors. In fact, ocean education programs play an important role to facilitate direct interactions with the ocean both in K-12 environment and though informal education programming (Fauville et al. 2019). Some of these initiatives also provide professional development for teachers and leadership development opportunities across a broad spectrum of experiences. Such experiences influence in the individuals' pro-environmental attitudes and the connections to the environment (Myers & Saunders 2002; Wharton et al., 2019).

To date, there are few studies that explore how ocean literacy programs are reaching their goals within the community and within participating classrooms (Fauville et al, 2019; Fortner, 2019). The limited number of studies about marine issues in the fields of education confounds the potential to improve the range and quality of ocean education programming (Fauville et al, 2019). A more in-depth understanding of how programs are performing would encourage broader discussion and reflection on the lessons and challenges that current ocean literacy programs face and how these should be addressed in the future.

For this study, I focus on the case of *Ocean Wise* as a unique context, that offers programming in all these areas, thoroughly discussed in the following chapters. The Ocean Wise not-for-profit organization was launched in 2017 by the Vancouver Aquarium focused on main four areas, Aquarium Management, Education, Engagement, and Research (Vancouver Aquarium, 2017). Since then, several educational programs were launched and changed by the organization in both BC and across Canada that encourage ocean literacy and ocean stewardship (Ocean Wise, 2021). I analyzed a range of the programs offered by Ocean Wise in BC (but not exclusively) for K-12 students and pre-teachers. Through instrumental and exploratory case studies, I

observed in-depth specific moments during these programs and conducted focus group interviews and questionnaires after the event with grade 3-5 students, their teachers, student-teachers, and Ocean Wise (OW) staff (here called as leaders) as explored on chapters three and four.

1.2. Research Questions

For this research, I explored a range of programming that would incorporate theories of experiential education with the program participants. The main line of inquiry for this research (for all selected programs) focused on the following research questions:

1. How are the programs and resources generally perceived by students, teachers, leaders, and student-teachers, participants of this research?

2. Do students, teachers, student-teachers, and leaders perceive the programs and resources offered by OW as contributing to the development of ocean literacy? If so, how do these activities and resources accomplish this?

1.3. Methodological Overview

To answer the research questions, I selected a case study methodology for the study of selected programming for a variety of reasons. Case study has been described as an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). For my purposes, I deemed that an exploratory and instrumental approach would best suit the study context of *Ocean Wise (Y*in 1993; Stake 1995). The data were collected in February, March, and October in 2020 and in May to October in 2021. A total of three programs were analyzed where data from observations, focus groups and questionnaires were collected in this qualitative methods study. The programs took place in a variety of learning environments, in an elementary school, in the Vancouver Aquarium and in the Sunshine coast in BC. I employed a thematic analyses approach because qualitative data were used to answer the research questions.

To examine these, I considered non-experimental phenomena ‘in-context’ for our study (Kostoulas, 2010; Levy, 2017; Yin, 2003). In addition, the development of the case studies allowed us to develop “a complete understanding of a process, program, event or activity” (Wholey et al., 1994, p. 163), and had further potential to yield insight and in-depth understandings about Ocean Wise programming as explored in detail on chapter three.

1.4. Organization of the Thesis

In chapter two of this thesis, I provide a review of selected literature that explores the definition, development, and application of ocean literacy in a local and global scale.

Chapter three presents the methodology for this thesis and explains the selection of exploratory and instrumental case study as a foundation for the research design. The chapter describes the methods used in this study including participant selection, the development of the questions for focus group and the process for data collection and analysis. A discussion on the limitations and ethical considerations for this study close the chapter.

The findings of the data analysis are presented in chapter four using select quotations from the focus groups and observations as supporting evidence. The chapter presents findings for each of the four guiding research questions and includes a presentation of key themes that emerged as representations of the participants’ experiences.

Chapter five concludes this thesis with a discussion of the findings including the participants’ experiences, key insights regarding *Ocean Wise programming* educational approaches, and my recommendations to the programs examined. The chapter also reflects on the research methods, ways in which I would modify this research if I were to do it again and future research that is needed.

Chapter 2.

Literature Review and Conceptual Framework

The conceptual framework for this study centres on place and land-based ideas about learning as central to experience as you can find similarities in their meanings. The framework of ocean literacy (OL) works as an approach that connect students who belong to the local community (in the BC context) with the local marine fauna, the stories that the BC coast holds and how they can learn from the ocean about their coastal place. As one of the ideas of place-based education, experiential learning is a way to provide real experiences to learners when becoming ocean literate. By learning about the ocean through direct experiences, the learning becomes integrative and holistic, combining experience, perception, cognition, and behavior (Kolb, 1998).

> *"The circle of ecological compassion we feel is enlarged by direct experience of the living world."* (Kimmerer, 2013, p.239).

2.1. Ocean Literacy History and Framework

Ocean literacy (OL) is defined as how one, "understands the Essential Principles and Fundamental Concepts about the functioning of the ocean; can communicate about the ocean in a meaningful way; and is able to make informed and responsible decisions regarding the ocean and its resources" (NOAA, 2020, p. 2). This term and definition originated in the United States in the earlies 2000s. By realizing the lack of ocean-related subjects in the American national curriculum, a group of ocean scientists and educators launched a process to develop the inclusion of ocean studies in the formal education. In 2002, the United States National Oceanic and Atmospheric Administration (NOAA) in collaboration with the National Science Foundation, the Centers for Ocean Sciences Education Excellence (COSEE), the College of Exploration, the National Marine Educators Association, and the National Geographic Society started a work to address this gap in education, publishing the OL term in 2005, officially on the "Ocean Literacy Essential Principles of Ocean Sciences". Through a national and state standard, this was the start of the ocean literacy movement and in 2010, the National Marine Educators Association and COSEE further expanded this work to be finally included in

the U.S. K-12 school curricula (NMEA Ocean Literacy and International Committees, 2019).

In 2017, this collaboration originated more recent work that was published as “Ocean Literacy for All: A toolkit” available in four languages. After a consensus on the definition of ocean literacy, it was set a framework that led to the seven ocean’s essential principles with 45 fundamental concepts. Through the review work of small teams of scientists and educators, the final document, Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences K-12 [12], was published.

Indeed, the ocean literacy framework comes from the work of diverse fields in science, including biologists, marine scientists, geographers, social scientists, and educators that put together principles and fundamental concepts that an ocean literate person should understand and know to engage in meaningful conversations, make responsible decisions and actions, towards the ocean (NOAA, 2013). Specifically, **t**hese seven principles are:

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored. (NOAA, 2020, p. 5)

By understanding the fundamental concepts for each principle, ocean literacy aims to promote dissemination of ocean knowledge that leads to a better understanding of human relationships with the ocean, and how our actions influence positively or negatively in the ocean’s health (Ocean Literacy, Essential Principles, 2013). Physical, chemical, biological, and social concepts related to the ocean are addressed in the forty-five concepts an ocean literature person should understand. According to the framework’s authors, students should graduate from high school knowing the ocean’s principles and concepts in order to make responsible decisions regarding the ocean in a local and global scale. The framework helps educators to create learning experiences

that connect the students to the ocean and its concepts. Ocean educators have the responsibility to teach not only the science of the ocean, but also the interdependence with humans. Although environmental literacy addresses the biosphere, OL tries to fill a gap in environmental education curricula that often underrepresents ocean curricula despite its importance for a healthy environment (Gough, 2017). In addition, according to the U.S. Commission on Ocean Policy, in 2004, “Ocean literacy is especially significant, as we implement a first-ever national ocean policy to halt the steady decline of our nation’s ocean and coasts via the Ocean Blueprint for the 21st Century.” (U.S. Commission on Ocean Policy, 2004; Theresa Greely, 2008, p. 2).

In addition to the framework, ocean literacy relies on a world-wide campaign from decentralized efforts involving scientists, policy makers, educators and communities that go beyond classrooms across the world. In fact, it works as a call for industry leaders, police makers, citizens and influencers. Through collaboration of all parts, OL has potential to mitigate the human impacts on the ocean, promoting sustainable solutions to its conservation. Ocean literacy has also been identified in the strategic objectives for the upcoming United Nations Decade of Ocean Science for Sustainable Development (2021-2030) through a community-wide consensus-building process.

A recent “Global Ocean Science” (IOC-UNESCO, 2020) report stated the status of the ocean and ocean sciences, providing the gaps and how to address the challenges in the dissemination of ocean awareness. The report points out that ocean literacy is more than just educating or informing the public about the ocean. Ocean literacy should work in partnership with the community and networks of business, universities both to engage students and society with the ocean concepts and most importantly creating actions that will be sustainable pressing ocean issues (IOC-UNESCO, 2021). In addition, the report shows the importance of this understanding of ocean concepts and actions due to the “Sustainable Development Goal 14” of the 2030 Agenda (IOC-UNESCO, 2021). Called “Life below water” item, SDG 14 goals and targets is based on the civil understanding of the ocean’s influences and impact on the economy, culture, environment and by knowing its concepts and impacts on day-to-day life. Thus, the SD14 goal is that the world’s population by 2030 has a cognitive, socio-emotional, and behavioral learning of the ocean on a local and global scale (IOC-UNESCO, 2021).

Thus, the ocean literacy framework works as a first response for the Agenda 2030 and SDG 14 (IOC-UNESCO, 2021).

2.1.1. Ocean Literacy Around the World

The term “ocean literacy” may be new for many countries since it was developed in the context of the United States. Yet, this framework has been adopted across the globe including countries in the Americas, in Europe, Japan, Australia and Fiji (NOAA, 2020; Canadian Ocean Literacy Coalition [COLC], n.d.). The Ocean Literacy toolkit by UNESCO is available in five languages (English, Portuguese, Spanish, French and Italian) while the first version of ocean literacy guide has also been translated to Chinese and Japanese fostering ocean sustaibanility and ocean stewardship among students and teachers abroad the US.

Recently, UNESCO hosted a School Teacher Training Workshop with teachers from diverse countries from Latin America and Caribean (Santoro et. al. 2017) to promote the *Ocean School*. The Ocean School is an online tool developed to support *Ocean Lteracy for All in the Regional and Global* actions project. The Ocean School Teacher Training prepared teachers to use the Ocean School in their classrooms, adapting to different classroom settings and educational systems.

In Europe, Portugal hopes to connect ocean concepts to curricula expanded ocean principles to other many subjects, such as geography, social studies, culture, art, and music (COLC, 2020). The country is also one of the first to create a version of ocean literacy document that was linked to its culture and language, for example, transforming “ocean literacy” into “Conhecer o Oceano” (“Knowing the Ocean”) implemented in formal school. Currently, the European Union Ocean Coalition (EU4Ocean) aims to unite education and actions coming from universities, organizations, and projects to connect the population to the diverse ocean literacy initiatives. EU4Ocean promises to enhance awareness and engagement in ocean concepts and actions as well as influencing Europeans to become ocean advocates and add ocean literacy as one of the priorities in the policy agenda (EUROcean, 2020). The Ocean Literacy for All Toolkit brings successful cases of OL implementation around the world, including, Brazil, Canada, Bangladesh and Africa (Santoro et al. 2017).

2.1.2. Ocean Literacy in Canada

Canada is surrounded by three oceans with the longest coastline in the world. The ocean is associated with the overall wellbeing of Canadians and an appreciation of this benefits all aspects of life in Canada (COLC, 2019). However, ocean education remains only a compulsory course in two provinces (McPherson et al. 2018): Nova Scotia, which offers a subject called “Oceans 11” for high school students as a secondary science credit requirement covering, for example, the marine biomes, coasts, aquaculture and motion (Department of Education and Early Childhood Education (2011-2019); and Prince Edward Island, which offers oceanography course for high school students that include marine sciences (Prince Edward Island, 2021-2022). Thus, challenging the country’s mission to contribute to the recent UN Ocean Decade (COLC, 2019). In addition, according to Scully, 2018, the advancement of ocean literacy in Canada requires collaborative strategies between schools, government, public and private sectors. Yet, there are many ocean organizations in Canada hoping to foster ocean connection and conservation among their participants and the three oceans.

In 2013, Anne Stewart led the launch of the Canadian Network of Ocean Educators (CaNOE), formed by volunteers in the marine field to engage educators in the formal and non-formal settings to discuss ocean literacy strategies in classrooms and communities across Canada. Similarly, the Canadian Ocean Literacy Coalition (COLC) was founded by Canadian ocean and environmental organizations and scientists to advance OL in Canada in all sectors, including, education, government, and industry, with a goal to achieve an ocean literate society (COLC, 2019).

COLC aims to “better understand Canadians’ varying relationships with the ocean and to examine how ocean literacy (OL) is understood and practiced across different regions and sectors” (COLC, 2019). In a series of recent reports, the COLC gathered data around current understandings of ocean literacy as part of a strategy to improve and increase ocean awareness across the country. This is important as previously, most published studies on ocean education and programming originate from the United States (Mogias et al. 2019). Without more published studies on ocean education in Canada, it becomes difficult to evaluate, learn and improve on our current programs and curricula aimed at fostering ocean literacy.

Scully states that to advance ocean literacy in Canada, it is important to analyse what state Canadians are in their relationship with the ocean and to look for successful global and national cases in the implementation of ocean literacy both in the formal and informal education sectors. On this idea, the COLC undertook the first national research project aimed at understanding and identifying youth's perspectives and recommendations for ocean literacy. In 2020, COLC released the report, *Understanding Ocean Literacy in Canada*, with key insights about the ocean literacy term and suggestions to future educational approaches.

The report highlights that ocean literacy is a Western science term and can exclude the local community and Indigenous knowledge (Glithero, 2020, p. 6). It also argues that the ocean literacy approach should also include and recognize the different waterways and all interconnectedness that takes place on its way when it finally reaches the ocean (Glithero et al. 2019). Thus, the inland Canadian population may feel connected to the ocean even far from coastal regions through other waterways. Alongside this insight, the COLC report highlights that all educational efforts about ocean, water, climate, and nature should recognize that they co-exist and should not be taught separated but as a whole. Youth also reported the importance for ocean literacy in the Canadian context and suggested more place and land-based, outdoor experiences in delivering OL programs, "everyone should go to the ocean and realize how we depend on it" as well as the use of social media for awareness and education. The youth believe that knowing the ocean is essential for "our environmental, cultural and spiritual health" engaging Canadians to be "stewards of the ocean" (Roy, 2020, p. 1).

This recent report brings key insights for the promotion of ocean literacy in Canada and outlines problems discussed in the "Heart of Biosphere" by Glithero et al. 2019, including to recentralize Indigenous ways of knowing as an asset of advancing OL in Canada.

2.1.3. Ocean Literacy and Indigenous Knowledge

Canada has a unique context that brings opportunities to co-create a framework with Indigenous communities. This approach has not been accomplished yet, for example, in the United States (Scully, 2018). Due to the diversity of Indigenous

communities in Canada, the OL framework needs to be re-designed to address the centuries of knowledge and connection that Indigenous people have had with the land and ocean. Without a partnership with Indigenous leaders in education, OL advances in Canada could harm Indigenous ways of knowing and traditions towards the ocean. Glithero et al. (2019) states, “Such a modern intervention as “ocean literacy” is nebulous and perplexing, as ocean connectedness has been understood and practiced for generations in much deeper ontological and relational ways.” (p.5). Although practiced for many Coastal Peoples for centuries, the OL term “has social and historical contexts rooted in a colonial mindset.” (p.5) bringing risk for local, land-based knowledge and connections with the ocean. Scully (2018) outlines six necessary items to co-develop an environmental education program in Canada by Leanne Simpson (2002) with an Indigenous pedagogy, (1) having the community Elders who are the knowledge and traditions keepers, (2) having Indigenous philosophies as the foundation of these programs, (3) Indigenous ways of teaching and learning, (4) language, (5) connections to the land and (6) creating spaces for land, culture, and knowledge protection.

In addition, Glithero et al. 2019, brings three different perspectives and stories from those who live on the coast and have a special relationship with the ocean for generations. The Pacific coast, Inuit Nunatak and Atlantic Region are also explored in a unique way bringing new but ancient perspectives for “ocean literacy” in the Canadian context.

2.1.4. Ocean Literacy on the Pacific Coast

Considered as “a source of sustenance and spirit” (Yumagulova 2020, p. 5) for the peoples of BC, the Pacific coast holds significant ocean biodiversity, and it is the strength that maintains the local economy and community welfare, through tourism, fishing, leisure and other marine activities. In BC, there are over 120 initiatives that works for the advancement of OL, but the term is not widely common as much as “ocean stewardship, knowledge, connection and relationship.” (Yumagulova, 2020).

Waterfall (2019) a Heiltsuk knowledge keeper, underlines that the Pacific Coast Nation, Hailhzaqv, and all the coastal peoples sustained a long standing and interrelationship with the natural world and its life. Waterfall provides stances of the community engagement to protect the oceans and how ceremonies are important for

those events. “Ancient cultural practices give insight into our close relationship with the ocean.” (Waterfall, 2019, p. 11) she highlights that the ocean is not in this planet to serve us, but it is here as our home, “we belong to it”. This approach brings an insight that we are responsible for ocean wellbeing not because we rely on it but because we are part of it. Waterfall then says that the Heiltsuk and coastal peoples have been ocean literate for over 700 years (Glithero at all., 2019).

Similarly, in the recent Pacific Regional Report by Yumagulava (2020), when asked to explore the OL definition, Melody Charlie, a Nuu-chah-nulth First Nation leader stated:

> “When I think about the ocean, I think about it being a spiritual sacred relationship first. And then I think of another part of the relationship: it’s our food… Who are we as Indigenous people without salmon and even what does salmon look like without us First Nations as well? We are so connected. We have this saying, which is hishuk ish tsa’walk, which means “everything is when we’re connected to everything”/ The ocean…it’s who we are, it isn’t separated from us. I really believe that it’s our lifeline for many reasons.” (p.6).

