

ATHABASCA UNIVERSITY

TEACHERS AS CHANGEMAKERS: ANALYZING OER FOR GRADES 5 TO 7 ENVIRONMENTAL  
EDUCATION IN BRITISH COLUMBIA

BY

EMILY LYNN GRADY

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EMILY GRADY



### **Approval of Thesis**

The undersigned certify that they have read the thesis entitled

**TEACHERS AS CHANGEMAKERS: ANALYZING OER FOR GRADES 5 TO 7 ENVIRONMENTAL EDUCATION  
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Submitted by

**Emily Grady**

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**Master of Education**

The thesis examination committee certifies that the thesis  
and the oral examination is approved

**Supervisors:**

Dr. Constance Blomgren  
Athabasca University

Dr. Cynthia Blodgett-Griffin  
Athabasca University

**External Examiner:**

Dr. Robert Power

April 7, 2026

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## Acknowledgments

This research was made possible in large part by the various scholarships, awards and bursaries that have supported my educational journey at Athabasca University. These are summarized in Table 1 below.

**Table 1**

*Summary of Awards, Scholarships and Bursaries 2023-2025*

<b>Name</b>	<b>Year</b>	<b>Value</b>
<i>Institutional Leadership Scholarship Athabasca University</i>	2025	\$1,000
<i>Graduate Level Student Bursary Athabasca University</i>	2025	\$2,013
<i>Ruth Binnie Fellowship Canadian Federation of University Women</i>	2025	\$6,000
<i>Faculty of Graduate Students Research Fellowship Athabasca University</i>	2025	\$7,500
<i>Excellence in Research Scholarship Athabasca University</i>	2025	\$3,000
<i>Dominique Abrioux Graduate Scholarship Athabasca University</i>	2025	\$2,500
<i>Canada Graduate Student – Master’s Program Social Sciences and Humanities Research Council</i>	2024	\$27,000
<i>Leadership Award for Women Athabasca University Graduate Student Association</i>	2023	\$1,000

Special thanks and appreciation go to my two children for their patience and independence as I worked through my master’s as a solo parent and mature student. This study was conducted on the traditional and unceded territories of the sngaytskstx tum-xula7xw (Sinixt), Secwepemcúl'ecw (Secwépemc), Ktunaxa ʔamakʔis, and Syilx tmix<sup>w</sup> (Okanagan) Nations where I live, work, raise my family, and study as an uninvited guest.

### **AI Disclosure Statement**

This thesis is the original work of its author, Emily Grady. The author acknowledges the artificial intelligence tools using the Artificial Intelligence Disclosure (AID) Framework (Weaver, 2024).

#### Artificial Intelligence Tools:

Elicit, Perplexity, Microsoft Copilot, Microsoft Editor, Google Gemini Pro, Nano Banana Pro.

#### Information collection:

Elicit and Perplexity were used in conjunction with Google Scholar and Athabasca University's library to find articles and resources related to the research. All articles and resources were read and verified by the author.

#### Methodology:

Microsoft Copilot was used to generate ideas for research design and methodology based on the proposed research. Specific methods were then validated against *Research design: Qualitative, quantitative, and mixed methods approaches* by Creswell and Creswell (2022).

#### Data analysis:

Google Gemini Pro was used for the initial data analysis to determine alignment of OER resources with BC curriculum standards as well as resource author, license type and year created.

**Image creation:**

Nano Banana Pro, as part of the Google Gemini suite, was used to generate infographics based on detailed information provided by the author. Iterations of the image were produced until the infographics contained accurate information.

**Writing – Review & Editing:**

Microsoft Editor and Perplexity were used to verify grammar, punctuation, clarity, and spelling after it was composed by the author. The author confirms that she edited and reviewed the AI suggested changes to ensure accuracy.

### **Abstract**

This study examines the availability of Open Educational Resources (OER) for environmental education in Grades 5 to 7 in British Columbia (BC). As environmental challenges escalate, providing young learners with the knowledge to understand and promote involvement with global issues such as climate change is essential. OER provide accessible, adaptable, and high-quality materials that align with BC's curriculum and support UNESCO's Sustainable Development Goals. Despite their potential, the extent to which existing OER meet the needs of BC educators is not well understood. This research addresses that gap through a qualitative document analysis of OER repositories. The outcomes of this analysis comprise a curated list of existing OER that teachers can integrate into their curriculum and identification of gaps in OER for environmental education. Findings will be shared with educators, policymakers, and environmental organizations to encourage OER use and to contribute to broader discussions on OER adoption in K-12.

*Keywords:* OER, open educational resources, environmental literacy, environmental and sustainability education, Sustainable Development Goals, British Columbia, K-12 curriculum, document analysis.

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**List of Abbreviations**

<b>Term</b>	<b>Abbreviation</b>
Artificial Intelligence	AI
British Columbia	BC
British Columbia Teacher's Federation	BCTF
Creative Commons*	CC
Environmental and Sustainability Education	ESE
Environmental Educators Provincial Specialists Association	EEPSA
First Peoples Principles of Learning	FPPL
Kindergarten to Grade 12	K-12
Open Educational Resources	OER
Portable Document Format	PDF
Retain, Reuse, Revise, Remix, and Redistribute	5Rs or 5R activities
Sustainable Development Goal	SDG
United Nations Educational, Scientific, and Cultural Organization	UNESCO

\* Individual Creative Commons license type abbreviations can be found under the Definition of Terms

## Chapter I. Introduction

### Introduction

Whether it be fires, floods, droughts, heat domes or rising sea levels, we all face escalating environmental challenges, thus making education for ecological awareness and sustainability among young learners a priority (BC Ministry of Education, 2007; Orr, 1991; UNESCO, n.d.-a). In British Columbia (BC), where natural landscapes come together with urban development, education plays a critical role in developing environmentally conscious citizens.