When talking about OL in Canada and in BC, OL has great potential braiding the Indigenous knowledge to it, bringing a spiritual and emotional side for OL.

In addition, the Pacific Regional Report (PRR) highlighted the main concerns perceived by the participants for OL definition. Ocean literacy should include waterways as a connection from us to the ocean, Indigenous ways of thinking and understanding the ocean and foster emotional connection in our relationship with the ocean (Yumagulava, 2020). In fact, the ocean goes beyond scientific concepts and the OL conceptual framework concentrates essentially on the interdependence of the ocean and human as two separated things. Including the Indigenous knowledge as the central idea of OL, this relationship is cultural, social, physical, emotional, and spiritual. The PRR also underlined First Nations stewardship and leadership, long-running OL initiatives and place-based and experiential learning as key strengths for the advancement of OL in the region. Indeed, OL in the Pacific region might start its process of co-leadership in the advance of OL in Canada, differing from OL in Europe and the US.

The discussions around ocean literacy in Canada have been an attempt to make the term accessible for its own population, to braid into the Indigenous knowledges

(specially from Coastal Peoples), connect with the other environmental efforts and explore OL through place-based, experiential learning approaches, in addition to make the ocean accessible to the population. It also ranges from understanding and knowing what has been done and how OL can be improved in its terms and delivery in the educational, industrial, social, and cultural levels.

> "That is, the awakening to the gap that exists when it comes to our shared understanding of just how important a healthy ocean is to human and planetary well-being, and how our actions – individual and societal – are impacting the ocean." (Glithero, 2020, p. 6).

2.2. Connecting Ocean Literacy to 'Place'

Programs that provide experiences of connections between people to place has been discussed as a potential in OL approach (Glithero et al., 2019; Scully, 2018; Yumegulava, 2020). By exploring the local marine living beings, place-based education hopes to connect students to their closest ocean waters. By experiential learning, which is a strength of Pacific region (Yumagulova, 2020), students are provided with immersive learning experiences engaging in their curiosity, sense of wonder, connection and love. According to Yumegulava, 2020, almost half percent of the organizations in BC provides experiences on/in the ocean, nearly 90% takes place on the shore, but few have been analyzed or published yet. My research aims to contribute to the specific programming cases happening in BC with attention to the place-based/experiential learning approach they may provide. Thus, filling a gap in ocean literacy research, helping the program being researched and others to improve and include the place in their pedagogy to connect students and participants to their local ocean waters.

2.2.1. Place-base and experiential learning conceptual framework

My experience with the place I grew up and the place I live was the driven force to connect me with the ocean. By experiencing the shore, I learnt that the ocean is home for other species with diverse features. My experience with the ocean through place inspired me to concept this framework. By understanding the role of the place as the main provider of meaningful experiences with nature and ocean, I consider place-based experiential learning theories an appropriate framework or lens through which ocean literacy can best be experienced and interpreted.

Place-Based Education (PBE) might be a pedagogy, approach or/and methodology that aims to explore the student's local context (ecological, cultural, political and social) making the learning environment beyond the classrooms. Sobel (1993; 1996) described place-based education as a way to foster empathy towards familiar places to connect individuals to where they live by exploring their backyard, school, community and outward. Sobel states that education should create spaces where students can nurture their connections with the environment to learn how to love it before learning how to save it. Several theorists (Bowers, 2008; Grunewald, 2003; Hutchison, 2004; Orr, 1992, 1994; Thomashow, 1996; Woodhouse & Knapp, 2000) expanded these ideas becoming clouded to define place-based education due to the multifaceted and interdisciplinary nature of the literature where this notion seems to reside.

Woodhouse and Knapp (2000) stated that place-based education should be multidisciplinary, experiential, reflective and about the place and its dwellers. In addition, the idea to connect students with their places through experiences that happens outside of the classroom, has been discussed in different contexts years before the PBE term by, for example, John Dewey, Rachel Carson and David Kolb. Dewey (1925-1949) believed that the education should create opportunities for students to experience the knowledge by doing it. Real world experiences in student's place context were believed by him to be the purpose of education (Grunewald, 2008). The environmentalist and marine biologist Rachel Carson (1956), when exploring the importance of humans' "Sense of Wonder", stated that "it is not half so important to know as to feel" (p. 56) when referring to science concepts about nature. She believed that as early in their age humans experience their local natural environment as earlier, they would nourish a sense of love, empathy, and care towards the natural world they live in. Years later, Kolb (1998) launched his experiential learning framework, where he believed the theory met the practice. According to him, experiential learning is "a holistic integrative perspective on learning that combines experience, perception, cognition, and behavior." (Chap 2, para 2). By defining learning as a process of knowing by experiences, Kolb (1998) supports the idea that knowledge comes from reciprocal and transactional learning where the learner has a relationship (more than interact) with the subject, involving the environment and the learner.

Grunewald (2003) writes that the idea of place-based learning connects theories of experiential learning, contextual learning, problem-based learning, constructivism, outdoor education, Indigenous education and environmental education. He critics the conventional education model based on standardized tests to prepare students for competition for the global market (Grunewald, 2003), proposing a pedagogy about the self's place context. According to him, by knowing, understanding and exploring the areas that students inhabit, they can conserve and restore the "shared environments for future generations" (p. 6). Grunewald affirms that "[p]eople must be challenged to reflect their own concrete situationally in a way that explores the complex interrelationships between cultural and ecological environments" (p.6) to "relearn" and "reinhabit" their connections with place, community and schools not only with the natural world but with the social context that may have changed that place to continuously "limit the possibilities for human and non-human others" (p. 7). Thus, Grunewald envisions place-based education with critical lenses, calling this framework a Critical Pedagogy of Place.

However, there are critiques surrounding Grunewald idea of place-based learning as it may eliminate the cultural background from the community that uses "the place" (Bowers, 2008) in their own way. Bower (2008) argues that "reinhabiting" word is prejudicial to the peoples who already have their connections with the place, as it suggests that they "need" to learn to inhabit their own places in a colonial way again. In fact, this term may hide, for example, in the Canadian and Pacific Coast context, the ways of knowing the place/land from the Indigenous peoples.

Land-based education from Indigenous knowledges, involves not only the land and the physical aspects (human and non-human made) but also the traditions, such as ceremonies that the place holds emotionally and spiritually. As described by Waterfall (2020), for example, the Pacific Coast people celebrate the land, ocean and salmon through ceremonies on the "place". It is also described by Kimmerer (2013) from Potawatomi Nation as the celebration of salmon as a powerful tradition that connects humans with the ocean and all the other species that belong to it. Since these traditions are not mentioned by the Place discourse (Scully, 2020), it is critical here to acknowledge that place-based education as written by such is exclusive of Indigenous knowledges and peoples and still Eurocentric. On the other hand, Land-based knowledge comes from the Indigenous (and humans) relationship with land (and sea)

(Calderon 2014; Scully 2012, 2015, 2020; Styres et al. 2013; Tuck et al. 2014). While place is mainly humanly constructed, land is the giving of nature, “it is dynamic, pragmatic and is fundamentally about recognizing the Land as kin, not resource with humility.” (Scully 2020, p.236). It’s important to acknowledge that place-based education without the land-knowledge as the central idea, misses elements to make deep connections and understandings of the Land and how we are part of it. As Scully (2020) agrees, although PBD does not include Land lenses in its pedagogy, critical PBE is still crucial to work as an initial step for Canadians to understand what is Place but it is still not enough. In fact, it is necessary to have the Land-knowledge in education as the “pathway to make a widespread change in service of Land and of Indigenous futurities in Canada.” (Scully, 2020, p. 233).

2.2.2. Ocean as “Place”

Seeing the ocean as the subject, ocean literacy may rely on transactional and reciprocal learning provided by experiential moments involving the ocean.
Although place-based and experiential learning have been cited as a recommended approach for OL in BC (Glithero, 2020; Yumagulova, 2020), few studies have been published examining the best practices of ocean literacy in Canada (McPherson et al. 2018) and with the latter approach. However, there are several benefits (COLC, 2021) when learning and experiencing the ocean in a place-based context, since learners may connect with their “own backyard”: what happens there and what is their relationship and influence on that. Not only communities on the coast but populations far from the ocean, may still learn with the place, for example, through the near bodies of water, the region’s weather and climate, the local vegetation, from the elders of the region who are the knowledge keepers, wildlife, culture among other features of that place to learn about the ocean. Indeed, the place gives opportunities to explore the ocean as whole, including, the water streams, forest, soil, river, mountains, rural and urban areas. Then, the essence of OL can connect to the social, environmental, cultural, physical, and spiritual characteristics of the student’s region.

In addition, PBL provides experiences with the other living organisms that also needs the ocean for survival. Research points out that connecting students to the local

marine life is a way to emotionally connect students with the ocean and influence in their behaviours pro-ocean. Place-based and experiential learning may bring opportunities for the local community (including the students) to develop emotional connection with the ocean and land through a sense of care and empathy for the local fauna. These feelings are known to change behaviours towards conservation (Wharton et al., 2019). Emotional connectedness to nature influences acts of care towards itself (Kim 2014; Mayer & Frantz, 2004). The “emotional affinity” (Kim, 2014, p. 23) may be developed by positive experiences in nature (Kim, 2014; Mayer & Frantz 2004), that initiates a sense of care for the environment nurturing a connection to nature and its living beings.

For example, when giving opportunities to students to touch, take care or/and watch another animal, they become more familiar with other species and its needs, recognizing, and understanding why that place should be conserved and maintained healthy. Likewise, when exploring the seashore, students (individuals) can feel the ocean by its breeze, smell, sight, and touch experiencing their sensory perceptions that can bring a richer and better understanding of OL and a sense of connection and empathy to these places (Wharton et al., 2019). As stated by Joyce et al (2019), “educators need to make learning about the ocean an experience which is not only intellectual but also, and perhaps more importantly, emotional (Seamon 1984; Bogner 1998)” (p 172). Direct experiences in nature bring benefits not only for students but for the local community that may also become more engaged to care, share and understand their relationship with the natural environment.

In BC, OL efforts are focusing on PBL and First Nations education to include ocean education in the provincial curriculum. The PRR highlighted place-based and experiential learning with hands on opportunities as key approaches to connect students with the local species and water. The report also highlighted emotional connection as a way to transform students’ behaviours and actions in benefit of the ocean (Yumagulova, 2020). Thus, when OL takes place beyond the classrooms and the learning process is grounded in experiences, strong connections with the ocean may be created fostering a better understanding of the ocean’s influences on us and our influences on the ocean. To achieve an ocean literate society, real experiences with the place (and land) should be encouraged in formal and informal settings. In combining ocean literacy with a place-based and experiential learning perspective, learners have a broader vision of the ocean

and how their relationship with it have direct and indirect impacts on the local marine organisms and the ocean's health maintenance.

2.3. The Role of Ocean Educational Programs Provided by Ocean Wise in the OL context

Ocean education is not a compulsory course in the K-12 school system in most part of Canada, including BC. Ocean/ environmental education programs play an important role to address ocean literacy in formal and informal settings. For example, programs provided by marine aquariums give opportunities for students and general visitors to connect with the ocean with experiences with the marine life (Kim, 2016). Experiences provided by Aquariums are often seen as a place where students learn for fun (Packer, 2006; Kim 2016) besides impacting in student's sense of care and advocacy towards the ocean (Ballantyne et al., 2011; Scott, 2007; Wyles et al., 2013; Kim, 2014). Programs that provide experiences with the ocean, engaging visitors with ocean knowledge and conservation, have been reported as positive influences in visitors' awareness, responsible attitudes about marine life and enhance their OL (Adelman et al., 2000; Ballantyne, Packer, Hughes, & Dierking, 2007; Falk & Adelman 2003; Falk et al., 2007; Schubel et al., 2009; Kim, 2014). Yet, further research needs to be developed to understand how ocean education programs provided by aquariums can be a bridge to connect them with the local ocean and its living dependents in an ocean literacy framework.

In addition, ocean programs can work as a bridge to connect students to the unseen parts of the seas. Although BC's province has the longest coast in Canada, there are communities who live in the interior that might not have had experiences in the ocean. Ocean educational programs can connect with the inland schools so students can explore their exhibitions. Even the population that live close to the shores, have difficulties to see the different layers of life in the ocean. Ocean education programs often have samples that are provided to students while they learn about the variety of life that the ocean holds and hides. These moments are essential in an individual OL process, since learning the ocean in the theory may be challenging and often nebulous. As Longo and Clark (2016) expressed "the ocean is commonly viewed as something far removed from human society. In some way, it is deemed 'out of sight, out of mind" (p.

465). By bringing the ocean and its biodiversity closer to communities, students can enhance or create a connection with the marine waters. Thus, marine aquariums with ocean education programs may fill an essential role in the advancement of ocean literacy.

However, few researchers have studied how these programs connect students and teachers with their local marine ecosystem, with a place-based experiential learning approach to engage in OL. Indeed, OL interventions have few publications regarding how these efforts influence on participants understanding and connection to the ocean (Fauville et al., 2019). Responding to the COLC goals on OL advancement in the Pacific Region and the need for OL publication in Canada, this study seeks to understand (1) how an ocean education program motivate and engage students in OL and (2) how the program explores the student's place and region to connect students with the local ocean.

Ocean Wise organization from 2017 – 2020 provided several educational opportunities for local and national communities in BC and Canada to understand, explore and engage with ocean awareness and conservation. OW provides experiences with the ocean for coastal and inland regions both by the aquamobile project called AquaVan, both providing online teaching resources for students and teachers in BC that follows the BC curriculum that can be used in the public schools or in private programs, as well as non-students (https://ocean.org/learnonline/). OW goals are also engaged communities with their local waterways and biocultural diversity in the coast of BC. Thus, OW educational programs give opportunities for research in the OL field to analyze, explore and understand how they can work as bridges between students and ocean filling the gap in the educational system.

Summary

The above review of ocean literacy and place-based experiential learning literature suggests that there is a strong alignment between the potential goals of OL in BC and the enhancement of the Pacific's population connection with the ocean. Place-based experiential learning has been shown to be effective in exploring the relationship between participants and the place where they live leading participants to understand their influence on that place and the place on them, resulting in a sense of care and

empathy towards that place. Thus, PBL suits the OL essential principle, to understand this relationship and to make responsible decisions about the ocean and ocean resources as the place you live and take care for. The review of current literature in the role of marine aquariums and educational programs suggests that these facilities and programs are important to provide visitors and students with experiential moments of seeing, touching, and learning experiences, nurturing in them responsible attitudes towards the marine life. Therefore, ocean education programs may be well-positioned to accomplish its goals of advancing OL, improving ocean health and its conservation and inspiring a culture of care and empathy towards local marine organism.

This thesis explores participants' experiences in the *OW educational* programs with respect to its two research questions and contributes to filling the gap in the literature when it comes to the publication of ocean education initiatives and their work disseminating OL in Canada. In the following chapter, the methodology and methods used to design and conduct this research are described including a review of the literature related to the exploratory and instrumental case study method that informed the design of this study.

Chapter 3.

Research Methodology

In this chapter, I explore the study context, location, and participants. Then, I discuss the methodology and various methods that I used to collect qualitative data to answer the research questions (p.37). In addition, I describe this exploratory case study approach and how I analyzed my data, followed by a discussion of validity, and significance of the study. I conclude with a discussion on the study's limitations during a global pandemic and comments on the ethical considerations.

3.1. The 'Ocean Wise' Context

Ocean Wise is a global ocean conservation organization founded in 2017. During 2017 to 2020, it was based out of the Vancouver Aquarium with four key pillars of: engagement, aquarium management, education, and research. The Ocean Wise mission is to inspire the global community to become 'ocean wise' by increasing its understanding, wonder, appreciation and stewardship of our oceans. As part of a rebranding in 2017, the Vancouver Aquarium launched a website (ocean.org) that aims to be a storytelling hub transcending international borders. The site shares information about ocean related issues such as overfishing, climate change, urban development and pollution and how these contribute to disturbing the natural balance in the ocean realm. A press release about this transition to the brand Ocean Wise stated:

> "When the Vancouver Aquarium was deciding on what to call this new, global conservation initiative focused on an international audience of ocean and nature lovers, Ocean Wise was a natural choice. Our name is the shortest expression of our story …" (Ocean Wise, 2017).

The Vancouver Aquarium (a component of Ocean Wise 2017-2020) is a long-standing BC based institution that has been an education leader in ocean conservation through, sustainability and education for more than 60 years. The organization offers a broad range of programming for youth, the general public, K-12 schools, and teachers in BC. With its long history as an educational leader, and its broad range of programming, Ocean Wise offered us a unique and ideal context for an in-depth case study. In

addition, OW educational resources are focused on BC curriculum and BC's marine wildlife, giving opportunities for teachers and students to explore their place (ocean and land).

"The ocean is the perfect lens in which to teach many of the core competencies and curriculum requirements. We have curated the activities and resources to best support the BC New Curriculum. In each resource description, you will find the curriculum requirements and competencies that can be met. While we have curated the course based on BC Curriculum, the application of the resources is endless.". (Ocean Wise, 2020).

The case study explores the three OW educational programs (Aquavan, Research in Action and the OW online resources for teachers and students) with the lenses of the researcher and the participants from Metro Vancouver, BC.

3.2. Study Location

This study was conducted in several locations (see Figure 1) where OW set their educational activities both virtually and in person. The in-person research was undertaken in Chilliwack, the Vancouver Aquarium and on Bowen Island where OW provides ocean education programming. The three places are examples of the intentions of each program I will describe in the following chapter. To begin, Chilliwack is a city of 91,797 habitants, around 75 km from the closest (Pacific) ocean (Waddington, 2017). Often the community study, work and live in Chilliwack and accessing the sea could be a rare for many of them. Therefore, observing one of OW programs happening at a place with this context may be valuable to understand the impact of providing an ocean education program for part of this community.

Vancouver Aquarium has a reputation for excellent educational programs and also provided a shuttle service for schools in Metro Vancouver. The educational programs mission is to raise awareness of the ocean ecosystem and promote conservation through experiential learning, including marine life observation, games, dissections among others. Ocean Wise provides programs both indoors and outdoors, as well as resources that are available online whereby students and teachers can

explore and understand the local marine environment of Howe Sound, southern coast of BC.

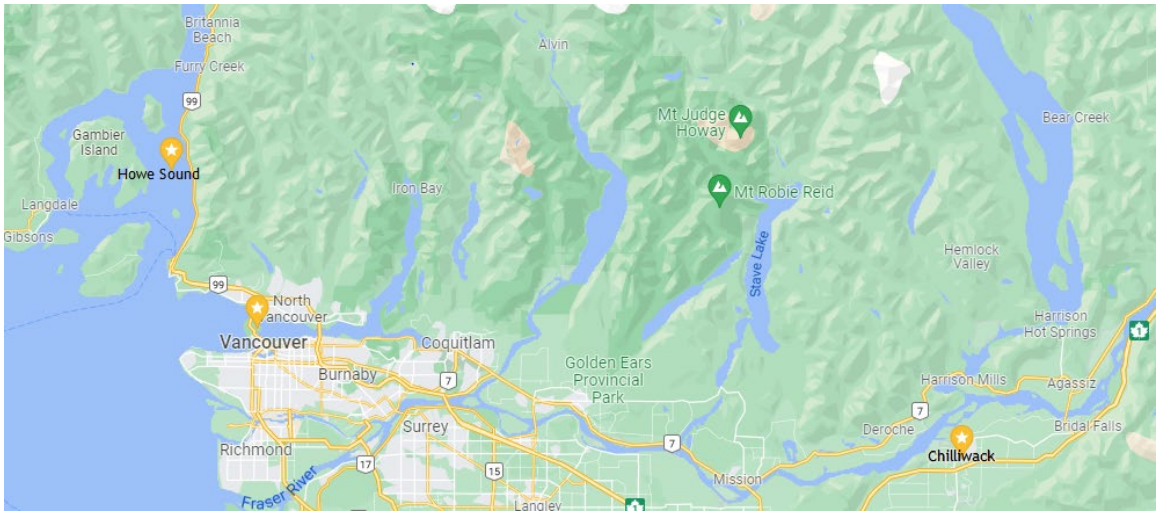

Figure 1. Metro Vancouver, starring Howe Sound, Vancouver and Chilliwack
Photo: Google Map website

3.3. Methodology

The present study follows the purposes of a qualitative research in order to "build a depth of understanding about some dimension of social life (Leavy, 2014)." (Leavy, 2017, p. 9). Through an inductive method, qualitative research allows the researcher to learn an event from the perspective of its participants, by revealing how they perceive, ascribe, and react a/to phenomenon (Leavy, 2017).

To date, there are few studies that explore how ocean literacy programs are reaching their goals within the community and within participating classrooms (Fauville, 2019; Fortner, 2019). The limited number of studies about marine issues in the fields of education confounds our potential to improve the range and quality of ocean education programming (Fauville, 2019). A more in-depth understanding of how programs are performing would encourage broader discussion and reflection on the lessons and challenges that current ocean literacy programs face - and how these should be addressed in the future. In addition, evaluating educational programs have been a challenge for many organizations and this research will help to archive the nuances from the participants perceptions of the OW selected educational programs and platform.

In order to understand the AquaVan, RIA and OW Online Resources, and their potential impacts on the development of students' ocean literacy/connection, a series of qualitative methods were employed through a case study methodology. I selected a case study methodology for my study of selected programming for a variety of reasons. Case study has been described as an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). For this study purposes, I deemed that an exploratory and instrumental approach would best suit the study context of Ocean Wise (Yin, 1993; Stake, 1995). Case studies tend to be selective, focusing on a few issues that are considered fundamental to understanding the system (or program) under study. For the goals of this research, I intended to explore a range of programming that would incorporate theories of experiential and place-based education with the program participants.

I consider non-experimental phenomena 'in-context' for this study (Kostoulas, 2010; Levy, 2017; Yin, 2003). In addition, the development of the case studies allowed us to develop "a complete understanding of a process, program, event or activity" (Wholey et al., 1994, p. 163), and had further potential to yield insight and in-depth understandings about Ocean Wise programming.

The richness of the study lies in the strength of the research methods themselves. My aim was to produce rich and descriptive data from the programs through focus groups, questionnaires, and observations. The selection of the programs was made by their availability and convenience to access for the research. A wide variety of Ocean Wise programming was studied, including detailed observations of an 'in school' visit of the mobile *AquaVan* program at a local elementary school, and further observations made during an elementary school field trip (onsite) at the *Vancouver Aquarium* and the Research in Action (RIA) program provided. The online resources for teachers on the Ocean Wise website was also studied through the perceptions of student-teachers.

Additional data collection came from focus groups with participating students and student teachers (from school and university classrooms) as well as email communications with supervising teachers and leaders. In summary, qualitative methods of data collection included researcher field notes, direct participant observation, and open-ended questions in a questionnaire and focus groups.

3.4. The Study Participants

This research included students and teachers from grades 3 to 5 of an elementary school in Chilliwack, student-teachers enrolled in the Professional Development Program offered by Simon Fraser University from a 2020-2021 co-hort as well as selected OW leaders who lead or conducted AquaVan and Aquarium activities.

All students registered in AquaVan and in the Vancouver Aquarium visit were regarded as potential participants because they were aged between five and twelve and this is a critical period for developing individual's relationship to their world (Sobel, 1990), they are able to respond and participate in a focus group with approximately 8 questions as suggested by Krueger and Casey (2009) for conducting focus group with young people, and the grade levels from which we received the greatest parents' authorizations.

The study was conducted in February and March of 2020, July 2020 and in the Summer of 2021. The research had to be paused for couple months with the global pandemic COVID-19 outbreak when in middle March 2020, the government of Canada declared state of emergency and mandatory quarantine for all provinces (Elflein, 2021).

3.5. Data Collection

In order to gather the data for this study, I was present throughout the programs studied to build a positive relationship with the teachers, students and student-teachers. As Stake (1995) states, "observations work the researcher toward greater understanding of the case". I mainly focused on the interactions between the students and the activities provided by the program and the students' reactions to them. After the observations I was able to adjust our questions for the focus groups and questionnaires, helping in our comprehension of the program and what was "…unique in this experience the participants were involved in the context of OL." Importantly, during my study, the global pandemic affected the direction of the research in that it became increasingly difficult to follow up with participants and teachers in a face-to-face manner. Some programs that I had intended to study were suspended due to Provincial Health and Safety orders. Despite these challenges, I did collect sufficient data to contribute to a broader

understanding of how Ocean Wise programming functions and the participants perceptions of the potential influence on their OL described thoroughly below.

Direct and Participant Observations

Most of my data comes from observation as it is an important and useful method for field-based studies. Johnson and Turner (2003) agreed that observations are a way to see what people do and not what they say they do. Observation is also a recommended method when including young children as research participants since it is a more “unobtrusive” data collection (Bowen, 2005; Kim, 2014), and I can capture how kids react to an event without asking them.

I observed, as a non-participant, one day of AquaVan in the elementary school in Chilliwack for 4 hours. I was excited to see how students reacted with the marine life specimens provided (Figures 3, 4, 5, 6 and 7). Each grade had 1 hour within the program and in total I observed 4 rounds of the program with two classes in each round a total of 4 hours of observation, note taking and photographing the activities.

A week and half later, I observed the same students who then participated in the AquaVan program, on a day trip to the Vancouver Aquarium. I focused my observations only on students who provided written consent from their parents to participate in the research. I observed a total of 4 hours that included the visit to the exhibitions and the students’ attendance in the Research in Action (RIA) program at the same site.

As Merriam (1998), Hatch (2002) and Leavy (2018) suggest, I kept written notes of my observations in a research notebook to facilitate recording the children’s experience, as well as keeping notes on Google document shared only with myself so I would not lose my notes keeping them in the “cloud”. I documented students’ behaviours, engagement in activities, and their responses and comments to the experiences provided both in the Aquarium and at the school. I also recorded how the leaders conducted the activities and interacted with OL topics and students. Additionally, I recorded the duration, times, and location of all of the various activities, and I took photographs of the spaces used during each of the activities. Thus, a visual record aided my thinking and recall of how the activities took place and what tools were being used to connect students with the main themes in each of the programs under study.

Questionnaire

I used two short post-activity surveys to contribute to my data regarding the first two research questions for this study. In order to explore how students experienced AquaVan and RIA programs after the event, a questionnaire with open-ended questions was also sent to the teachers of the classes registered in the two programs. For the OW leaders who conducted the programs, I administrated a post-questionnaire in order to have a broader idea of how, according to the leaders, the program impact students' ocean literacy from their experience running it. The questionnaire had 5 open-ended questions that were linked closely to the research questions, and these are fully explored in the later chapters.

I chose questionnaires to share my questions with teachers and leaders mainly due to the influences of the pandemic and the social distancing protocols in place in schools and other public spaces. Online questionnaires were done using Google forms with only one submission allowed per email. Online questionnaires allowed for adherence to these protocols but also gave time for participants to reflect and answer the questions in their own time / preference. Also, questionnaires simplified the process for teachers and leaders who were already facing challenges to teach and perform their duties with the ongoing changes due to the social distancing mandate. Volunteer participants were given 31 days to answer to the questionnaires or get in touch by email with additional comments regarding the program if they wished.

Interviews - Focus Groups

Another method for my data collection came from focus groups interviews. Focus groups were conducted to explore grade 3-5 students' perceptions of AquaVan to understand how the program connected them to the ocean and student-teachers' perceptions of the OW-OL online teacher resources as a tool to deliver ocean literacy in K-12 classrooms.

I chose focus groups due to their potential to expand on a chosen topic or to uncover ideas that might not be explored in structured interviews. According to Leavy, 2017, focus groups allow the researcher to understand and collect participants to share their experience, motivation and context using their own language and concerns. The

questions started from simple and broad to more specific and detailed as recommended by Roller and Lavrakas, 2015, and Leavy, 2017, as “[it] “allows participants time to get more comfortable while you build a rapport, and also allows you to learn some things that may impact later, more specific questions.” (Leavy, 2017, p. 140).

To gather data from the AquaVan experience, I facilitated two focus groups with guiding questions for students who wished to share their experience after the program and who had provided informed consent from their parent or guardian. All the 12 students were from grade 2-5 and they were separated by age (eg. grade 2-3 attended the first session and = grades 4-5 the second). The focus groups happened at school in a room where they could come and go at any time they wished. I attempted to establish a good environment and connection with the students throughout their participation. Before I started with the questions, I provided snacks (allowed by their parents and school) and played a game where they should choose their favorite sea animal to “sub” their names for this research as well as memorize their classmate’s favorite animal. I also stated that I was not their teacher, not the OW leaders but a student like them, and that this was my research homework. Thus, students could feel more comfortable to share their answers and engage in the discussion. Each focus group lasted approximately 45 minutes. Focus groups were audio recorded and then transcribed to guarantee a full record of all the information being shared and discussed.

Knowing the potential of the focus groups, I chose this method to explore the student-teachers perception of the OW OL online resources for teachers as well. Since these resources are designed for teachers in the BC K-12 system, student-teachers were tasked to read the resources (https://education.ocean.org/teachers) for their Environmental Education course and I had the opportunity to interview those who wished to share their understanding, concerns and ideas of the usability of the resources. Thus, a focus group would be ideal to gather a more in-depth data as well as a chance for them to collaborate by listening to each other and sharing ideas. In total, 15* students participated in two different sessions having 7 in one session and 6 student-teachers in the other session, each lasting approximately 1 hour.

Before the focus groups, I spent two weekends during the course liaising with potential participants in order to create a sense of community and build relationships with teachers. David my supervisor and professor of the course offered, welcomed me to

his class providing me time to get to know the student-teachers and to talk about my research. Due to the pandemic the classes were happening in small groups at different times and days (with a maximum of 10 students in each group). After the two weekends, I conducted the focus group on Bowen Island where the course was being taught for that weekend, in June of 2021. I designed 8 guiding questions that will be described and explored in chapter 4.

Supporting Methods

Other supporting methods included digital photographs and researcher field notes. I took photographs of (1) the activities which provided me with a visual record and helped my recall of *AquaVan and RIA* within specific contexts, and (2) one-one conversations with OW leaderswhich provided additional information about students' perceptions of the ocean and marine organisms as well as their responses to the *Aquavan and RIA* program. In addition, for online resources, emails were collected from the participants to complement their views on each topic.

3.6. Data Analysis

Data were analyzed by following the "general phases of analysis and interpretation" as described by Leavy (2018) and cycling as suggested by Yin (2003) for case studies. I prepared and organized my data as I was collecting it and adjusted according to my findings. After each collection, I immersed myself in the findings to have a better view of my data and the "pulse of the data" (Leavy, 2017; Saldaña, 2014). Following this I began to colour code data through in vivo coding and categorize them, which is the process of grouping similar or related codes together (Leavy, 2017; Saldaña, 2014). Finally, I found themes that helped me to interpret and connect my data from student-teachers, students, and teachers, a process called triangulation, where I could address different sources of data and methods, field notes, focus groups and responses from open-ended online questionnaires to the same questions as recommended by Green 2007; Greene, Caracelli & Graham, 1989; Hesse-Biber & Leavy, 2005, 2011; Leavy; 2017.

The results were validated by triangulation, member checking and matching data with my supervisor who was connected to this research. Triangulation is a strategy to assist in the validation process (Leavy, 2017) as it tries to find similar results from different methods of data collection. Student-teachers had the opportunity to check my notes and interpretation of the data when I visited during their last day of class. A copy of my field notes was given to them, giving them a chance to review them and to add comments if they wished.

Limitations of The Study During a Global Pandemic

The COVID-19 pandemic has brought countless impacts on people's mental and physical health, finances, achievements, and education. Most of the year 2020 required self-isolation and quarantine, which lead many establishments, organizations, and institutions to close their doors and/or work on virtual platforms, including many K-12 schools. Studies from the BC Centre for Disease Control (BCCDC) show that students mental and emotional health has been impacted in addition to the interrupted learning and loneliness, "[I]t was as a whole perhaps one of the most challenging for educators and students in our nation's history." (Dorn et al., 2021). The study points out to the increased dropouts in schools, affecting students' chances to go to post-secondary institutions. More than 35 percent of parents interviewed in the survey are "very or extremely concerned about their children's mental health" (Dorn et al., 2021, para. 2). The pandemic not only affected K-12 students, but also their teachers, parents, and school staffs.

This scenario also had significant impacts on my research which relied on the interaction of the participants with the ocean literacy programs. First, Ocean Wise paused and/or canceled many of its programs and temporarily closed the Vancouver Aquarium, which is now owned by another company. Second, teachers and students were dealing with a stressful time with the closure of schools and the start of the online learning. Finally, writing during a pandemic was mentally challenging, and feelings of discouragement and stress were often present while I carried on with the research.

Following my research proposal, I wished to observe the *Learning Journey* program offered by OW. This program brings grade 9-12 students to Vancouver Island for four days with place-based education approach to explore their coastal area,

community, ocean, and science BC curriculum concepts (Ocean Wise, 2021). I was keen to observe this program as I found it unique due to its potential to connect students to their local sea while getting units/credits for secondary school. However, this program was canceled. The absence of Learning Journey program in my research, not only interfered with the study of a place-based program, but also limited the diversity of the programs I could study.

OW has now laid off many of its staff involved in the educational programs when they were paused/canceled. The sensitivity of this situation also impacted the collection of data from former staff who designed and/or ran the programs. A year passed before I was able to send an online questionnaire to a few of the current and former OW leaders who agreed to participate in the research.

Currently, the Vancouver Aquarium is no longer owned by the Ocean Wise Conservation Association, as well as the programs are no longer offered on site. The continuity of RIA and teacher professional development programs at the Aquarium remains uncertain. However, I write with the context of the programs as they were when I observed them, during the Ocean Wise ownership of the Aquarium in a pre-covid scenario.

The change from in-person to online classes caused increased exhaustion and stress on teachers (Gadermann et al., 2021). Adjusting for a new format may be challenging for current and new teachers, and my planned interview with teachers who registered their classes to the *AquaVan* and *RIA* were adapted to a simpler questionnaire/email exchange. Since my communications with teachers were limited, I did not run a second focus group with the students after their experience with RIA.

The isolation periods also impacted my own writing process for this thesis. The uncertainty of the return of the programs, being far from my family and friends, and dealing with the sickness of this virus, brought times where I felt discouraged to continue with this research. The support of my former and current supervisors was a keystone to the continuation of this study.

The pandemic showed how education programs could be fragile in difficult times and the one of the first to face the impacts of the pandemic. Although the research plans

were impacted, I was still able to collect enough data to complete the study and my results are shared in the next chapter.

3.7. Ethical Considerations

Prior to my data collection methods (observation, focus groups, questionnaires), all participants were informed about the purpose of the study and their voluntary participation. In some cases, this information was provided by classroom teachers (for elementary students) and written and informed consent was obtained from parents and the local school district (Appendix E.). For adult participants, consent procedures were in accordance with institutional and national guidelines and the study underwent a full ethics review by the Simon Fraser University Research Ethics Board.

I continue now with a description of how the case study unfolded, interacting with a variety of forms (or *currents*) of OL programming.

Chapter 4.

Results

This chapter reports on the results of my qualitative analysis in order to answer my two research questions as well as implications and limitations of the program and my research.

This exploratory case study provides insights on elementary students', student-teachers and OW leaders experiences in ocean literacy during different activities provided by the Ocean Wise organization. Qualitative data were obtained through questionnaires, focus groups, observation, and direct communication and used to examine students' and teachers' perception of their activities in *Aquavan* and RIA, Teacher Professional Development and the student-teachers' perceptions of the Teachers Online Resources. Summarized responses are detailed in relation to the research questions below.