This urgency is not only theoretical; it is very personal. Over the past decade, the BC mountain town where I live has been threatened by wildfires every summer, and my children have grown up thinking that smoky skies, having an emergency grab-and-go bag, and checking the air quality index is normal. This experience, combined with my role as a parent, environmental advocate, and educator, has inspired me to find ways to advance accessible environmental education.

This study explores how Open Educational Resources (OER) can enhance environmental and sustainability education for students in Grades 5 to 7. By analyzing the availability and alignment of OER with BC's curriculum, this research supports teachers in developing environmentally conscious citizens. More specifically, this research contributes to the fields of OER and environmental education in the kindergarten to Grade 12 (K-12) context.

### Statement of the Problem

Since 2016, BC's curriculum has emphasized environmental learning and highlighted social awareness and responsibility as key competencies (BC Ministry of Education, n.d.-b). Despite the importance of environmental and sustainability education, many BC educators lack access to

high-quality, locally relevant resources to teach this subject and often do not have the time or expertise to find and develop their own materials (Hales, 2024). A solution to this problem is the adoption of Open Educational Resources (OER).

OER are considered “(sic) learning, teaching, and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation, and redistribution by others.” (UNESCO, 2019, para. 1). As such, OER can enhance environmental education by providing accessible and engaging materials that can be adapted to specific contexts.

OER research to date has focused on OER usage and teachers’ perceptions, as well as the benefits, challenges, barriers, and best practices associated with their implementation (Blomgren, 2018; Kelly, 2015; Kimmons, 2014, 2015; Kuo et al., 2024; Tang et al., 2021). This study, however, focusses on identifying OER that align with BC’s environmental curriculum standards for Grades 5 to 7. The results include:

- a curated list of existing OER that teachers can use to integrate into their curriculum,
- identification of gaps in existing OER, and
- a document analysis process that can be applied to other subject areas to identify OER that align with provincial educational standards.

### Purpose of the Study

The purpose of the study is to explore the availability and suitability of OER for delivering environmental education to children in Grades 5 to 7. Specifically, the study aims to determine whether such resources exist and, if they do, evaluate the extent to which they align with BC curriculum standards. By assessing the relevance and quality of OER materials, the research seeks

to provide insights into their potential for supporting effective environmental education within the BC educational framework.

### Research Questions

Accordingly, there are two central questions for this research. They are:

1. *To what extent do Open Educational Resources for environmental education exist for Grades 5 to 7?*
2. *How well do these resources align with British Columbia curriculum standards?*

Based on the central questions, the following sub-questions are addressed:

1. What OER are currently available for teaching environmental education to students in Grades 5 to 7?
2. To what degree do the identified OER align with the four key areas outlined in the BC curriculum for environmental education?
3. What gaps, if any, exist between the available OER and the requirements of the BC curriculum for environmental education?

### Significance of Research

As we face escalating environmental challenges, promoting environmental awareness and sustainable practices in young people is a priority (BC Ministry of Education, 2007; Orr, 1991; UNESCO, 2021). BC's education system plays a critical role in developing ecologically conscious citizens by providing students with an opportunity to experience and explore the connections between individuals, communities, and the environment (BC Ministry of Education, 2007). This research supports BC's education system by analyzing the extent to which current OER meet educational standards, including the First Peoples Principles of Learning. This alignment will help

identify gaps and areas for improvement, ensuring that OER can be effectively integrated into the curriculum.

Environmental education is considered essential throughout kindergarten to Grade 12, and several studies indicate that the ideal age for developing environmental literacy and introducing social action is from 10 to 13 years old, typically Grades 5 to 7 (Brant, 2020; Field et al., 2019; Harker-Schuch, 2019; Trott, 2021), coincidentally the same age range as my children. My research focusses on this pivotal age group to ensure these children are provided with the learning resources they need to become environmentally conscious citizens.

Despite its importance, many BC teachers currently lack access to high-quality, locally relevant resources to provide environmental education, and often do not have the time or expertise to develop their own material (Hales, 2024). My research will identify and curate OER that align with BC's curriculum standards, making it easier for teachers to find, use, and adapt these resources to their context.

The research will also benefit cultural heritage institutions whose staff are knowledgeable in OER, such as galleries, libraries, archives, and museums (GLAM), by providing them with insights into how they can create and distribute OER supplemental materials to teachers.

By focusing on environmental education and providing teachers with high-quality OER, this research aligns with several of the United Nations Educational, Scientific, and Cultural Organization's (UNESCO's) Sustainable Development Goals (SDGs). These goals work towards peace and sustainable living for all and ensure protection of the planet. The goals most pertinent to environmental education and OER include SDG 4 (quality education), SDG 12.8 (ensure that people everywhere have relevant information and awareness for sustainable development), and SDG 13.3 (improve education, awareness, and capacity on climate change mitigation, adaptation, impact reduction, and early warning) (Ossiannilsson, 2023; UNESCO, n.d.-a). Consequently, the results of

this study will ensure that teachers can access relevant resources to equip students with the knowledge and skills to understand and become involved with global environmental issues.

In spite of their potential, OER continue to be underutilized in BC's kindergarten to Grade 12 (K-12) education system. The findings of this study have broader implications for promoting the use of OER and open educational practices in K-12 education in BC.

In addition, this study will create a document analysis process that can be applied to different topics and different provinces in terms of alignment of OER with provincial curriculum. Furthermore, it will provide the groundwork for future projects and research; for example, determining the effectiveness of the identified OER on student behaviour and their sense of stewardship.

To share my findings, I will engage with local and provincial organizations, highlight available resources, and promote the use of OER in environmental education. My intention is to influence educational policy and practice by providing evidence-based recommendations that support the adoption of OER. I also aim to present my research to groups such as the BC Teachers Federation Environmental Educators Professional Specialists Association and Committee for Action on Social Justice, as well as environmental education groups, including those at events like the Outdoor Learning Leadership Conference.

### Delimitations

Delimitations refer to factors that are under the control of and imposed by the researcher (Nenty, 2009). The delimitations of this study include the specific topic of study, age and province restrictions, how many and which repositories were used to search for OER, and the factors used to determine the alignment of OER to BC curriculum. The OER repositories selected based on

recommendations by experienced users and only English, freely available, and digital OER were included.

### Limitations

Limitations are outside the researcher's control (Nenty, 2009). For this study, limitations include the quality and sample size of OER that are available and whether those OER are relevant to the topic of environmental education and the defined age group (10-13 years; Grades 5 to 7), and whether they align with BC curriculum. One of the greatest limitations I experienced was the notable gap in literature related to OER and environmental and sustainability education in the K-12 context.

### Definition of Terms

The following terms are defined to provide clarity of terminology within my study.

**Artificial Intelligence (AI)** is a computer-based system designed to achieve human-defined goals by making predictions, recommendations, or decisions that impact real or virtual environments (Wikipedia, 2025). AI in Education (AIED) is the integration of AI technologies in learning environments to enhance teaching, learning, and educational administration (Holmes et al., 2019; Pedró et al., 2019; Saputra et al., 2023; UNESCO, 2023).

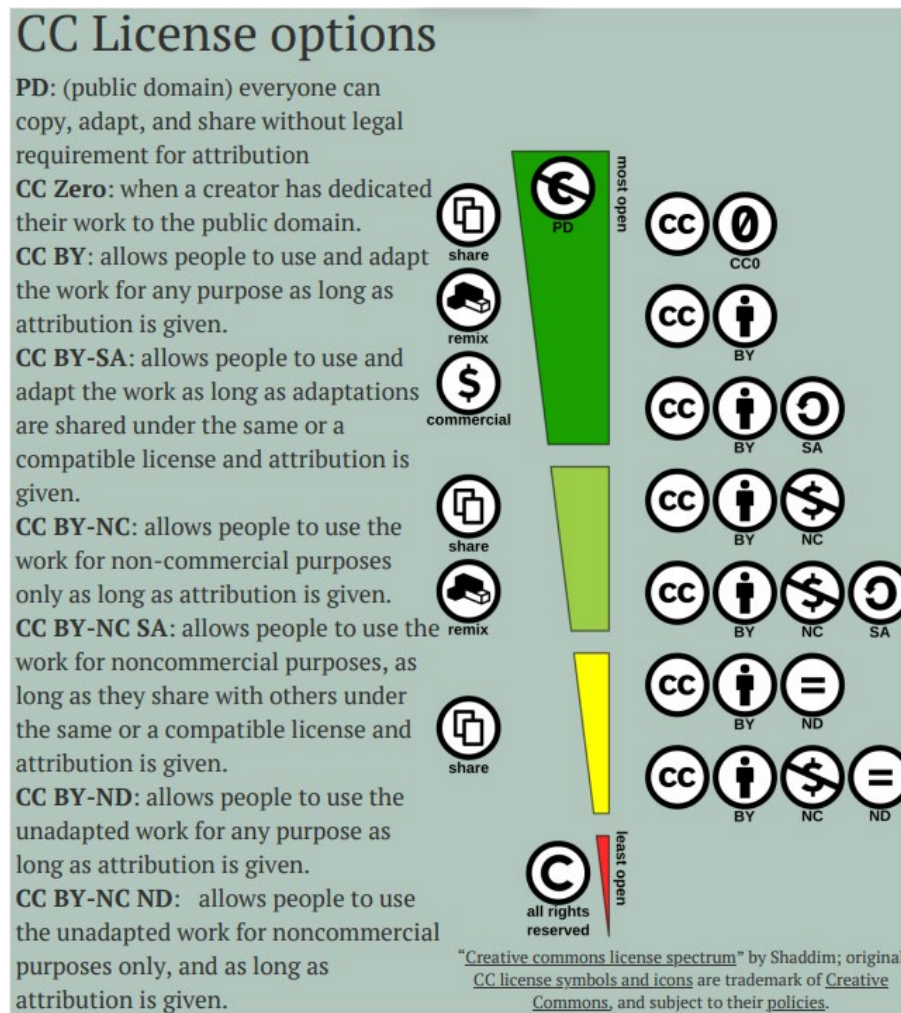
According to BC's Ministry of Education (n.d.-a), **Core Competencies** are foundational for K-12 curriculum and refer to "sets of intellectual, personal, and social and emotional proficiencies that all students need in order to engage in deep, lifelong learning" (para. 1).