1. How are the programs and resources generally perceived by students, teachers, leaders, and student-teachers, participants of this research?

2. Do students, teachers, student-teachers, and leaders perceive the programs and resources offered by OW as contributing to the development of ocean literacy? If so, how do these activities and resources accomplish this?

4.1. Ocean Wise Mobile Programming (the AquaVan)

The *AquaVan* is a mobile ocean literacy program that brings Ocean Wise programming directly into schools and communities through the transport of a curated collection of live organisms and preserved specimens (eg. live aquaria, and artifacts such as whale skeletons and sea otter fur) in a trailer (Figure 1). Aquavan has been in more than 150 cities across Canada aiming to bring ocean awareness to communities through social events and in schools with the intention of "Connecting communities to coastlines" (Ocean Wise, 2016).

Figure 2. AquaVan's truck and trailler

The collection is accompanied by an experienced Ocean Wise educator team and aquarium staff who care for the live collections when travelling. From the conversations with the OW staffs, the live animals rotate from time to time to rest and when not on tour, they are cared by the veterinary team from the Vancouver Aquarium. Ocean Wise hold permits from the Fisheries and Oceans Canada department, to keep a list of species that the Aquarium might have. The animals are chosen according to certain characteristics that help to carefully pick them up and put in a bowl without causing injuries, usually "hard-core" invertebrate intertidal animals used to fluctuations and more stressful conditions, such as some sea stars and sea urchin's species (Figure 3).

Figure 3. Aquaria with marine invertebrates.

My study begins at a small elementary school in Chilliwack, BC: a school that had arranged to have a day long *AquaVan* program delivered as part of their school wide environmental programming efforts. The city of Chilliwack is located approximately

100 kilometers inland from the coast. This characteristic makes it common to have students attending the school who have never visited the ocean. Still, viewing salmonids and other marine species is a common occurrence in the nearby Fraser River. While distant from the sea, the ocean brings a range of important economic, cultural and social impacts to the community (Waddington, 2017). Participants in the research included students in grades 3 to grade 6, teachers from School District 33 (Chilliwack), and Ocean Wise leaders who worked to deliver the program**.**

I observed program activities with four different cohorts of classes, each with an hour-long experience with the programming. The lessons are enacted in the school's gym with four program leaders on site. Each leader is responsible for leading an "ocean station", where students spend 20 minutes at each exhibit. Each focuses on an ocean theme, including: Cetaceans (bones and krill); Fur and Pinnipeds (representing sea otters, sea lions, seals); Plastic and Sea animals; and a collection of live aquaria containing sea stars, sea urchins, sea anemones, an assortment of snails and fishes (some with touch pools). The leader announces to students that all of these stations are samples from the *Salish Sea*, and that they are found near downtown Vancouver. Typically, classes participated in the activities for one hour and I conducted observations on a total of eight classes from grades 3 to 6 (with the presence of my supervisor who was also there as an observer).

The briefing activity begins with leaders and students in a large circle where they tell stories about the ocean and invite the children to participate. They introduce why the ocean is important to them and also how the health of marine lives is being threatened. One of the leaders, subdivides the large group and four smaller groups are formed. Each is directed to one of the themed stations. The groups spend 10-15 minutes at each station with a different leader. Students listen to stories and lessons related to each station theme. Students are welcome to ask questions and share stories related to the ocean and to what they are learning.

At the Pinniped Station (Figure 4), one leader explains about a food chain linking the kelp forest to the sea otter and asks what would happen if one of these animals were no longer there: "that is how a species can go extinct", says the leader. She also shares that kelp is found in our medicine and our food, so it is not only good for sea animals but for "everyone". Students then touch the sea otter fur, *"Sea otters get old just like us, they*

will get white hair" says the leader and then touching a specimen of sea urchin, stating: "*you will see a live one today.*" One of the students then responds: "*this is such a good school day!"*

Figure 4. Pinniped Station: Stuffed sea lion, seal's fur, seal and sea otter's bones and skulls, pinniped's photos.

At the Cetacean Station (Figure 5) there are artifacts (eg. dried baleen) from a grey whale, its cervical bones and an orca's jaw. As the children are from the early grades, the leaders incorporate more storytelling and body movements to mimic whales feeding. Students are welcome to touch the samples and are surprised by the size of the grey whale vertebra "*Oh my God, this is the biggest thing I could see from an animal today*!" says a student. They are observed comparing their own vertebrae by rubbing a classmates' back. It is interesting to note a sort of discomfort with students as they are told to touch the samples, *"ugh, this is gross!"* said one now touching the orcas' teeth

and grey whale's baleens. The leader explains the difference between the specimens and how the structures relate to the diet for each.

Figure 5. Cetacea station: Orca's jaw, whale's baleen, whale's vertebra, whale's ear bone, cups with krills and microplastics.

At the Plastic in the Ocean Station (Figure 6), students are very talkative and bring examples of how their lives are related to plastic. The session includes a turtle shell/case, and a photo album with animals containing plastic inside their bodies. The leader asks: "what do you see in a healthy ocean?" and students answer, "No plastic, colorful fish, clean water." Another shared "When I was in Mexico, I saw a bottle of water in the ocean and I tried to get it with my sister." In this session, the leader discusses the use of fishing lines and nets and asks which one will bring the lowest impact to marine lives, after first talking about seafood.

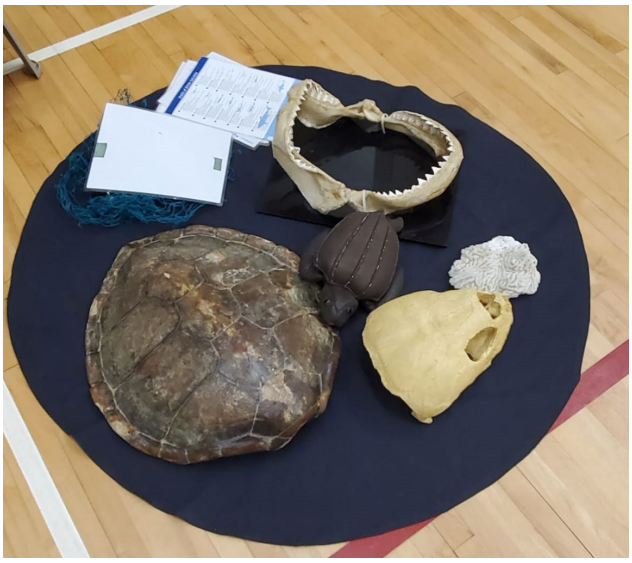

Figure 6. Plastic in the Ocean Station: Turtle's shell and skul, shark's jaw, stuffed turtle, fishing net and a plastic bag.

Lastly, is an interactive station where students walk around a series of small aquaria (Figure 7). With stories, the leader invites students to mimic the animals' movements inside them: giving special emphasis to the sea urchin. The excitement starts when the leader tells students that they will be touching the animals. The leader invites them to use their little finger and points out that the animals are alive and can feel their touch, so they need to be gentle. "It is like having eyes on your feet," says the leader. The leader shares that the tube feet help pull the urchin along and are the most sensitive part of the sea urchin, helping the sea urchin to sense its surroundings. As students touch the sea urchin "it is so soft! I can't believe it doesn't hurt" says one student while the rest agrees, "yes, it is very soft!".

As students complete the tour of stations (around 45 minutes), they return to the large circle where it began for a program debrief. The leader wraps up the program by asking students how much they learned and if they liked the tour. Students share their comments out loud and ask further questions. The leader proposes to them a final "Hi 5 Challenge", indicating they should share what they learned in the activity with five people they know. Overall, students are participative, and few are left out during the conversations with leaders. No prior knowledge is required for the program and for many, it seems this is the first time learning about ocean topics. In one hour, the program touches on many content areas that would be difficult to do in a classroom.

The structure of how the content is explored helps the leaders to fit all the content into a dynamic flow. Defining the activity in one word, as observers, we say: intense.

Figure 7. Ocean Wise leader answering student's question about sea stars. Mobilie aquaria with marine invertebrates

Focus Groups

After students' participation in the program, I conducted two focus groups with a subset of the participants: each including six students from the same class. These conversations lasted approximately 45 minutes each and I provided snacks and a comfortable environment where students could come and go any time they wished. The first of the focus groups was conducted with younger children from grades 2 and 3 and the second included older children from grades 4 and 5. Having age defined groups also helped students to feel more comfortable and encouraged them to speak freely. We arranged for a studio space for the conversations with couches and comfy chairs so that they wouldn't feel they were in a formal setting. Focus questions were the same though we adapted an age-appropriate vocabulary for each age group. We began with open-ended questions to create a dialogue and clarified for students that this was an open space where they could say anything they wanted about their learning and that their comments would be kept private (no names). Below are the highlights from the focus group transcripts.

Interviewer: “What is your favorite thing from the activity today and how is it different from your classes?”

Salmon: “Live animals - you never see animals in school.”

Blue whale: “Seeing the starfish and touching it.”

Blue whale: “I also like to touch myself during the animals’ movements we had to mimic.”

Oyster: “Yes, I like to touch the sea urchin’ spines it didn't feel spike - only if you press it hard… to protect from other animals.”

Oyster: “Because I don’t know how to swim, I see things that I can’t see in the water.”

Sea Lion: “We never bring nature to class, we always go there” Me: Really? Where? “Close to the school around here.”

Turtle – “See live animals and the history of the animals.”

Kelp, Bear, Squid – “Real life animals, like starfish.”

All – “Touch live animals.”

Interviewer: “What was your least favourite activity today?”

Blue whale: “I didn’t really like touching the skeleton of the animals, like the shark jaw…And the water was too cold to touch the animals.”

Salmon: “I hate the fact that there were no games… It is a gym, it’s supposed to have games… and it was way too long. We had no time for recess.”

Everybody agrees

Sea Lion: “Touching the sea urchin. I would prefer to see the animals in the nature not at the school.”

Shark: “I like everything!”

Polar Bear – “I didn’t like the whale’s section. It was kind of gross…”

Squid- “The turtle shelf.”

Polar Bear – “It is very sad to know how animals are dying from pollution…”

All – “The whale section skeleton.”

Interviewer: “What was new for you today?”

Oyster: “I have seen seals before in the aquarium only time in my life I saw live seals, but I never touched it. I thought their fur was thick and not smooth. When I touched it today was *sooo* smooth and beautiful. They are lucky to have that hair.”

Shark: “Yeah, that’s right, it was shiny and smooth.”

Oyster: “My leader said that sea otters are like us, they turn their hair blond/white when they get old. I didn’t know they were similar to us like that.”

Blue whale: “I saw seals when I was going to Victoria in the ferry. But I didn’t know about the fur…I didn’t know we could swim inside a whale… and how they eat is new to me - with the big mouth they eat such tiny animals.”

Sea Lion: “I have never touched a starfish and fishes before. It is very nice.”

Salmon: “Yeah they were in that small cup like little shrimps.”

Sea Lion: “Krill!”

Participants start to imagine themselves in a whale’s mouth and them escaping through their blowhole - Some were making fun of going out through their second hole.

Salmon: “Seals fur (is) waterproof - black oil for the fur”

Turtle, Dolphin and Kelp: Touching the live animals, starfish (sea stars) and sea urchin

Interviewer: “What are the threats that humans cause for sea animals?”

Blue Whale: “Yes! (thinking) The whales can eat plastic by mistake because they could be small like the animals they eat… it can get trapped in their baleen.”

Salmon: “Orcas are endangered too… too much garbage in the ocean.”

Blue whale: “There are so many plastics in the ocean, once I saw a commercial where they take plastic and make bracelets and sell it.”

Interviewer: “What is your relationship with the ocean?”

Turtle: “I like to surf.”

Polar Bear: “I have never been in the ocean.”

Fish: "I have seen starfish (seastars) and turtles but I don't know if it was in Vancouver?"

Polar Bear: "Is the water on the beach the ocean? Me: If it is salty, it is!"

Polar Bear: "So I swim there!"

Interviewer: "Can you see anything in your town that has a connection to the ocean?"

Everyone thinking…

Kelp: "I think the rain is a connection. When it rains here the garbage can go to the ocean."

Turtle: "Yes, the garbage from school and homes can go to the river and get in the ocean."

Sea Lion: "I think some invasive species we have came from the ocean."

Interviewer: "How can we protect sea animals?"

Shark: "They are way too cute we have to stop littering."

Blue whale: "We need to grab the garbage in the river so it doesn't go to the ocean and buy the bracelets!"

Shark: "Yeah, we should stop throwing garbage in the lake and recycle."

Salmon: "We should clean up the coastal areas, not throwing garbage in the river and recycling."

Sea Lion: "We need to take care of them."

Turtle: "We should use reusable bags and recycle more. We need to stop buying plastic."

Sea Lion: "Think about our actions before we do it."

Squid: "Recycle."

Overall, students were excited to see and touch live animals and showed enthusiasm to learn about local sea animals. They were able to link these experiences to previous learning and related animal welfare with pollution reduction actions. Addressing the consumption of plastic was noted by most participants as the most urgent action required. By experiencing features from the ocean, students demonstrated genuine care for marine life that they studied in the program.

Teachers' perceptions

Supervising teachers also gave valuable feedback about the *AquaVan* program and their reasons for selecting it. When asked why they had participated, they shared those children did not usually get the opportunity to go to the ocean or an aquarium and that this allowed for hands-on learning and a fun and engaging experience with aquarium staff. One noted: "I thought it would be a different and interactive activity for my students … also, doing hands on activities with artifacts and living things is so engaging for students."

Teachers shared that the live animals were a 'huge hit.' Students were surprised at the textures of the animals they touched and seemed to have grasped key concepts from their experience. One teacher noted: "They were excited to touch the artifacts. They were excited to tell me about the furs, bones, and teeth that they saw and touched." Lastly, when asked whether the program had met their expectations, teachers noted that it used knowledgeable educators who are enthusiastic, and clearly like being around kids. "It was well organized. It was engaging. The presenters had good management. Time was used wisely and effectively."

Other constructive suggestions included the idea that students would have benefited from more time at the live animal exhibit and that the gym set up was distracting and loud at times. A further comment suggested that since some activities were rushed, they could be spread out over two days.

AquaVan Leaders Responses to Questionnaire and Informal Interview

A total of four OW leaders (L1 – L4) shared their experiences in running the program by answering the questionnaire questions both online and by video chat. The leaders who I had the opportunity to speak with on a video call provided information that went beyond my structured open-ended questions (for more details see Appendix B). Below I summarized their answers with their written and verbal consent, according to each question for the proposed of this study

Question 1. From your experience delivering this program, how do you think the students perceive AquaVan? Explain.

> L1: Even students that live near the coastline rarely get to actively explore and the programs give them a glimpse into what it is like to see and touch sea animals. Often students are observed having strong reactions of surprise (sometimes repulsion) at the beginning and then get very curious.
>
> L2: Students often do not know what to expect, unless the AquaVan has been to their school or community previously. Once the program starts, they are excited at the prospect of being able to see and touch the artifacts and the live animals that we bring.
>
> L3: "I never grasp the fact the "seastar" are actual real animals, just seen in cartoons and pictures – I thought they were a unicorn or something" - The kids don't choose to be there, but most of them are excited to be there. - AquaVan is a spark – make them curious and make them want to know.
>
> L4: Kids are remembering – later in the school they tell us things "I got to touch that whale" – "I don't get to see this all the time; can I touch it? Now I am intrigued, and I can ask more questions" - They are guiding – the inquiry based will guide on what they are interested in.

Question 2. What are the approaches that you believe that help this program to motivate or inspire students to become ocean literate?

> L1: "Sharing the awe and wonder of aquatic habitats. Keeping the conversations positive and focusing on things that we can do/learn about rather than the overwhelming issues and what we cannot do. The ability to take live marine invertebrates to communities where they would otherwise not be able to experience them. It is a hands-on program - giving students the opportunity to touch, feel and smell things. Lastly, the staff - our educators are all passionate about the ocean and the animals that live there - they are able to communicate that passion to the students in their groups and inspire excitement about aquatic habitats.".
>
> L2: "Ensuring they all can get the same amount of physical hands on and have a group discussion about it, inquiry-based as possible, hands on and student lead. I like having more artifacts that I can talk about because maybe they will be curious of a skull we didn't talk about – so now they are curious, and they can try to know more. Wanting to know more than "well I know the whole ocean – now I can leave, bye!" With the artifacts - Picking and choosing on students' interests - I am teaching them a snitch of OL but mostly I want to them to go away with questions, wanting to know more and wanting to engage. We try to incorporate role-playing and games and physical movements – so kids will remember what they did with their bodies. Using the knowledge in

different ways "smell the fur if this will help you remember" Out of 1 hour is the beluga smell that they remember sometimes…".

L3: "Inquiry-based as possible, listening to questions and tying the questions to what you want to bring – but you want to know what they want to hear about. Time to ask questions while the other half respectfully touches the animals. More sharing stories from students. - . there is no right way to do it – there is no script – there are concepts adaptations, climate changes impact in animals and humans – connect students to that and make them want to learn more.".

L4: "I think it is having an experience with ocean life (live or specimens) as well as direct connections made to how their actions impact the health of the ocean and the lives of organisms. Through experiential learning, students get introduced to how the ocean impacts them and they impact the ocean. It makes it personal and not just a distant problem. We give extra way to connect and to share experiences, these moments are really valuable.".

Question 3. Do you think AquaVan allows for local/ community/ individual interpretations of ocean literacy? Why?

L2: "Yes. We emphasize working with students to help them come up with actions/ideas that are relevant for their community. Actions and interpretations may be different in every community. Our goal is to empower students to understand that their contribution or action in their hometown impacts the greater waterway/ocean/planet.".

L3: "We rely on kids to do and bring the context. We talk about stream, so kids say – "oh so that is the stream we have here". I think the nice thing is because we are using ecology and it is very easy to draw connections to ecosystems – they are all interrelated and connected – a tiny piece of info from them and you can connect. And they can do in their environment too. We ask, "Tell me more about it?""