**Creative Commons (CC) Licenses** provide authors/creators with a range of options for how their work can be used by end-users (Creative Commons, n.d.; Elder, 2019; *What Is Creative Commons?*, n.d.). There are six types of CC licenses plus a tool that enables a creator to dedicate

their work to public domain. Figure 1 below describes each license type, listed in order of openness, where *public domain* is the most open and *all rights reserved* is the least.

**Figure 1**

*CC License Options*



*Note.* Description of different license types.

Screenshot from “Creative Commons Licenses” by Emily Grady licensed under [CC BY 4.0](#)

**Environmental and Sustainability Education (ESE)** is education that extends beyond the fundamentals of environmental science; it aims to develop the skills, attitudes, values, responsibility, personal investment, and active involvement in environmental issues (Hungerford & Volk, 1990; Leicht et al., 2018; Roth, 1984, 1991, 1992; UNESCO, 2006).

The Partnership for 21st Century Skills (2009) defines **Environmental Literacy** as the ability to comprehend environmental systems and their influencing factors, understand human impacts on nature, critically analyze environmental issues to determine effective solutions, and engage in both individual and collective actions to address environmental challenges.

**Open Educational Resources** (OER) are considered “learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation, and redistribution by others” (UNESCO, 2019, para. 1).

**Sustainable Development Goals** (SDGs) are calls for actions adopted by all United Nations Member States in 2015 as part of the 2030 Agenda for Sustainable Development (UNESCO, n.d.-a). There are 17 SDGs that provide strategies for ending poverty, improving health and education, reducing inequality, and promoting economic growth while, at the same time, addressing climate change and preserving the planet’s oceans and forests (UNESCO, n.d.-a).

The **United Nations Educational, Scientific, and Cultural Organization** (UNESCO) is a specialized agency consisting of 194 member states that works to promote education, science, culture and communication (UNESCO, n.d.-b)

## Summary

In this chapter, I provided an overview of the background to the study on OER for environmental education for Grades 5 to 7 in BC; the questions that will be addressed as part of the study; why this research is important, relevant, and timely; some of the limitations and delimitations that impact the study; and important terminology.

According to the Government of Canada (2024b), “education is crucial to influence environmental action” (p. 1). Hence, this research addresses a pressing need for accessible, high-

quality educational materials while supporting sustainability goals. There is also a tremendous amount of growth possible in the use of OER in K-12 (Blomgren & McPherson, 2018). Thus, the outcomes of this research work toward greater awareness and education for the common good.

In the following section, Chapter II, I describe a literature review of studies involving OER, environmental education, and how both topics are applied in the K-12 context. Chapter III outlines the methodology used to identify and analyze OER based on defined parameters, including the use of artificial intelligence (AI) to conduct the initial analysis. Results are summarized in Chapter IV, including charts and tables to illustrate key findings. In Chapter V, I discuss the importance of these findings and their implications, including recommendations for future studies. This final chapter concludes with a summary of my study and its contributions.

## Chapter II. Review of the Literature

### Introduction

This chapter provides an overview of the literature related to three key areas:

- Concept 1: Open Educational Resources (OER),
- Concept 2: environmental and sustainability education (ESE), and
- Concept 3: the kindergarten to Grade 12 (K-12) context.

The sections for Concepts 1 and 2 include a definition and description of the benefits, challenges, barriers, and connection to other areas.

Google Scholar, Elicit, and Athabasca University Library's Discover (EBSCO) were used to find journal articles, grey literature, reports, and other relevant resources relating to the key areas.

Table 2 summarizes the search term used with relevant Boolean operators.

**Table 2**

*Search Terms Used to Find Relevant Literature*

<b>Concept 1: OER</b>	<b>Concept 2: Environmental &amp; Sustainability Education</b>	<b>Concept 3: Kindergarten to Grade 12</b>
Environmental	Children	Open Educational Resources
Climate change	Grade 5	OER
Conservation	Grade 6	Open
Nature based	Grade 7	Resources
Climate kind	Middle school	Curriculum
Sustainable	10-year-olds	Pedagogy
Green	11-year-olds	Program
Outdoor	12-year-olds	Learning
	Youth	Education

Google Scholar, when linked to Athabasca University's library, was most effective for retrieving applicable journal articles. These articles referred to other valuable reports and resources, including United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Sustainable Development Goals (SDG), Canada and British Columbia-specific guidelines and frameworks for environmental education, and barriers faced by educators when it comes to using OER and delivering ESE. A summary of findings for these topics is provided below including gaps in the literature and justification for this study.

Open Educational Resources in K-12

### ***OER Definition***

UNESCO (2019) defines OER as "(sic) learning, teaching, and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation, and redistribution by others." (para 1)

OER constitute educational materials that are either in the public domain or licensed in ways that enables users to engage in the 5R activities: retain, reuse, revise, remix, and redistribute (Wiley, n.d., 2014; Wiley & Hinton, 2018). The ability to revise and remix a resource is an important distinction between OER and open access resources. While open access resources are typically free, they are often read-only and may not be altered or adapted. In contrast, the 5R activities enable educators and learners to engage with OER without restrictions and therefore provide opportunities to teach and learn in a broader range of ways than traditionally copyrighted resources (West et al., 2020; Wiley & Hinton, 2018).