L4: "We ask questions so they can tell us about their local context. But the time is definitely a barrier for us. "The role of salmon plays in the ecosystem can you think of an animal with the same role on your ecosystem?"".

Question 4. Which challenges did you face by delivering ocean education programming?

L1: "I have observed that if you live close to the ocean, you tend to take it for granted and if you live far from it, you think that you have no relationship to it. We need more entry points to getting people thinking about their relationship to the ocean.".

L2: "None that I can think of at the moment.".

L3: "I think the big hurtle is the big binary – good people recycle, I recycle, I am good. I don't I am bad. There is no room for growth. People

– and including kids, think that recycling is everything they need to do to keep the planet healthy… recycling is the last resource when we think about the three Rs (reduce, reuse, and recycle)"

L4: "The biggest challenge is to put the context to wherever we are. We rely on kids to do and bring the context. We talk about stream, so kids say – "oh so that is the stream we have here – yes!" The role of salmon plays in the ecosystem can you think of an animal with the same role on your ecosystem? … The time is also a big challenge; we don't have much time to go deep in these connections and relationship with the kids".

Question 5. What would be your recommendations for future ocean education programming?

L1: I think that those "ah-ha" moments that create wonder and awe are really important to starting people on that continuum.

L2: Keeping the program positive, sharing the awe and wonder with students and helping them to forge connections with and understanding of the natural world. If students know and understand something, it is much easier for them to care for it and move along the pathway towards becoming stewards.

L3: 1 hour and 45 minutes was perfect -We only have 20 minutes with kids and ask teacher to do a wonder jar prior to our arrival. The teachers who did that we had an awesome time! It is hard to guarantee that because teachers are busy. But when it happened, I thought was really nice because the students were more connected.

L4: "Definitely giving more time for the program would help! We rely on teachers to do the pre and post activities but yes they have the curriculum to follow…"

The sentences above were taken from the questionnaire and video call with the leaders - they better represent leaders' perceptions of the program and the participants in general. The positive comments are related to the opportunity that the program provides to students to let them see, touch and share their experiences with the ocean and marine organisms. Through hands on, inquiry-based in an experiential learning approach, leaders believe that the program let students ask their own questions while materializing the ocean by bringing the collection. Leaders considered AquaVan as a first gate, for many, to understand our relationship with the ocean and the influence we both have in each others life even if the students live far from the coast.

One of the main limitations of the program according to the leaders are the pre-concepts of what it means to be environmentally responsible. Leaders stated that most people they encountered think if they recycle, they are good people and are already doing their part to “help the planet”. They raise a concern of rural communities where recycling may be not a choice, and that there are many other better ways to keep the oceans clean and healthy when participants think this is all they need to do. Another challenge faced by the leaders is the time allocated to the activities. Leaders said that half an hour is not enough to create a real connection with the children. They believed that if they could rely on teachers to extend the program to their classes this would increase students’ ocean awareness, but they know it is difficult for teachers to find time for the pre and post activities. Allocating one and a half hour to the program would improve the delivery of ocean literacy according to the participants. This study now continues with the results from our onsite visits to the aquarium.

4.2. Research in Action

This program takes place onsite at the *Vancouver Aquarium*. As the name suggests, the program engages students in research as they are “scientists” for one day. The activity enforces observation skills, curiosity, and appreciation for local marine ecosystems. The program is delivered around a story of rockfish research and conservation in Howe Sound, BC. The program provides a research experience where students observe, explore and link conservation with research. Students also examine the internal anatomy of fish through a herring dissection.

One week after the *AquaVan* came to the Chilliwack school; one elementary class travelled to Vancouver to attend this onsite program. For this part of our study, we spent 4 hours observing a *Research in Action* program that included some of the same students participating in our earlier focus groups. On this day, students spent a half day informally exploring the exhibits at the Aquarium and a half day in the *Research in Action* program. We observed student interactions, taking notes about their activities, describing the goals of the program and how *Ocean Wise* leaders cover ocean topics connecting these ideas to the local context. We recorded information about the program through photos, document review, through informal conversation with aquarium leaders and staff, and a similar questionnaire that was sent to *AquaVan* leaders.

The school arrives at the Aquarium early in the morning by school bus. The grade 4 and 5 students are organized into two groups with one teacher (and a parent chaperone). They explore the Aquarium exhibits for about 2 hours. Students are very excited and for many this is their first time at the Aquarium. The students ask many questions regarding the curious animals they are seeing. The Aquarium hosts a number of exhibits highlighting not only the Salish Sea ecosystem but also tropical marine ecosystems (such as coral reefs), as well as a simulation of the Amazon rainforest.

After their 'free time', students gather together for the formal activities called "*Research in Action* " led by the Aquarium staff. Students are directed to a classroom where the leader asks: "What did you do today that you like the most?" Students reply with different responses but related to the animals they saw. "Blue Whale" replies: *"The sea otter knocking a rock into the sea urchin and then playing with a ball, I remember when we talked about it in school"*. After this question, the leader asks about their community in Chilliwack, and what they like most about their town. Responses vary but include reference to the school area, playgrounds, swimming pools and wildlife they often see (such as raccoons). The leader describes her own example when she is commuting from her house to Stanley Park where the Aquarium is located:

> "We are not just people living in a place, we are sharing it … I need to see and listen to this place, very often I commute without realizing how my path is affecting others … I am not paying attention to my surroundings. I acknowledge that this place is on the unceded land of the Musqueam, Squamish and Tsleil-Waututh Nations …"

In this way, the leader introduces a story involving an Indigenous man who fought for a fish species to survive: in spite of overfishing. To tell the story she asks students to act as a researcher and to find out which fish species live in Howe Sound. The program then unfolds into a role play format that includes three parts: a game, field research and dissection.

The Game

Similar to memory games, students hold scramble cards of two types: fishes and anatomical descriptions. In groups students match the cards, having the image of a fish and its description. By hearing the word 'game' students are excited and engaged with the activity. At the same time, they are learning and practicing what they know about fish

anatomy. Shark says: "*what is the name of the fish's nose again, something with G?*" in Sea Lion from the same group, answers "*they are gills, and these are not as the card says*." The four groups formed for this activity finish the game matching all cards and show their work to their teacher when they are done. Transitioning to the next part, the leader says that now they know the anatomy of each fish in Howe Sound, stating: "*It is time to dive in, please wear your wetsuits before we go to the Sound*." Students pretend to wear wetsuits while the leader says that now they cannot hear each other because they are underwater. One says: "*We can talk to each other using our hands*".

Field Research

In teams of two, students are given a worksheet to complete with fish names and a catalogue. To do so, they are released from the classroom and instructed to look for answers in the *Salish Sea* exhibit. As students try to locate the fishes from the worksheet, they put a check mark next to the ones they find. Working in silence, the students pretend to be exploring the ocean, learning once more about the fishes from Howe Sound. The students continue to search and keep pointing at the aquaria and fishes – locating most of them before the activity ends. The leader calls to them to 'get back in the boat'. Back in the classroom, the leader says that now they have evidence that some fish species are missing or are very hard to find: "*Howe Sound should be a protected area*."

Figure 8. Ocean Wise Rockfish Exhibit (Research in Action program)

Fish Dissection

For students it seems this is the best part based on student's engagement creating and sharing their "scientific study" with each other. Students are excited to touch and dissect a real fish from BC waters: a fresh caught herring (a voluntary activity) approved by DFO through a list of species OW can keep. A few students say *"ew"* while others say *"they* (fishes) *are not gross at all!"* The leader challenges them to look for something they are curious about for possible scientific research. "*Do not open or cut the fish without an explanation"* she says, for example: "*I want to open the fish to see their brain anatomy and to see how different they are from our brain."* Each group has two fish they can dissect and investigate however they want *"Wow that is so exciting, I have never touched a fish before!!"* says Polar Bear before asking *"Can I touch the fin? I want to know how it feels.".*

The inquiry continues with lots of excited questioning. *"Why are you making the fish bleed … that is not good?"* Oyster said. Sea Lion shows us what he is doing: "*I am trying to find plastic in their body or any injury.*" Squid says she doesn't want to touch it (the fish) but seems to enjoy it anyway. In the end, she touches it and says, "*We have discovered the inside of their eyes* … Wait, *what is that?"* her partner replies: *"The gills… that is how they breathe!".*

Figure 9. Students handling a herring fish (Research in Action)

The students are excited but as observer I notice that the excitement increases with every new activity. To wrap up the leader challenges the students to find one new thing in nature during their bus ride home. She states: "*every day we can observe new things and how we can take care of them*."

Research in Action Leaders Responses to the Questionnaire

Two participants answered the questions, and one chose to have a video call to discuss this study. According to the former OW staff, the way the program has been canceled during the first months of pandemic, it would be difficult to be in touch with the leaders who run the program. Below I summarized the answers from the two leaders (L1 and L2) who shared their perceptions regarding this program and consent verbally and written to be part of this study.

Question 1. From your experience delivering this program, how do you think the students perceive Research in Action? Explain.

> L1: "Students get to be hands-on in Research in Action by dissecting a herring specimen, it takes somewhat abstract knowledge of life in the ocean and makes in tangible and real.

L2: I think the students understood that they were practicing real research techniques to understand biodiversity

Question 2. What are the approaches that you believe that help this program to motivate or inspire students to become ocean literate?

L1: "I think it is having an experience with ocean life (live or specimens) as well as direct connections made to how their actions impact the health of the ocean and the lives of organisms. Through experiential learning, students get introduced to how the ocean impacts them and they impact the ocean. It makes it personal and not just a distant problem.".

L2: "I think the use of actual hands-on practice of research techniques paired with lessons showing real researchers in action helped to engage the students.".

Question 3. Do you think Research in Action allows for local/ community/ individual interpretations of ocean literacy? Why?

L1: "The broad definition of ocean literacy being to understand the ocean and our relationship with it (http://oceanliteracy.ca/what-is-ocean-literacy/) is already open to interpretation and as I think we have seen with Ocean Literacy having different interpretations in the US with NOAA's Framework, Europe with the IOC Ocean Literacy Toolkit and the recent Canadian Ocean Literacy Coalition report that culture and geography do impact interpretations of ocean literacy. While Research in Action focuses more on the scientific principles, AquaVan adapts to its audience, location and place more readily. Participants may connect to ocean literacy emotionally and spiritually or more as an economic sector depending on their prior knowledge and the community, they are in.".

L2: "Yes to some extent.".

Question 4. Which challenges did you face by delivering ocean education programming?

L2: "The program was only 90 min long and Ocean literacy is best taught through multidisciplinary and longitudinal approach. This program was a great introduction.".

Question 5. What would be your recommendations for future ocean education programming?

L1: "Increasing people's awareness of their connection to the ocean aims to help people acquire the tools and knowledge they need to keep our oceans sustainable over the long term, while continuing to benefit from them by making informed decisions as voters and consumers.

L2: "I think having pre and post program resources/ requirements would give depth of knowledge acquisition and retention.".

Overall, RIA leaders' comments were positive towards the program and how the students perceived it. Through experiencing the scientific method for a day, students could explore the marine life differently from how they would in a classroom. The program is seen as a "great introduction" to ocean literacy and in pair with pre and post (program) activities provided by OW, the program's goal could extend to the students' learning process.

In the next section I explore the results from the OW resources provided for K-12 teachers from the student-teachers' perspective.

4.3. Teacher Professional Development and Ocean Wise Resources

Ocean Wise provides resources to deliver custom professional development (PD) opportunities for teachers. These involve visits to the *Vancouver Aquarium* for such celebrated offerings as 'teacher appreciation night' hosted yearly, as well as a variety of day or multi-day programming. These are augmented by a variety of online resources and course modules developed around 'emergent' ocean literacy themes. In this study, I followed two different programs of pre-service teachers engaged in PD hosted by Ocean Wise. The first involved face-to-face visits to the Aquarium over several days as part of a university course, the second involved pre-service teachers only with a newly developed online education platform. Due to the pandemic, the research extended the focus on the online platform with two years of data collection from two different cohorts.

PD at the Vancouver Aquarium

In person teacher PD at the Vancouver Aquarium involves a sampling of the various programs that are available to K-12 schools adapted for an adult audience (eg. *Wet Lab* or *Research in Action*). Pre-service teachers that we observed appreciated the modeling of the programs that are typically delivered to K-12 schools and enjoyed the opportunity to try out a variety of ocean literacy strategies. Typically, a discussion ensues after an activity as program staff and teachers discuss how various activities can

be adapted for target age groups or specific grade levels. In the program we observed, educators were allowed a range of experiences related to the Wet Lab programs and these were augmented by other programming such as a 'sustainability scavenger-hunt' conducted in the marine exhibits plus a dialogue about on-going controversies (including one involving marine mammals in captivity). Teacher education programs often include 'behind the scenes' tours giving participants a sampling of the varied conservation efforts and associated research that is also conducted by Ocean Wise in and for local communities.

Overall, the teacher candidates were impressed with the ocean literacy programs. An overarching theme emerging from participant comments related to a broader awareness of ocean literacy and its importance for the broader movement of environmental education. This could be described as a 'bluing' of their ideas about environmental education that more typically focuses on terrestrial (or green) issues. A sampling of representative comments for this theme included:

> Student-teacher 1: "The whole planet is connected by water and oceans."
>
> Student-teacher 2: "Everything is living and they are all connected. Trees, rocks, water, kelp.
>
> Student-teacher 3: "Ocean Wise topics shed light on infinite number of systems we are connected to …".
>
> Student-teacher 4: "Oh my god, when you look at the details, it's really complex … (ST - referring to jellyfish in an exhibit)"

Many teachers became more aware of specific controversies at play in their community. There was a realization that controversy in and of itself is not a bad thing—and that handled professionally, considering all aspects of a controversy with K-12 students may create excellent opportunities for learning. Some representative comments for this theme were:

> "Education is a failure when things were labelled as black or white, right or wrong." (Student teacher). - "Not that plastic is bad. It's our attitude … (for example), our money is made of plastics just like (drinking) straws, but you don't see money at the bottom of the ocean." (Student teacher)

Another theme around programming reflected a perception that Indigenous knowledge and pedagogy needs to be better reflected in both Ocean Wise exhibits and

programming. This perception was acknowledged by education staff who indicated this is emerging as a strategic initiative for Ocean Wise. Representative student comments included:

> "I liked the controversy part … more indigenous aspects would be awesome." (Student teacher)

> "Ethically this is Indigenous territory." (Student teacher)

I hoped to include some of these attempts at decolonising education exhibits at the Aquarium and in Ocean Wise programming within our case study but this was interrupted by complications around COVID 19. A variety of Provincial Health and Safety orders led to a temporary closing of the Vancouver Aquarium to the public and a further suspension of the in-person aspects of their programming (including *AquaVan*, onsite visits, and teacher PD). As my research continued, I pragmatically shifted the focus to the online platform that was rapidly expanding in its attempts to serve the needs of teachers and K-12 students during the pandemic.

Online Platform and Educator Resources

The online platform by Ocean Wise features an Educator Resource Library that is a comprehensive and curated collection of resources, lesson plans and classroom activities designed to help educators include ocean literary curricula in their classrooms. The resource is free for teachers and is described as an 'easily navigated tool' that has everything teachers need to 'bring the ocean' to the classroom. In the resource library, teachers can find detailed content information, activities, lesson plans, resources, and supportive media to help them incorporate ocean literacy in their classrooms. The website also breaks up the content into three main resource categories: Elementary (Grades 3-6), Middle School (Grades 7-9) and High School (Grades 10-12).

The online platform is also designed so that students can take the courses, working through the principles themselves at their own pace. For some teachers, this is a way to add a 'blended learning' element into a class, or to entirely 'flip the classroom'. As students interact with the courses they earn 'virtual badges' by completing quizzes and assignments, or they can read through the material and explore the resources (including a range of curated multimedia and interactive tools). The online courses are also linked to the United Nations (UN) Sustainable Development Goals, as well as to

work with principles outlined for the UN Decade of Ocean Science for Sustainable Development.

As part of the study, I asked two cohort of teacher-candidates (enrolled in a university course Summer 2020, Summer 2021) to interact exclusively with the education courses and resources available to them on the online platform. Participants were assigned to user groups linked to their classroom and grade level experience and then asked to provide a variety of different types of feedback to Ocean Wise staff and the course designers. These ranged from comments on the 'usability' features of the website, as well as the quality and age appropriateness of content and curated resources made available for the courses at each intended grade level (Table 1).

Table 1. Summary of Feedback from Teacher-candidates

Positive	**Constructive**
Great video resources	*Reading level is too high and complicated*
Included story maps are awesome	Too much text not enough visuals
Teacher resources are good	*Need easier connection to the curriculum components – include in descriptions of each resource so they don't have to read through*
Love the lesson plans	
The curriculum achievements are helpful – they link to specific activities that match the 'big idea'	Include more interactive resources
	Include more French resources.

Middle School Level (Grades 7-9, ages 12-14): See https://education.ocean.org/oceanlitmid/

In the summer of 2021 two focus groups were taken with student-teachers regarding the online platform and its content. Below are the highlights from the focus group transcripts (Appendix A).

Table 2. Summary of Feedback from Teacher-candidates

Incentives	**Barriers**
Makes the teaching job easier	*Very new resource*
	New risk

Different voice into the class, more engagement

Lessons very tied to the BC curriculum

Unit plan is malleable, you can modify according to your own region and keep it PBL

Place-based learning approach

Many Lessons are outdoors, not every school has access to the outdoors – physically and financially

Only one local (Howe Sound) of so many in BC.

Middle School Level (Grades 7-9, ages 12-14): See https://education.ocean.org/oceanlitmid/

Student-teachers also shared alternative ways to connect students to the ocean beyond the resources provided by Ocean Wise, highlighted below:

> Student-teacher 6 – "We can bring from the ocean to other areas too if you are from some other subject.".
>
> Student-teacher 1 – "Who knows if we will be allowed to go to the ocean." Said the student-teacher not sure about the pandemic scenario and its restrictions – "I want to do a field trip in the forest where I can connect the salmon in the creek to the ocean." .
>
> Student-teacher 3 – "Emotional and physical connection – when I think at the beach I think of my experiences at the beach, physical nature and 6 senses activated differently, you can relocate these feelings using imaginative education forms. Emotional connection to it, using arts, through painting, sounds, touching sand…".
>
> Student-teacher 2 – "Videos, photography of the ocean. You can see amazing footage and everything… ocean sound scape. – these are ways you can help inspire students with the ocean if you are unable to take them to visit it.".
>
> Student-teacher 1 – "Salmon is a natural connection because travel from rivers to the ocean, as connecting piece to the ocean and the forest and how they feed the forest. You could do that with water and pound like it is the ocean.".

The focus groups also provided cross-program discussion opportunities. Two of the participants knew of AquaVan and how it was associated to Ocean Wise. One of the student-teachers mentioned that her daughter participated in the program before "because of AquaVan my daughter pursues marine biology, she was in love with the staff, the activities and especially the animals she saw and touched.". Participants asked

her how she got the AquaVan to go to her daughter school, and she said because of the “good funds” the school received. This comment brought the discussion to the importance of funding and when possible, bringing parents together to pay the costs of AquaVan or other ocean education activities that the school could hold or visit. “It is not fair that some students have access to very cool projects while others are stuck in their daily routine”, said one of the student-teachers who acknowledged the reality of many schools in BC.

Overall, feedback from participating teachers was positive around the utility of the online platform provided. Educators were thankful for the provision of a comprehensive and content rich resource – especially as it had been provided free of charge to educators since the beginning of the pandemic. The widespread use of this ambitious and developing resource has assisted many educators through a challenging time for the K-12 education system.

As with any platform, educators had much to say about how the online resource could be improved over time. Many felt the platform should make its ‘curriculum achievements’ clearer for each resource or assignment – arguing that the easier it is to find and access curriculum achievements the more likely students will use this feature. Teachers also argued the resource could be improved with more visuals and more interactive components. Some espoused shorter courses: thereby reducing the amount of student time spent at the computer.

Participating teachers also noted that the usability of the online platform would be improved if it was designed ‘for students’ or ‘for teachers’ (not both) as the perception was that a combined approach was not working. They further recommended that the provision of briefing and debriefing information for the entire course would improve the overall quality of the online platform and its associated educational resources.

Although the lessons have a "great place-based approach" according to the student teachers, it mostly focuses on the Howe Sound. They believe the resource is still valuable and they can modify it to their school grounds environment and context. Novice teachers appreciate “ready to go” resources because it takes part of their work off their hands. Lessons and units that include ocean concepts, connects with the BC curriculum and are place-based seem to be an advantage for teachers according to the participants

of the focus groups. The focus group also provided opportunities for student-teachers to share their concern about ocean education and how they can include it to their classes. Concerns emerged on the subject being taught as well as teachers ocean concepts expertise. They mentioned “they don’t know much about the ocean” and having the new ocean literacy tool guide for teachers would be essential to help not only students but themselves to be ocean literate.

Summary

The qualitative results of the research uncover how students, teachers, student-teachers and leaders perceive the different OW educational programs studied here. Teachers and leaders’ responses contributed for a better idea of how students interact, react and respond to the activities provided by *AquaVan* and RIA, as well as the importance of the programs to the children in their understanding of the ocean. Through open-ended questions participants had the opportunity to explore their thoughts on what is unique from the programs and how children would benefit from the experiences provided. Leaders’ responses complemented the unseen part of my research and the big picture of these two programs along their experiences running them. By sharing what they have learned, heard and taught to students and adults, *AquaVan’s* leaders indicate that the artifacts presented with their passion and openness to hear their audience and how they connect themselves to the collection, are the heart of how to conduct the program. Teachers and student-teachers also shared their interests in having ocean literacy tools and activities handy during their classes, and that not only students but teachers can have a deeper understanding on the ocean in our relationship with it, connecting to the subject they teach.

Collecting students’ reactions and responses through observation and focus groups allowed the research to uncover the hidden details of the impact of the program on their understanding of the ocean and connection to marine lives. The collection of data from different sources/participants to explore the programs, made the case story coming from different lenses. Focus groups, questionnaires, observations and communications with the participants were the qualitative methods that contribute to the diversity of the data collection. The number of participants may be considered low, but the quality of the responses may be considered high.

A thorough discussion of the results comparing to the literature will be explored in the next and final chapter, followed by a conclusion of the research.

Chapter 5.

Discussion and Conclusion

This chapter provides discussions with answers to the two research questions below followed by implications and limitations of the programs and resources according to my results.

1. How are the programs and resources generally perceived by students, teachers, leaders, and student-teachers, participants of this research?

2. Do students, teachers, student-teachers, and leaders perceive the programs and resources offered by OW as contributing to the development of ocean literacy? If so, how do these activities and resources accomplish this?

I also provide suggestions for future research in ocean education to create a more ocean-literate society in its diverse meanings and understandings. I conclude this chapter with a summary of this study.

5.1. Discussion

This case study provides insights of the range of ocean literacy programming offered by Ocean Wise Conservation Organization. Although the concept of ocean literacy has been explored by Ocean Wise since 2017, this study provides a sense of how the programs have been designed and delivered with contribution of the perceptions that participants have as they interact with them. It is important to note that Ocean Wise has developed a positive reputation in the education field and has been widely regarded by many as a leader in ocean literacy programming.

This thesis research set out to understand students' experiences as participants of the *AquaVan* and *RIA* programs by Ocean Wise, through not only their own voices, but their teachers and the program leaders'. The research also explores the student-teachers' perceptions of the Teacher Online Resources provided by Ocean Wise for K-12 teachers in BC. By using a qualitative method through an exploratory case study, I

intend to inform future program design. Below I return to my two guiding questions to structure the discussion of my results.

1. How are the programs and resources generally perceived by students, teachers, leaders, and student-teachers, participants of this research?

AquaVan Mobile Program

The research results indicate that the perceptions of students, teachers, and OW leaders were very positive - especially those that incorporated aspects of experiential education, which include inquiry and hands on activities. For example, the observed excitement level of students during and after the activities (as noted through focus groups and in class observations) by their teachers, are broadly highlighted in the results.

Students felt that the *AquaVan* program provided unique opportunities to touch and observe animals up close in a familiar environment. The chance to feel, see and act like marine mammals was considered rushed and intense. However, student suggested they would participate in the program again and recommend it to friends and family. The *AquaVan* program was perceived positively across age groups with few differences. All students reported they had an exciting, for many a first-time experience, seeing and touching live animals and the curated collection.
Interestingly, younger children suggested that because the program is run in the gym it should incorporate more games. Students generally demonstrated great enthusiasm about the program and as a consequence hoped to see more animals in nature. This type of positive experience is important especially for children as it has been shown to influence intellectual, social and emotional development as well as fostering positive attitudes towards the environment (Gill 2014; Joyce, 2019).

When older students were asked about how to improve the program the following comment was typical: "*AquaVan should give us more time to see the animals and the stations, it is all way too fast."* This comment indicates that a few changes in the design could be made. While younger students perceive that the activity "was very long," older students claimed the opposite. The intensity and length of the program should be

adjusted relative to the age group involved as it is unlikely the same format works well for all grade levels.

On the other hand, teachers thought the time provided for the program was used "wisely an effectively" causing a "huge hit" to the school after the event. From the teachers' perspectives, students were excited to share their experiences in class, by mentioning how they enjoyed touching and seeing the artifacts, "They were excited to tell me about the furs, bones, and teeth that they saw and touched." Teachers were receptive to hosting the program again, as they found it essential in the students' understanding of ocean concepts, especially for the ones who have never been in the seashore. Teachers believed the program fills an important gap in education as many do not know how to include ocean education in their teaching material. Teachers extended my findings from the focus group, to what they describe in their classes, a general excitement in participating of the program.

Teachers and students shared positive thoughts about the program even though these were expressed in different, complementary ways. Students sharing of what they have learned, and their excitement highlighted the importance of the program in students' learning process as well as by the teachers' decision to host/participate in the program again.

AquaVan leaders were also very positive regarding the program and how students interact with the activities. They believe that the hands-on artifacts are essential to developing the connection of students to the ocean combined with the students' interests. The interests come from the stories students will share while they see and touch the collection. By touching, playing, listening, seeing and sharing, the leaders provide different ways to participants or explore the ocean using their senses. Leaders perceive the program as a place where students not only discover facts about the ocean but also become curious of what else the ocean holds and how they can nurture a relationship with it.

Teachers and leaders shared similar positive perceptions of the program, as they believe the program is important for students' learning about the ocean. By having students interact with the live collection, and other marine specimens, students are able to create these connections with the ocean sharing with their classmates, teachers and

leaders what they think of when they touch and see the collection along listening to the stories. Leaders' intension for the program is to connect students' prior experiences to what they are seeing, and how it is important to understand our role in the ecosystem and our relationship with the others in it. For example, the protection of sea otters is not only important for their own being, but for the role they play in the, in this case, northern pacific ecosystem. Leaders acknowledged that students will hardly remember all they tell them and that sometimes after one hour of interacting with the artifacts and sharing stories, "the student remembered the beluga skin smell". Yet, the idea of the program is to spark curiosity that may lead the students to look for answers and explanations after the program. This provides an opportunity to make a one-hour program a persistent reminder to be curious and understand not only our role in the marine ecosystem but the other non-humans' and the impact of them in our lives.

> As Fauville (2019) stated, "To understand this massive three-dimensional system, one needs to be able to navigate all the way from small-scale observations and knowledge to macro-issues in order to grasp connections such as the importance of tiny organisms (e.g. microbes) in the context of a worldwide scale phenomenon (e.g. carbon cycle).".

Research in Action (RIA)

During my visit to the Aquarium, I observed students' interest in activities escalating from moderate to high excitement. The way the activity was led was important for the engagement of everyone involved, with the leader providing time and freedom for students to explore and engage in ways that developed their own inquiry skills as explored below.

Students showed enthusiasm throughout the day, demonstrating more excitement after each activity as they played the role of researchers investigating the local marine environment. When students play such interactive roles in a learning environment that is closely connected to place, they can understand and connect to the world being showed to them in a meaningful way (Payne & Zimmerman 2010).

In this program, students used their imagination and hands on activities to explore and find answers to their own questions. When looking for local species of fish students were asked to be quiet, but they demonstrated their excitement by carefully checking their worksheet and the exhibition to find the species. They also often checked

in with their peers to share their findings. As the observer, I noticed that all students were embracing the field search activity by following with excitement the leader's instructions. In addition, all students were active in finding a rationale for dissecting the herring "*I want to open the fish to see their brain anatomy and to see how different they are from our brain."* and even those initially hesitant, were actively engaged by the end.

Former leaders' perceptions of the program are also positive, as they believe that RIA gives students opportunities to experience the scientific method for a day. By providing hands-on activities, such as dissecting a fish, the program brings to the students a way to conserve the oceans and its inhabitants, by research.

In this program, students have the chance to role-play in a game to study fish anatomy; to find a list of fishes, to study local marine biodiversity; and to touch, dissect, and complete the scientific method. These experiential moments inspire students to 'think out of the box' and comprehend that they can play an important role in revealing the mysteries of the ocean. Payne and Zimmerman (2010) affirm that scientific research and education are the pillars to improving ocean literacy: they may also inspire behavioural changes and more informed local decision-making.

> "Role-playing is one avenue for activating imagination and involves taking on the identity of the animal, either based on concrete observations or species knowledge. Role-players can then interact with others or the environment as that animal. This activates connections between emotions and thoughts, allowing individuals to experience what it is like to be the animal and in turn increasing their empathy (Myers et al. 2009)." (Wharton et al. P. 165-166).

As Rachel Carson, in the *Sea around Us* stated "we are dealing with life—living populations and all their pressures and counter-pressures, their surges and recessions understanding this has a mayor significance for the conservation of these lives around us." (Carson, 1962, p. 296). As observers I also note that RIA goals and practices are closely aligned with the importance of understanding ocean complexity to foster 'connection' and conservation on a very small-scale.

Teacher Development Program and the Online Ocean Wise Resources for BC K-12 Teachers

Similar observations were made within the Teacher Education programs with participants excited to touch live invertebrates in the touch pools of the *WetLab* or by 'mucking about' in hip-waders in the inter-tidal zone during a beach clean-up activity.

Student-teachers generally believe the resources provided online for teachers by OW are useful and impressive. The participants found that the resources are aligned tightly to the BC curriculum which is a great encouragement to use them. Since ocean topics are not specifically explored in the curriculum, OW provided the work of connecting the ocean to the curricular competencies and content. Thus, the resources are positively seen since it can save time for novice teachers when creating their unit and lessons. Often new teachers spend significant time preparing their classes according to a lesson plan, student-teachers highlighted that by having ready-to-go lessons teachers can save their time to adjust them to their own context (if needed) and focus on other teacher tasks. The resources also have potential to empower teachers who are not familiar with ocean concepts nor confident to teach them. The resources give them space to co-learn these concepts with the students.

Another incentive to use the resources comes from it suggested place-based approach. The place-based approach that the unit and lessons incorporate are appreciated by student-teachers who have been exposed to this education style in their Summer professional development courses and may not be very confident to incorporate it in their classes. The resources are a nudge to have a place-based class to teach and learn about the ocean.

Although many lessons and units take place in or refer to Howe Sound, some participants believe that they could adjust to their own school's surroundings. "I want to do a field trip in the forest where I can connect the salmon in the creek to the ocean.". This could direct influence on their decision to use the resources since this could take more or less work, depending on where they will teach. The resources can bring a new dynamic to the classes as they were pre-planned, thus it can bring students' excitement to hear from different voices.

In addition, the website provides useful media including interactive maps and videos that are important for online teaching specially. Students and teachers can watch from their homes or schools when it is not possible to be in-person and/or outdoors. The resources are diverse and still aligned to the curriculum.

The overall perception of the online programs and resources was broadly positive and welcomed by participants.

2. How does the program's activities and resources inspire or motivate students to become ocean literate?

Through the range of programming observed, it was clear that the type of activities designed work to inspire and motivate students to become ocean literate across programs, resources and grade levels. With an inquiry-based approach, *Ocean Wise* leaders encourage students to ask their own questions. My results indicate that the activities provided by *AquaVan* (for example) create a closer intimacy and understanding of the marine lives that rely on the ocean. The variety of *ocean specimens*, such as, seawater with krill, curated preserved specimens and live invertebrates, attracted the attention of both students and teachers.

Since the study school was located distant from the sea, most students were seeing these ocean creatures for the first time. One pupil was not sure if she had swum in the ocean before and confirmed this fact only when she realized that the ocean has salty water. By studying ocean literacy in such a removed context, I realize the goal of ocean literacy has perhaps a long way to go as such basic knowledge about the ocean is not obvious to everyone. On the other hand, many activities are designed with open-ended space for students who have had rich experiences with the ocean, to recall moments near the sea, interacting with marine life or in quiet contemplation simply watching the sunset from shore. Although the program included narratives and facts about the ocean, students were also welcomed and encouraged to share their thoughts. Importantly, *Ocean Wise* leaders also emphasize the concept of ocean pollution and engage students to relate their experiences in the sea with plastic pollution. For example, this student comments "When I was in Mexico, I saw a bottle of water in the ocean and I tried to get it with my sister" when the leader shows them the nets that can be trapped in a turtle and other sea animals, at the plastic pollution station. Students

could at any time jump in and add their thoughts and connections. As observer I also noted that the programs' goals and practices are closely aligned with the importance of understanding ocean complexity to foster student 'connection' and conservation of nature.

In my conversations with students, they demonstrated a sense of care and empathy towards the animals presented and stories they heard. By speaking about their past actions such as collecting waste on the beach, or stating that we need to reduce, reuse and recycle more, students were engaged with sharing their concerns about the environment. For example, when they are asked to touch a sea urchin with their little finger so they would not hurt the animal, students were provided an opportunity to embrace empathy. Embracing or reinforcing these feelings can also increase student's understanding of animals' behaviour, needs and their reactions when they experience stimuli. These practices can nurture student's sense of care and actions to benefit all wildlife (Bandura, 2000; Chawla, 2009; Wharton et al., 2019).

Students also demonstrated an understanding of the oceans influence on human needs, such as food, medicine, etc., as well as an appreciation of marine organisms in the food chain and the benefits humans receive from the sea. The impact of plastic pollution on marine species is an example of human influence on the ocean. By sharing a turtle shell from the BC coast, leaders shared that the Leatherback Turtle is a visitor to the local sea, further warning students about the impact of a single plastic bag in the ocean and how this can be mistaken for a jellyfish, a turtle's main source of food. Activities such as these fostered understanding about the impacts the ocean has on us, and vice-versa. Most notably, one of the students in a focus group stated that the only negative aspect of the program was her realization that many animals are dying from pollution. As stated by Wharton et al. (2019): "*Empathy is a stimulated emotional state that relies on the ability to perceive, understand and care about the experiences or perspectives of another person or animal*" (p. 158) and that these feelings are primordial.

When talking to the leaders, they outlined three approaches that can lead students to become ocean literate: hands-on, inquiry and student-lead. These are ways that leaders believe to run the program, by offering space to see, touch and share, students then may uncover a world that is connected to them as many would not think before the experience. Leaders from both *AquaVan* and *RIA* agreed that the programs

are introductions and might be a first-step to ocean literacy. It is for many students and community the first encounter with marine lives, where myths and assumptions about the sea are questioned, for example, leaders mentioned they have explained that sea stars are real animals and not a single decoration. They also tell students that “just recycling” is not enough to take responsible actions towards the nature. Leaders prefer to focus on the students’ interest to share their knowledge and stories regarding the artifacts they have. Thus, they avoid following a “script”, as mentioned by one of the leaders, because they acknowledge that every student learns in a different way, so letting the students take the lead on what they would like to learn is essential in their understanding of their relationship with the ocean.