Examples that meet these criteria include OER compiled into a textbook (open textbook), online course (open courseware), digital learning object, encyclopedia (e.g., Wikipedia), or online

archive (Commonwealth of Learning, n.d.; Indiana University of PA, n.d.). Farrell (2021) identifies digital learning objects as lectures, videos/audio, case studies, images/diagrams, assignments, quizzes, lab activities, games, and simulations. In general, OER development is funded by donors or governments, and the resulting materials are released using a Creative Commons (CC) license or listed as public domain (West et al., 2020).

As described under the Definitions of Terms, different CC licenses provide varying degrees of re-use and adaptation. Licenses that permit revision and remixing, such as CC BY, CC BY-SA, CC BY-NC, and CC BY-NC-SA meet the requirements of OER. In contrast, licenses that include a No Derivatives (ND) clause, such as CC BY-ND or CC BY-NC-ND, do not constitute OER because they prohibit adaptation and therefore restrict the full use of the 5R activities.

### ***OER Benefits***

In November 2019, UNESCO recommended that member states “create, access, re-use, re-purpose, adapt, and redistribute OER” (2019, p. 6) to help achieve SDG 4 which constitutes quality education for all. OER promote social justice and help bridge the digital divide (Kuo et al., 2024; Mishra, 2017; Ossiannilsson, 2023; UNESCO, 2019) by expanding access to underserved communities, including low-income, Indigenous, and remotely located populations. This access can promote dialogue, mutual understanding, and shared action, particularly on environmental and sustainability issues.

There are many other benefits to OER including:

- the ability for learners to access resources any time and from anywhere,
- scalability for distributing resources widely at little cost,
- providing supplementary and enhancements to existing materials and textbooks,
- quick availability for rapid dissemination,
- lower costs to students and schools, and

- the potential for continuing improvement through adaptation, modification, and contextualization (Atkins et al., 2007; Clements & Pawlowski, 2012; Commonwealth of Learning, n.d.; D’Antoni, 2008; Kimmons, 2015; Luo et al., 2020; University of Maryland Global Campus (UMGC) Library, 2025).

### ***OER Challenges***

Despite these benefits and recommendations, there has been a limited uptake of OER use in K-12 education due to lack of awareness, negative perceptions, lack of incentives for teachers, and limited administrative support (Arispe et al., 2025; Blomgren, 2018; Blomgren & McPherson, 2018; Kimmons, 2014; Kuo et al., 2024; Mishra, 2017; Tang et al., 2021). Other challenges with OER include quality issues such as lack of relevance or accuracy; additional effort required by teachers to learn about, find, adapt, modify, vet and publish OER; reliance on a computer, internet connection and electricity for access; OER being primarily created in the northern hemisphere and in English; time, funding, and resources required for the creation, digital storage, and maintenance of OER (Almeida, 2017; Bainbridge, 2016; Clements & Pawlowski, 2012; D’Antoni, 2008; Hashey & Stahl, 2014; Luo et al., 2020; Mutuzana, 2009; Skidmore & Provida, 2019; University of Maryland Global Campus (UMGC) Library, 2025). In addition, Hashey and Stahl (2014) describe how OER quality varies with regards to accessibility for students with diverse abilities such as vision or hearing impairments. Furthermore, much of OER activity is currently funded by grants or one-time funding (Dimopoulos & Adronisha, 2025), which results in issues around long-term sustainability.

To address several of the teacher-specific barriers, training, both pre-service and professional development, is paramount to the adoption of OER in K-12 settings (Arispe et al., 2025; Blomgren & McPherson, 2018; Kimmons, 2015; Mishra, 2017; Tang et al., 2021; Vladimirschi, 2018). As explained by Wiley and Hinton (2018), educators must understand OER and its benefits before incorporating it into daily practice. Likewise, this training should include how to find, assess,

select and adapt OER to meet the needs of all learners, as well as how to create and implement OER in effective and accessible ways (Hashey & Stahl, 2014).

Teacher training is especially critical given recent copyright lawsuits. For example, a 2018 lawsuit involving Access Copyright, representing writers, artists, and publishers, and departments of education, including 300 K-12 schools from across Canada (Stackelberg, 2019). This case examined the fair dealings law which enables teachers to make copies of certain materials for educational practices (Copyright Act, 1985). Access Copyright argued that actual teacher use extended beyond the fair dealings' law allowances and that writers and publishers should be compensated (CBC, 2018). As of February 2024, the school boards and ministries won the case (Cottier & Yeung, n.d.); however, this issue highlights the importance of increased awareness, development, and use of OER in the K-12 context.

### ***OER in the K-12 Context***

To date, research on OER in K-12 has been limited; however, studies that have been done primarily examined their usage, including teachers' perceptions, as well as the benefits, challenges, barriers, and best practices associated with their implementation (Arispe et al., 2025; Blomgren, 2018; Kelly, 2015; Kimmons, 2014, 2015; Kuo et al., 2024; Tang et al., 2021). From these studies, many themes emerge and underlying these themes is the strong teaching culture of sharing, collaboration, and partnerships (Blomgren, 2018; Kimmons, 2015). Also evident is a desire to individualize, personalize and adapt content (Blomgren, 2018; Kimmons, 2015, 2016; Tang et al., 2021) to make sure it is applicable and relevant (Kimmons, 2015; Kuo et al., 2024). As a result, there has been a slow but growing trend and awareness of OER within the K-12 context over the past decade (Blomgren & McPherson, 2018; Kuo et al., 2024). Yet, according to a 2023 report by Bayview Analytics (Seaman & Seaman, 2023), only 28% of K-12 teachers are aware of OER as

compared to 64% of faculty in higher education. Furthermore, most of those who are aware of OER did not know how to use them (Arispe et al., 2025; Seaman & Seaman, 2023).