Both programs work as gates towards a closer connection with the ocean. Leaders end the activity asking students to tell their friends and families what they have learned about the ocean. The intense activities provide them with an intellectual and emotional intimacy that facilitates discussions around ocean topics and ideas that can extend beyond that experience. The excitement the program causes for students to learn and share something new can work as gates to an advanced understanding of marine ecosystems and the role humans can play in keeping them healthy.

Student-teachers believe that the resources provide opportunities to connect students to the ocean by exploring their place and ecosystem. The resources have “great” unit and lessons plans with outdoors activities on the shore. Although most of the material is related to Howe Sound, they still think that by adjusting the plans to their own region they can bring the ideas of the material to connect to their place reported earlier.

Student-teachers also believe that including activities that explore students’ senses, by playing waves sounds and touching sand, for example, are ways to connect them to the ocean without visiting it. Student-teachers think the multimedia provided on the website is “great” and they agree that by playing the videos students can also embrace this connection when they cannot go outdoors.

The above examples of approaches incorporated in the programs and resources not only motivate and inspire students to become ocean literate but also address a challenge in the field of ocean literacy. Fauville et al., 2019, and Longo and Clark, 2016, discuss how few people have access to the ocean and the marine environment, which

then makes it a challenge to provide first-hand encounters and experiences with the marine life and its conservation. Students' disconnection from the ocean challenges ocean literacy, marine conservation, and awareness. By running programs such as those observed here, participants who cannot access the ocean gets an opportunity to foster this connection.

In addition, as studied by Jaksha (2019), to engage students in actions to protect the ocean, education programs need to go beyond stand-and-deliver teaching and empower "students' emotions, feelings and a sense of connection to the environment [so that] students build strong ocean identities." (p. 105). The programs' experiential learning approach that involves inquiry and hands-on, and place-based education resources explored in this research are pathways to build this relationship with the unknown, thereby connecting programs' participants to the ocean. The programs play an important role in making the ocean visible and uncovered, acting as the first steps to foster an ocean literate society.

Implications

In this case study, I hoped to better understand how Ocean Wise programming increased students' connection to local (aquatic or coastal) environments. From the programs and resources, I analysed, the Ocean Wise organization centers its educational activities on the experiential learning of the ocean by having the Salish sea and Howe Sound as the place/ models to do so.

Research in Action was a good example of a program that was intended to make such connections through hands on activities. The program I observed, explored the Howe Sound marine ecosystem through a dynamic and interconnected group of activities organized around narratives where students were the main agents in the story. Using storytelling and hands-on activities, the program inspires students to become ocean literate.

In my view, *Research in Action* plays a critical part in a localized (place-based) ocean literacy program. In this example, children spend one day playing, watching, and doing activities related to the nearby Salish Sea during an in-person visit to the Aquarium. Students showed enthusiasm throughout the day as they played the role of

researchers investigating the local marine environment. When students play such interactive roles in a learning environment that is closely connected to place – they understand and connect to the world being showed to them in a meaningful way (Payne & Zimmerman, 2010).

In this program, students used their imagination and hands-on activities to explore and find answers to their own questions. When looking for local species of fish students were quiet but very keen to identify specific local species. By providing locally referenced experiences, the program allows students to go beyond curriculum expectations and scripts, planting a seed of inquiry that perhaps can become a scientific journey or a more personal adventure. Likewise, in the third part of the activity when they are asked to dissect the herring, when the leader indicates they can look for anything they want as long as there is a 'scientific' reason, they all engaged with the activity. These experiential moments inspire students to 'think out of the box' and comprehend that they can play an important role in revealing the mysteries of the ocean even in a small-scale as developing a scientific question to dissect a fish.

For a broader, individual interpretation of Ocean Wise programming, teacher education programs that I observed and analysed also allowed participants to use critical thinking and inquiry skills in developing their own personal conceptions of ocean literacy. All PD efforts highlighted human activities as the mayor influence on species extinction. Through localized narratives from Howe Sound and other local examples in their online resources, the programs offered an opportunity for teachers and students to embrace practices that foster critical, inquiry skills and to understand the consequences of these for place-based educational practice.

In contrast to the above, the *AquaVan* program observed did not include specific connections to local community. While children are encouraged to share their experiences with the ocean, leaders did not integrate clear local and community connections. Since the program was offered inland (on the Fraser River), the program might have included numerous examples of how river systems estuaries, and eelgrass meadows connect them to the Salish Sea. Indeed, many important physical, social and cultural aspects of the local community were not explored in my observation. Including a broader community context could work to improve or broaden students' local interpretations of ocean literacy.

However, there are efforts from leaders to make such connections as highlighted on my results. These connections often come from *AquaVan* participants when leaders explore our relationship with the ocean, opening space for students, for example, to create their own connections from where they live to the ocean, “if I throw garbage in the river here, it will end up in the ocean”. Leaders do not give them answers, but instead instigate the participants to ask more questions and to keep a curiosity that they may explore after the program.

By providing experiences that nurture intellectual and emotional connections through place-based and experiential learning with the local sea life, the programs carry great potential to influence in behavior changes toward the marine ecosystem. Such connections can drive students to care and take actions that help to maintain the oceans healthy (Kim, 2014; Packer & Ballantyne, 2010; Packard, 2001; Scott, 2007). In addition, hands-on experiences as provided in AquaVan and RIA, increase the “comfort of learning and motivation to participate in activities” (Gniedoszytko et al, 2019; Hercxnski et al., 2012) which may impact on their ocean literacy steps/process.

Limitations

As a final theme for my inquiry, I hoped to uncover some of the key lessons and challenges faced in delivering ocean education programming. It is evident that the core strength of Ocean Wise programs is in how they connect students to the ocean through direct and hands-on experiences with marine organisms. In doing so, children can personalize their understanding. From there, students can personalize what it means to conserve and protect marine fauna and flora. Curated and live specimens work as a bridge to move students to empathize with the lives of ocean animals. In this study, many students had never experienced living sea creatures before, without tangible experiences, the ocean becomes a distant reality. Environmental awareness seems to be a key result of Ocean Wise programming however, there remain key challenges to overcome.

By enhancing marine education and awareness, Ocean Wise can inspire the next generation with a greater understanding and appreciation for the ocean. Still, it cannot effectively do so without a stronger focus on place-based and community engaged forms of learning. Bringing a renewed focus on local contexts would help

students to make more connections to their daily lives. *AquaVan* has strong potential to explore these connections in-depth, for example, by being extended – Both by the post-activities provided to students' teachers after the program, and by providing more time to delivery the program. In our results leaders mentioned that having more time would benefit the program's goals. This extended time might be for leaders to dialogue more with school staff prior the delivery of a program, create more connections with students while running the program, and/or to have further information available for students to take home with them about specific local impacts.

Another key lesson we take from the Ocean Wise approach is that connecting students with the ocean goes beyond textbooks and stand-up delivery approach. As witnessed, connecting students to the ocean requires action, empathy and experiential moments. In attempting to develop or adapt *Ocean Wise* programming to an online environment, this creates unique challenges as it is difficult to replicate these types of experiences in the digital environment. Student-teachers from the 2020 data collection, who reviewed the online platform noted confusion around the architecture of the website. Most felt there should be a separate Teacher vs. Student view when interacting with the course materials. Moving forward, it is advisable to narrow the scope of online courses and to clarify how they can be student or teacher led. A constructive suggestion was that the platform could be separated into two courses: a teacher guidebook on ocean literacy in the classroom; and a separate course for home learners and/or distance education students. On other hand, the student-teachers from the 2021 data collection, did not mention such limitations. Still, they pointed out to the challenge of taking students to the Howe Sound since most of the unit and lessons provided on the online resources take place in that area. The activities will rely on how much funding the school has so that they can take their students near the ocean. By extending the resources to focus on the many other areas in BC, student-teachers believed the usability of the resources would be increased.

Either from visiting the Aquarium or being visited by the Aquarium, through *RIA* and *AquaVan*, respectively, schools rely on how much funding they have and can allocate for such events. As discussed in the student-teachers focus groups, many schools could not afford to host or take their students to the Aquarium, and that means that many students do not experience the activities the programs provide. These

students may rely on their parents to pay the full cost to participate and experience the ocean. Efforts to raise bursaries and affordability for such cases should be encouraged, so that environmental education becomes accessible for low-income families and not just a privilege for some.

Finally, there remains the challenge of including more Indigenous content into all forms of Ocean Wise programming whether delivered onsite, through mobile programming or through the online platform. Indeed, much of ocean *literacy* conceptual framework as discussed in chapter 2, is viewed from an anthropocentric Western view - when the relationship with the ocean comes from keeping human existence only. This view excludes the importance of linking the ocean (not only to our survival) but to the many other species that rely on the marine ecosystem and its connections to other landscapes and waterways. On the other hand, one of the Indigenous interpretations of such connections tell us that to understand our relationship with the ocean, we need to go beyond our dependence on it.

One example comes from an Indigenous Potawatomi botanist, Robin Kimmerer, who encourage us to think of nature not solely as a resource. In fact, the ocean is home for an abundance of species that endures an ecological balance to keep their home safe. As Kimmerer states in her book, Braiding Sweetgrass, humans should act in reciprocal relationship as well as other species that keep the ocean healthy. As she suggests “[g]ive thanks for what you have been given. Give a gift, in reciprocity for what you have taken. Sustain the ones who sustain you and the earth will last forever.” (p. 183). The ocean will last forever if we act in reciprocal relationship with it. Many cultures express this in diverse ways, one of the Coastal First Nations, Heiltsuk Nation, celebrates that relationship, for example, by having a ceremonial ritual to be thankful to the salmon, or to listen to the herring laying their eggs (Glithero et al., 2020), as Waterfall, the Hailhzaqv elder, states “We don’t own the ocean – we belong to it and, as such, are responsible for its well-being which, in turn, defines and reinforces our well-being.” (p.11). This vision resonates with an *ecocentric* view, that place humans in the same level of the other living beings and gives the importance for the environment as itself, not only for the benefits it brings to humans. – “Ceremonies are a way to give something precious in return.” (p. 253).

The ocean, then, is important by itself, and it is essential for all the species who share its gifts. This understanding of ocean is not incorporated in the "universal" ocean literacy framework yet. However, the Canadian Ocean Literacy Coalition (COLC), encourages a local understanding of the ocean that include First Nations knowledges decentralizing Western views. It also recognizes that ocean literacy goes beyond the relationship between humans and ocean, but all that is related to it such as lakes, sea ice, land, coast, wetlands, rivers, and "shaped by diverse experiences" (COLC, 2021). Ocean Wise education programming should be an example of how to incorporate that in its core, especially as it is based in BC which holds the highest diversity of Indigenous nations and groups in Canada (Yumagulova, 2020). Although leaders give room for students to make their own connections, Indigenous ways of knowing are not yet rooted in the programs. This view was also recognized by a senior member of the Ocean Wise leadership team itself:

> "Nine months ago, we started a co-operation with the local Squamish communities … we have very limited knowledge from Indigenous perspectives in our exhibits. Yet there is large opportunity for more integrated Indigenous knowledge … We need to set tangible targets and hold ourselves accountable". (Administrator)

It is important to note here, that the goal to include more Indigenous knowledge in educational programming (and curriculum) is a priority for many organizations at this time and is a challenge faced by the K-12 education system in its entirety. Universities and teacher education institutions too, play a key role in efforts to decolonize our educational practices and to include more Indigenous knowledge and pedagogy in the education of K-12 students and their teachers.

Finally, as discussed in Chapter 3, I faced internal/political limitations in the organization while I was conducting this study. During the pandemic many staff from the RIA program were laid off, including its designer, resulting in an interruption of the program. The pandemic showed the fragility of such programs that in order to be maintained requires long term, reliable sources of funding. The outcomes of the educational programs rely on their consistency, so overtime it can be adjusted, improved, and perhaps extended. As discussed here, ocean education programs have positive impacts on students' lives supporting them in a relationship and an understanding of the ocean. In order to meet the programs' goals, it is important to

assure the continuity of such by allocating long term funding to continue the existence and delivery of ocean education programming.

Future Research

As I intended to analyse participants' perceptions of selected programs provided by OW, the research uncovered specific details of the programs, exploring their positive impact on participants and ocean literacy. However, the study was not designed to test claims regarding whether the program was indeed effective in advancing the ocean literacy of participants, improving the health of the ocean, or instilling a long-term impact on students' ocean literacy. I would recommend that future research is done both with the same programs on a broader scale, including more observations, interviews, and quantitative methods. Thus, the research can bring more consistent results to test the effectiveness of such programs in the advance of ocean literacy.

In addition, a more thorough study following AquaVan Mobile programming tours would help to have a better understanding of its impact in small remote communities as compared to communities on the coast. Future research with the OW resources could also be done with teachers who are teaching and incorporating these resources in their curriculum.

Perhaps, a participatory action research approach (Whyte, Greenwood & Lazes, 1991) could also benefit such programs by including the local community, incorporating local Indigenous ways of knowing as the center of ocean literacy and its design. The research may involve the researcher who is leading the study, the program staffs and interested Indigenous educators and students who together could co-create and delivery an ocean education and research design that has Indigenous knowledges in its roots. Learning and creating together may be an efficient way to connect participants to their community and environment. Thus, researchers, staffs, designers, and Indigenous leaders can contribute to go beyond a theorical framework bringing this lens to both action and practice.

As a response to the current pandemic scenario, future research exploring these programs would also be crucial to analyse the impacts on educational programming and ocean literacy. Extending to how they have (or not) overcome the pandemic challenges

would be beneficial for other organizations who are grappling to return their activities and contribution to ocean literacy.

It was interesting to note that even in this case study, a number of participants experienced several different types of programming offered by Ocean Wise and/or other organizations. OW offers other educational programs, such as Ocean Bridge, that would be interesting to explore how students' experiences in multiple programs reinforce or confound the intended program outcomes, as well as, analysing a diversity of programs outside of the organization. By comparing results from different programs, we could learn on what they have in common that works or needs change, and how students perceive them.

5.2. Conclusions

The ocean we rely on is beautiful, important, and inspiring, and faces clear threats that we must mitigate. Ocean literacy might be a way to bring ocean awareness to humans and the term carries diverse meanings around the globe. In Canada, efforts in Ocean literacy "is about listening to [communities] different experiences, learning from them, and acting together to ensure healthy waterways and a global ocean health for future generations is coming from coast peoples" (COLC, 2021) even though it is not fully implemented in the K-12 system. Ocean Wise Conservation Organization is working through a multipronged approach that involves engagement, research, conservation, and education to promote these concepts in BC and across Canada, with hopes to fill this gap in education. My study provided insights from selected programs delivered in BC and how participants perceived and interact with them. My research highlighted the importance of Ocean Wise play in the field of ocean literacy as it brings a "sample" of the ocean to students and communities.

While relationships among factors such as conservation, education and behaviour change are complex, I believe that by increasing ocean literacy delivery across Canada, Ocean Wise programming positively impacts students and communities in relation to their environmental awareness and with increased understanding about ocean-related issues, encouraging them to reflect, share and act towards ocean conservation. By providing locally referenced experiences through hands-on and inquiry, the programs allowed participants to explore BC's coast and its role in our ecosystem.

The breadth and depth of ocean literacy programming for teachers and students provided by Ocean Wise is diverse and encouraging to put in practice. While this study describes only a handful of programs, my case study gives rich examples of how ocean literacy has flourished here in BC. These provide opportunities for participants to nurture and improve their connection, understanding and appreciation of the ocean. By keeping a local focus on explorations of the Salish Sea, Ocean Wise also plays an important role in educating individuals to better understand the impact of the ocean on their lives and their own influence on ocean environments.

> If the intention is to influence behavioural change and build a sense of co-management, then it is essential to ensure that people understand the issue as it relates to them, feel responsibility for it, and feel motivated to take action, and … be capable of doing so (Scully, 2018, p.43).

As with any endeavour, there will still be challenges and limitations that can be addressed in efforts to create a better and longer experience for students, teachers, staff, and in the general delivery of ocean literacy across Canada. Future research will be essential in promoting these efforts. Ideas for future research involve a more ecological view of programming -- one that focuses on the *relationships* among the different programs on offer, rather than just the programs themselves; ocean education programs in BC apart from OW; research including quantitative methods with a larger sample; and action research to include Indigenous views in the delivery of ocean literacy in BC and Canada.

Finally, increased partnerships with under-funded schools and communities are encouraged in order to foster more local, equal and long-lasting experiences that could result in stronger outcomes (or actions) needed to maintain a healthy marine environment for all to enjoy.

I hope this research encourage organizations and educational institutions to inform and inspire students through experiences that nurture their connection with the ocean even being far from it. By providing opportunities for all to nourish their sense of wonder, to listen and learn from the many other living organisms we share the earth with, we can then, understand our role to heal the oceans.

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Appendix A.

Teacher Online Resources – Student Teachers Focus Groups

Session 1.

June 05, 2021

What are your thoughts about the resource you found in the Ocean Wise Online Teachers Resources website?

Student 1a: The OW unit plan is an asset, grade 7 is usually boring but the natural selection the way the ocean wise explored is more exciting, comprehensive with videos and photos. It is laid out, does the work for you, instead of you creating it.

Student 4a: Trying to implement that in a practicum, is tricky because of the curriculum and working with that

Student 5a: But it is related to the curriculum.

Student 4a: But it is hard to take risks, risky to do something totally different, go into it quite intentionally.

Student 1a: Could be useful – practicum setting it is reasonable to bring lessons – I am already – ocean sciences lessons, very tied to the curriculum.

Student 1a: We have to create this in our own, we can take pieces of it because you have to create your own plan and unit. For me who already did that can use that. But I have to adapt to my school location context.

Student 2a: You will adapt the OW resource, designing any single lesson is stressful and very rare that you will come with brand new idea. – you can use the resource as inspiration for your own PBL purposes, even if you don't use every single details

Student 3a: The links to the because curriculum are really cool – on topic.

Student 6a - From high school perspective is hard to fit in with social sciences…

Student 1a - the unit plan is malleable that you can do a PBL unit plan, I came with my students that they don't know the ocean… all this curriculum

Student 6a - Can bring from the ocean to other areas too if you from some other subject.

Student 1a - Who knows if we will be allowed to go to the ocean. – I want to do a field trip in the forest where I can connect the salmon in the creek to the ocean.

Student 2a – Engage the ocean without visiting the ocean? Children don't have resources and money, school bus to the beach, how engage are they going to be. Maybe using videos to connect them with the ocean. - \This is about reflecting on working with students living in poverty; some students with financial privilege or in wealthier areas may be able to pay to hire buses to take them on school trips, but for inner-city children living in poverty getting them into wild spaces is very hard – access to the outdoors is a social justice issue

Student 1a – I love "Aquavan" great program, my daughter had the AquaVan and the teacher My kid wants to be a marine biologist after the experience, the school should have the funding. It is a great program, and it is where the money should go.

Student 4a - That is where it becomes to make it inequitable – I would love to do this but funds? And barriers for families and make it easier.

Student 3a – Emotional and physical connection – when I think at the beach I think of my experiences at the beach, physical nature and 6 senses activated differently, you can relocate these feelings using imaginative education forms. Emotional connection to it,

Student 2a – Videos, photography of the ocean. You can see amazing footage and everything… ocean sound scape. – these are ways you can help inspire students with the ocean if you are unable to take them to visit it.

Student 1a – Salmon is a natural connection because travel from rivers to the ocean, as connecting piece to the ocean and the forest and how they feed the forest. You could do that with water and pound like it is the ocean.

Student 3a - I like the art point,

Student 7a – Not exclusively to sciences. Learning the night before teaching, you can apply ocean studies to politics, equal justice, governments.

Student 5a – This resource is great because I am not an ocean expert, you can bring your knowledge your relationship, but you fill that with another knowledge.

Student 2a - The best way to teach is to learn with the students and figure it out together, create an ocean in a box, you can write about the ocean, poetries so much stuff. Octopus… How cool with ocean animals…

Student 3a – The resources can make a more engage learner, don't think provide me with skill set that will make better with my profession, but guide the lesson and where to use my ideas

Student 5a - I wouldn't find own my own, I would never have found alone, so the resources are great for that.

Student 4a -So much we don't know what is important, what I want to teach… your own wonder…You can use the framework but _ backwards.

Student 3a- The ocean literature resource provides place-based learning which is great!

Student 4a - Do they have workshops? I'd like to learn about it.

Student 2a - That is a good question and suggestion.

All: Yes, we would love a workshop – professional development for teachers on ocean topics.

Student 1a – Student teachers take more risks, they don't think about to use the kind of stuff, we would use. When I was in my practicum, teacher said try it out and then I can use it and do it. Even trying out would be really good.

Student 2a – None of us live in the howe sound, but we can make adaptations of this unit

Student 3a – The whole ocean is one ocean, global education perspective, all the additional – make sure to include - the title is adapted to Howe Sound.

Links to curriculum are good, but I would also want to build emotional/imaginative learning.

Student 1a: It's place-based if you bring to your community. Brining the large overall big ideas, rather than the details.

I have a lot of connection to Squamish, it is my land I will have to do the research to connect to their communities?

Student 2a - It could be limiting to howe sound?

Student 3a– No it is not limiting; you can bring to your own context. If I go to Ontario, I can just change the activity for my area but would keep the place-based idea.

What marine organisms live in Howe Sound and how are they connected. If I change to my context, I will have to find all the background that is applicable to another area, so it is limited to the Howe Sound.

Student 3a – It is still applicable in PBL, just take the action points that you can do in your community, based on what your learned.

Student 2a - It appears to be PBL for that area, so then I wouldn't use it.

There is no connection… I could use it, then I would use it. Literally where I am, and then I branch up. How you recycle? …

Student 4a - This is just a resource; you can take with you what you need.

I ask - As an inspirational resource?

All: Exactly, as an inspirational resource.

Student 3a – I would bring the outline to Ontario with me you could start from local and then global or the opposite, making connections to the ocean.

Session 2.

What are your thoughts about the resource you found in the Ocean Wise Online Teachers Resources website?

Student 1b: To learn from a different source is very appealing, it makes things easy

Student 2b: The Ocean Wise programs are really fun, students love new face coming that are really passionate about what they are talking, like the ocean.

Student 3b: The resources provide students with more experiences – they can feel more engaged with something different.

Student 4b: That is all we do; teachers read and need resources for classes

Student 5b: It could be extra work to test it out, but by having the resources ready to go takes work off.

Student 6b: There are also other ways to take students to the ocean by showing them the videos of Bowen Island, media, stories of the ocean connecting how many waterways lead to it

Student 5b: Yes, how you feel connected to the ocean and how you can do it, there are different aspects of the ocean, podcast, things they can touch from the ocean… sense experience…bringing artifacts. Stories that they can resonate with, bring a guest speaker from Ocean Wise may have more knowledge of the ocean.

Student 3b: It is important to talk about Howe Sound, I didn't realize how important it is for the ecosystem. I didn't realize how polluted it was and how long it took to recover, I went in the mines in high school, they didn't talk about how Indigenous communities were impacted, how the ecosystem was polluted and how the mine impacted on that.

Student 2b: Not sure about UNESCO biosphere didn't know what it was…

Student 6b: Howe Sound area is a drive thru for many of us, I never thought I could teach here.

Student 6b: I don’t know if that would be very accessible, I would like to take my students there, but the costs of transportation, to meet there… hire a school bus…I would prefer to do the activities closer to home.

Student 1b: Yes, me too. I see Howe Sound as a connection to the ocean, and I will try to apply closer to home, in Coquitlam.

Student 3b: Taking the bus would be a hurtle this time, and this kind of learning takes more time, but it sticks with you, when you are in a place learning about it

Student 4b: Hands on experience I feel I learn so much more in practicum, hands on, engaging remembering it. Not only intellectual, but my body also get the experience, and I internalized much more, it’s like the sense of the ocean, if you are watching only, you don’t have the senses of smell, touching…Inspires me to have place-based learning in my own classroom and hands-on learning.

Student 5b: Why is so important to do hands on, I would never learn what I did here.

Student 2b: Place-based learning can be challenging, takes more time, you have to have the benefits right on front to go through. How I like it to be being in the moment, being present, and being completely open to still be meaningful.

Student 6b: I knew I want to incorporate, and the experience reminded me why.Get outside and get excited about something, place-based learning can be exciting.

Appendix B.

Aquavan Mobile Programming - Leaders Semi-Instructed Interview

Interviewer: How or why, did you choose to work for OW in the AquaVan program?

I liked to introduce people to the ocean, so I wanted to keep doing that, the opportunity to bring a sea star to a kid in the northern interior BC – is wild. It makes not theocratically anymore, it makes it real.

“I never grasp the fac the sea star are actual real animals, just seen in cartoons and pictures – I thought they were a unicorn or something” - “People see it as a decoration…”

Interviewer: How has been your experience delivering ocean literacy?

T: When I was in Saskatchewan – the two local newspaper’s ladies – “what are you doing here?” – Connecting communities to coastal lines, we said– “but we are not connected to the ocean” so we said “but this river here connects you” we explain how water cycles are connected, and she goes “that is why littering is bad, we need to teach our kids that!”

D: Being in those places and reminding people how their actions impact the oceans even when you are not in the coast. I think as coastal people is very easy to feel that connection – but actually that is not even true, we have been in surrey and students haven’t been in the ocean, not few students, the majority of every class.

T: There are also a difference between urban and rural communities – we have to change our teaching styles. For example, in rural communities there are great natural knowledge – ecosystem they are familiar with and you explore the ocean connected to that ecosystem. In urban communities there are a lot of good facts – but what animal are you using to connect with ecosystem and natural world? It is easy to forget how grass is part of the nature.

D: There is a range of exposure to the ocean, - how they perceive the ocean – if you grow up going to the beach, your experience will be different from the ones who went diving in Mexico.

D: Even when we are doing a community set up – adults had many questions, but they were embarrassed to ask questions. “I think I should know this because I am an adult”

T: Everyone misses a day of kindergarten so every day you are seeking kindergarten. It is something we don’t know yet – help people fill those kindergarten gaps. Create an environment where it’s very comfortable to people to be like “wow, this is a world I don’t know anything about”.

Interviewer: Is the program set for 1 hour round?

T- We typically aim to run 1 hour program for each grade. We really want to do – and try to give more time for these programs but the people who fund the program don’t. They want numbers.

D – For larger schools we try to give 45-50min.

T – group of 10 to 30 kids.

Interviewer: How are your teaching styles? Do you think it allows local/ community/ individual interpretations?

D – It changes depending on the type of the program – if it is in a gym with classes when you have a full class for yourself – inquiry-based as possible, listening to questions and tying the questions to what you want to bring – but you want to know what they want to hear about. Time to ask questions while the other half respectfully touches the animals. More sharing stories from students. Community – set a table and they can go see things on their own and leave anytime they want to.

T - Community – they are there because they are choosing to be there when they are in an event. Or their kids are interested – teaching is more a conversation “hey what are you curious about?” more personal connections at community events because that s why they are there. School – children were told to be respectful and to listen. The kids don’t choose to be there, but most of them are excited to be there. Sometimes behavior is challenging because excitement is hard to control in their little bodies. We sometimes give them jars where they can write their questions and leave there. Play games – never have I ever – so they can tell you things without you asking… I get to know you game without using the words. Share-pair where I get them to close their eyes imagine the

ocean what did you imagine tell the people next to you – to verbalize their experiences and their thoughts – even though I can't hear 30 students at the same time. But ensuring they can get the same number of physical hands on. Pet as we have the conversation – Three furs each group touch the seal fur and then they share – and have a group discussion about it, inquiry-based as possible, hands on and student lead.

D: I like having more artifacts that I can talk about because maybe they will be curious of a skull we didn't talk about – so now they are curious, and they can try to know more. Wanting to know more than "well I know the whole ocean – now I can leave, bye!" With the artifacts - Picking and choosing on students' interests – this is the message of the station – here at this station climate change impacts animals – here animal create adaptations to help them survive in their environment.

Interviewer: Do you think these approaches ways to motivate and inspire students to become ocean literate?

D- Kids are remembering – later in the school they tell us things "I got to touch that whale" – extra way to connect not only words – sharing experiences are really valuable. "I don't get to see this all the time; can I touch it? Now I am intrigued, and I can ask more questions" They are guiding – the inquiry based will guide on what they are interested in.

T – I can tell things I think it is cool about the ocean, but if you never seen them you won't connect. AquaVan is a SPARK – make them curious and make them want to know. I am teaching them a snitch of OL but mostly I want to them to go away with questions, wanting to know more and wanting to engage.

D- there is no right way to do it – there is no script – there are concepts adaptations, climate changes impact in animals and humans – connect students to that and make they want to learn more.

T- Not everyone learns the same way – we try to incorporate role-playing and games and physical movements – so kids will remember what they did with their bodies. Using the knowledge in different ways "smell the fur if this will help you remember" Out of 1 hour is the beluga smell that you remember.

T - The biggest challenge is to put the context to wherever we are. We really on kids to do and bring the context. “We talk about stream, so kids say – oh so that is the stream we have here – yes!” What are the three animal you see here?

D- We ask questions so they can tell us their local context. But the time is definitely a barrier for us.

T – I think the nice things is because we are using ecology is very easy to draw connections to ecosystems – they are all interrelated and connected – a tiny piece of info from them and you can connect. And they can do in their environment too. Tell me more about it?

D- The role of salmon plays in the ecosystem can you think of an animal with the same role on your ecosystem?

T- They are smart little sponges! - by letting them know is validating their knowledge.

Interviewer: What are the challenges you see in the program in delivering OL?

T: In general, the ideas that are already burned in someone s brain id very hard to take out “megalodon still exist” it’s very hard to convince that they are extinct. Different possibilities – we listen to their views and tell how we can see this in the ecosystem – a big player.

D: Kids are getting really _ that recycling and putting their trash in a garbage can is all they need to do. I think that is very hard because they think they are doing so much, and there are so much bigger things that we need to do too, and it is very challenging.

T- picking up garbage is what we can do to help the environment, remembering them that the recycling is the last of three – reduce, reuse, and recycle. Really trying to push people to reduce and reuse.

D – Small town you don’t have the same possibilities you might have no recycling and you can’t compost because there are animals nearby – so we have to talk about privilege and access.

T- a big hurtle the big binary – good people recycle, I recycle, I am good. I don't I am bad. There is no room for growth.

D – Some of the curriculum is trying to break it down – older grades, I have seen that more that they are challenging the good things and big things we can do – breaking down the good and bad. Great conversation in old grades, but the primary years where you can keep more simplified is better so you don't have to break that down later.

T- people get very defensive – they are talking to us and they want validation that they are doing the right thing. I tried to phrase that I am not doing everything that is possible to do, but the improvement of doing more is a journey to beyond rather then, oh I did it - check!

D- Simplified life but this is not how life it is.

Interviewer: What are the things that could mitigate those barriers and get people to think more outside of the box and the checklist of bad and good?

D: Improve programs – more time with students would build a relationship and make them reflect and add more – multiday program. Same group for a period of time – it builds much more – teacher resources to do pre and post but we can guarantee they would do it.

We only have one opportunity to do something similar to it –

Interviewer: Solutions to mitigate these challenges?

T - 1 hour and 45 minutes was perfect Sometimes we only have 20 minutes with kids and ask teacher to do a wonder jar prior our arrival. The teachers who did that we had an awesome time! It is hard to guarantee that because teachers are busy. But when it happened, I thought was really nice because the students were more connected. They already have so much in the curriculum.

D: I also wonder if we give 1 thing to do instead a bunch of options …Curious to know what teachers think about the resources pre and post AquaVan as well as the online resources – curriculum kit.

Interviewer: What about animals' ethics?

D: We only take animals from the Aquarium that are used to stressful conditions – sea star had some characteristics that would be easier for us to transport them – for example how hard-core they are.

T: Only certain animals were put in bowls … smaller animals so if they were too large for us they would have a home in the aquarium. Only animals that would be never able to be released.

D: All animals that belong to the AquaVan team are housed in the WetLab at the Aquarium – sublet Ocean Wise and Aquarium – they are looking what that mean in terms of the organization transfer – valuable option. Current agreement – December 31st. It is unclear what is going to happen later.

T: There is a lot more to figure out now. Aquavan historically has required in the aquarium a lot – care and quarantine there, they had a vet team. But also, they don't know much about these animals' – Vets used to tell us "You know this animal best." Inverts are sometimes not very well studied.

D: We also rotate the animals on tour to give them a time off.

Appendix C.

Teachers Questionnaire

1. Why did you give time and space to allow your students to the Ocean Wise programs/activities?
2. What were your students most excited to tell you about in class about their experiences with the program?
3. In which ways did the program meet (or not meet) your expectations?

Appendix D.

Leaders' perceptions delivering OceanLiteracy

Helping a master's student to graduate and the dissemination of ocean literacy publications!

1. From your experience delivering this program, how do you think the students perceive AquaVan (or Research in Action)? Explain.
2. What are the approaches that you believe that help this program to motivate orinspire students to become ocean literate?
3. Do you think AquaVan (or Research in Action) allow local/ community/ individual interpretations of ocean literacy? Why?
4. Which challenges did you face by delivering ocean education programming?
5. What would be your recommendations for future ocean education programming?

Appendix E.

Letter of Consent

RESEARCH COPY – SEND WITH YOUR CHILD BACK TO SCHOOL

SIMON FRASER UNIVERSITY
SFU Ethics Application number (2019s0270)

INFORMED CONSENT FOR MINORS BY PARENT, GUARDIAN AND/OR OTHER APPROPRIATE AUTHORITY TO PARTICIPATE IN A RESEARCH PROJECT OR EXPERIMENT

The University and those conducting this project subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of subjects. This form and the information it contains are given to you for your own protection and full understanding of the procedures, risks and benefits as outlined in the attached information sheet (Please see Information Sheet for Subjects). Your signature on this form will signify that you have received the Information Sheet for Subjects which describes the procedures, possible risks, and benefits of this research project, that you have received an adequate opportunity to consider the information in the document, and that you voluntarily agree to participate in the project (and have your child participate).

As (parent/guardian) of (name of child) ,
I consent to the above-named child engaging in the procedures specified in the document titled: Information Sheet for Subjects (Ocean Literacy: Case Studies of Practice).

To be carried out at (name of school):_____,
at the following time(s): ,
in a research project supervised by: Dr. David Zandvliet of Simon Fraser University.

I certify that I understand the study methods to be used and have fully explained them to (name of child)_____

In particular, the subject knows the risks involved in taking part in this research. The subject also knows that he/she has the right to withdraw from the project at any time, and will not be impacted negatively because of their withdrawal. Any complaint about the study may be brought to Dr Jeff Toward, Director ofResearch Ethics, Simon Fraser University, 8888 University Drive, Burnaby, B.C.

I may obtain a copy of the results of this study, upon its completion, by contacting:

Dr. David B. Zandvliet, Professor
Faculty of Education
Simon Fraser University
8888 University Drive, Burnaby B.C. V5A 1S6

ADDRESS:

_____

NAME (please print): _____

SIGNATURE:

DATE:

Please sign both copies of this consent form, and send one back to school with your child while keeping the other for your records. Please also keep the Information for Subjects sheet for your records. Thank you for your time!

RESEARCH COPY – SEND WITH YOUR CHILD BACK TO SCHOOL