### ***Environmental Impacts of OER***

Studies on OER largely ignore its environmental impacts, both positive and negative. In general, OER are maintained as digital resources so that they can be easily found and accessed online. As such, Allman et al. (2024) describe the cost-savings and ecological benefits of online OER based on reduced printed materials. However, no studies mention the power consumption, resources and water requirements needed to create and maintain data centres where OER are stored. Likewise, few studies discuss the costs to sustain and update existing OER. This is an important shortcoming of sustainable OER creation, maintenance, and use.

### ***OER and Artificial Intelligence***

At the time of writing, a growing area in OER development is the integration of artificial intelligence (AI). AI technologies offer numerous possibilities to improve and refine existing OER (BCcampus OER Production Team, 2021; Ossiannilsson et al., 2024). For instance, according to Kimmons et al. (2025) AI can be used to:

- translate content,
- generate summaries,
- define key terminology,
- convert text to speech,
- simplify complex material,
- enhance accessibility features, and
- generate learning checks.

Wiley (2025) also suggests that the ideal OER may involve openly licensed prompts that are provided to students to enter into generative AI. This would result in an interactive, formative, and

educational session that's customized to individuals, including their preferences and their learning needs; this is referred to by Wiley (2025) as "conversational learning" (33:45). When AI is applied thoughtfully to existing OER, it can lead to valuable improvements in accessibility, relevance, and overall educational value (Kimmons et al., 2025). These many benefits can ease the transition for teachers who wish to adopt OER usage by reducing the workload involved with adapting or modifying existing resources to fit their context and learner needs.

However, thoughtful application is essential to using AI in OER given the range of challenges and risks involved. Many of these are identified by the AI & OER Community Hub (OER Commons, n.d.-a). For example, AI-generated content often contains misinformation and bias so all content must be verified by users (OER Commons, n.d.-a). Additionally, because AI systems often access data that may be protected by copyright or subject to complex licensing, users must identify original sources (OER Commons, n.d.-a) and ensure that their use of such material is both ethical and transparent. Other significant concerns include the digital divide, where differences in access and content creation can exacerbate inequities, as well as the collection and storage of private user data by AI tools, raising privacy issues (OER Commons, n.d.-a). Lastly, the environmental impact of AI technologies is substantial; the data centers that power AI consume large amounts of electricity, emit a significant amount of carbon (Yu et al., 2024), require tremendous amounts of water for cooling (Ren, 2023), and contribute to mineral mining and electronic waste (OECD, 2022). By understanding the impacts, OER developers can make more responsible and ethical choices in their use of AI, ensuring that the benefits outweigh the harm. (Romero Luis et al., 2025)

## Environmental and Sustainability Education

“In the end, we will conserve only what we love; we will love only what we understand; and we will only understand what we are taught” (Dioum, 1968, as cited in Valenti & Tavana, 2005, p. 308).

### ***Environmental and Sustainability Education Definition***

According to Leicht et al. (2018), environmental and sustainability education (ESE) is based on promoting environmental literacy, which extends beyond knowledge of the environment to the adoption and promotion of pro-environment behaviours. The Partnership for 21st Century Skills (2015) defined environmental literacy as the ability to comprehend environmental systems and their influencing factors, understand human impacts on nature, critically analyze environmental issues to determine effective solutions, and engage in both individual and collective actions to address environmental challenges. Environmental literacy includes understanding climate science coupled with sustainable practices and the ethical and social dimensions of environmental challenges. Thus, climate change education and environmental literacy are key elements of ESE.

These definitions of ESE and environmental literacy are supported by many others who added that an understanding of environmental science aids in the skills, attitudes, values, responsibility, personal investment, and active involvement in environmental issues (Hungerford & Volk, 1990; Roth, 1984, 1991, 1992; UNESCO, 2006). Further, based on an environmental literacy ladder developed by the North American Association for Environmental Education (n.d.), there are several elements to ESE, including environmental knowledge, academic achievement, critical thinking, civil engagement, and personal growth. All are important for developing environmental literacy.

There are many terms encompassed by ESE such as climate change education, climate and environmental literacy, environmental education, sustainability education, land and place-based learning, and education for sustainable development. Consequently, ESE is considered an umbrella term and aligns with Canada's National Framework where ESE is a "tool to address the global crises of climate change, biodiversity loss and pollution" (2025, p. 5). For this reason, ESE is the primary term used for this study and includes all the above concepts unless otherwise indicated.

### ***Importance of Environmental and Sustainability Education***

It is widely recognized that environmental and sustainability education is a pressing issue (Ardoin & Bowers, 2020; Christ & Dreesmann, 2023; European Commission, 2022; Field et al., 2023; Government of Canada, 2024a, 2025; Government of New Brunswick, 2022; Hargis & McKenzie, 2020; LSF-LST, 2025a, 2025b; Orr, 1991; P. Schwartzberg et al., 2022; Teacher On Demand, 2023; UNBC, 2023; UNESCO, n.d.-a). The Organization for Economic Co-operation and Development, representing 38 countries, identified environmental and sustainability literacy as one of the most important contemporary interdisciplinary themes that should be incorporated into core subjects (Fadel et al., 2024). The importance of this education is further emphasized by UNESCO's SDG 12.8 (ensure that people everywhere have the relevant information and awareness for sustainable development) and 13.3 (improve education, awareness, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning) (Ossiannilsson, 2023; UNESCO, n.d.-a). These goals are also supported by a 2022 survey on Canadians' Perspectives on Climate Change & Education (LSF-LST, 2022), the Government of Canada's National Framework for Environmental Learning (Government of Canada, 2024a, 2025), and, more recently, the 28<sup>th</sup> Conference of the Parties to the United Nations Framework

Convention on Climate Change (COP28) Declaration for the Common Agenda for Education and Climate Change (UNESCO, 2024a).

The need for ESE is heightened by the fact that environmental issues such as climate change, biodiversity loss, and pollution have greater impacts on marginalized communities (Younghusband et al., 2025). The Government of Canada (2024a, 2025) recognized that Indigenous populations experience these impacts disproportionately. For example, Indigenous peoples in northern BC are especially vulnerable to extreme weather events, such as heat domes, atmospheric rivers, and wildfires, due to disruptions to traditional subsistence practices, limits on access to clean water, substandard housing, and inadequate insurance or social safety nets (Encompass HK, 2022; Nakashima et al., 2018; UNBC, 2023). These inequities further emphasize the important role of ESE in addressing both global and local challenges and the instrumental role of Indigenous peoples in developing ESE based on traditional knowledges.

The important role of Indigenous peoples in developing ESE is increasingly recognized (Government of Canada, 2025; Nakashima et al., 2018; UNESCO Canadian Commission, 2021). For instance, two youth manifestos specify the need for a multi-stakeholder approach that includes representation from ethnic minorities and Indigenous peoples as well as incorporating Indigenous knowledge systems (Youth Declaration on Transforming Education, 2022). Indigenous knowledge systems include land-based learning which centers on “respect, reciprocity, reverence, humility and responsibility as values connected to the land” (A. Parent, as cited in UNESCO Canadian Commission, 2021, p. 1). By changing people’s perspective and relationships with the land, they are more likely to protect it.

Yet, despite our reliance on the natural world, there is a tendency to distance ourselves from environmental issues. Modern day individuals “have come to see themselves as separate from nature” (Loreau, 2023, p. 25) and there is a perception that we own land (Chrona, 2022). Yet,

the Global Youth Statement (COY17, 2022) emphasized the importance of seeing humans as part of nature. Moreover, as White (2006) observed, “regardless of economics, politics, and personal worldview, we are all connected. The reality of this connection must become part of our system of education” (p. 92). Educational institutions, at all levels and across the globe, recognize their social and ethical responsibility to further this education and make a difference (ACDE, 2022; P. Schwartzberg et al., 2022; S. J. Schwartzberg & Acton, 2025). Based on UNESCO’s report, many countries have national action plans that include climate change education (Subrahmanyam, 2021). Despite this recognition, changes in curriculum and policies are limited and implementation is inconsistent (P. Schwartzberg et al., 2022).

According to recent Canadian surveys on climate change education (LSF-LST, 2025a; P. Schwartzberg et al., 2022), most parents, members of the public, and teachers see the need for schools to prioritize educating young people on the topic. Young people also viewed ESE and climate literacy as integral to their education (LSF-LST, 2025a). According to a UNESCO study in 2021, 70% of youth say that they are not ready to address climate issues based on their education (UNESCO, 2024), yet the majority of students deem education to be the best tool to address these challenges (Bhattacharya et al., 2021; Government of Canada, 2025; LSF-LST, 2025a; P. Schwartzberg et al., 2022). In a rapidly changing world, environmental and climate education can prepare K-12 students in making informed decisions on how to take care of the environment, educate others, and motivate action to protect it (North American Association for Environmental Education, 2024; UNESCO, 2024a). Youth are seeking the “knowledge, skills, values and attitudes needed to act as agents of change” (UNESCO, 2024a, p. 18) through a holistic approach to education on climate change and ESE.

### ***Environmental and Sustainability Education Challenges***

Regardless of the importance of ESE in promoting responsible environmental behaviour, there are several barriers to implementing it, such as:

- insufficient support (Courtenay-Hall & Lott, 1999; Government of Canada, 2024a),
- time constraints (Government of Canada, 2024a; Lin, 1993),
- limited teacher knowledge (Brant, 2020; Field et al., 2019; Government of Canada, 2024a; Lin, 1993; P. Schwartzberg et al., 2022; S. J. Schwartzberg & Acton, 2025),
- lack of time within the curriculum (Government of Canada, 2024a; P. Schwartzberg et al., 2022), and
- a focus on cognitive and mainly science-based elements (Bhattacharya et al., 2021; Bieler et al., 2017; Brant, 2020; Field et al., 2019; Government of Canada, 2024a; Hargis & McKenzie, 2020; Lin, 1993; North American Association for Environmental Education, 2024).

Likewise, ESE, particularly climate change education, is deemed a highly controversial, contemporary, and political topic that poses challenges for educators to create and deliver with confidence (Brant, 2020; Government of Canada, 2024a; Nation & Feldman, 2022). For instance, climate change is not specifically referenced in curriculum, so many teachers feel ill equipped and “can’t justify time spent on the topic to parents who might criticize” (Government of Canada, 2024a; LSF-LST, 2025a).

In 2019, the international community was urged to advance education for sustainable development to reach UNESCO’s 2030 Agenda (UNESCO, 2021). Despite this call to action, government action has fallen short of meeting established commitments. Although numerous national and provincial reports, frameworks, and guidelines have been released (BC Ministry of Education, 2007; Brant, 2020; Field et al., 2023; Government of Canada, n.d., 2025; Government of New Brunswick, 2022; Hargis & McKenzie, 2020; Lê, 2021; North American Association for

Environmental Education, 2024) these largely represent intentions rather than tangible progress. Canada has agreed to meet several international obligations such as the Paris Agreement, the Kunming-Montreal Global Diversity Framework, the UNESCO Berlin Declaration, and SDGs (Government of Canada, 2024a, 2025), yet implementation remains limited. The 2024 National Framework for Environmental Learning acknowledges that "Canada is not performing as well as it should to advance environmental education" while "67% of Canadians think that schools need to prioritize climate education" (Government of Canada, 2024a). This lack of progress is mirrored at the provincial level, where only six out of 13 provinces and territories have included ESE into curricula and policy (P. Schwartzberg et al., 2022). Substantial and coordinated government action is needed to close the gap between commitment and delivery (Bieler et al., 2017; Field et al., 2019, 2023; Hargis & McKenzie, 2020; P. Schwartzberg et al., 2022; S. J. Schwartzberg & Acton, 2025; UNESCO, 2006).

As Bieler et al. (2017) noted, "[w]hereas climate policies often reference the significance of the education sector in combating climate change; education policies do not seem to have taken up the challenge" (p. 79). To address this gap, Field et al. (2019) recommended embedding core environmental and climate change expectations across all subjects. This recommendation is consistent with many other reports and studies, including UNESCO's recent *Greening curriculum guidance* (2024) and surveys of Canadian's perspectives on climate education (LSF-LST, 2025a; P. Schwartzberg et al., 2022).

Despite government, educators, citizens, and school-aged children understanding the value of ESE, there has yet to be a significant move to fully integrate it into the education system. And, while federal government policies and programs will provide more consistency across the country, supplying readily available, accessible, and adaptable resources directly to teachers can provide immediate action using a bottom-up approach. Practice influences and guides policy

(Government of British Columbia, 2020); therefore, a ground up approach is most effective.

Likewise, integrating ESE across all subjects supports a holistic way of seeing the connection between environmental issues and social, political, and economic systems, as well as diverse worldviews. OER can meet these requirements given their accessibility, availability, and adaptability. The use of OER and interdisciplinary use of ESE aligns directly with UNESCO's SDGs, which stresses the importance of education for all in promoting environmental awareness and engagement (UNESCO, n.d.-a). Moreover, ESE is a way to change social values and systems to achieve sustainability and social justice (Mappin & Johnson, 2005).

To date, only a recent presentation by Newton et al. (2025) was found that examines OER as a tool for delivering, adapting and sharing ESE in public school education. This highlights the importance of researching the availability of OER for ESE. Also, gallery, library, archive, and museum (GLAM) institutions and non-profit organizations are pivotal in producing these resources, including OER. Addressing the need for ESE requires a systemic approach, one that involves all aspects of a community, from local to national. In this way, existing work can be leveraged, and strategic collaborations can be made ensuring a collective impact (Government of Canada, 2024).

### ***Environmental and Sustainability Education in BC***

BC has taken steps to address national and international ESE recommendations. For example, in 1971 the BC's Teachers' Federation (BCTF) created a task force on ESE. This task force became the Environmental Educators Provincial Specialists Association (EPPSA) and has prepared provincial reports, guidelines and recommendations for integrating ESE into K-12 classrooms and across all topic areas. In 2015, BC's Ministry of Education and Child Care redesigned its curriculum to provide greater opportunity for students to learn and explore ESE topics such as climate change (BC Ministry of Education, 2024). The province also introduced the First Peoples Principles of Learning (FPPL) as central to curriculum; these principles emphasize relationship, reciprocity, and

responsibility to the land (FNESC, n.d.). And, in 2025, they released the *Climate Change Connection in the BC Curriculum: Kindergarten – Grade 3* resource along with a workshop resource to support educators in teaching about climate change (Ministry of Energy and Climate Solutions & Ministry of Education and Child Care, 2025). As of 2023, the BC Ministry of Education is the only ministry in Canada to issue a policy statement specifically on climate change education (Field et al., 2023). At an institutional level, Hart and al. (UNBC, 2023) from the University of Northern BC conducted research promoting climate education in teacher education to engage teachers from northern BC in professional development and to encourage collective action.

BC's redesigned curriculum emphasizes environmental learning and identifies social awareness and responsibility as key competencies (BC Ministry of Education, n.d.-b). Students are expected to “develop awareness and take responsibility over their social, physical, and natural environments by working independently and collaboratively for the benefit of others, communities, and the environment” (BC Ministry of Education, n.d.-b). However, references to climate change are not explicitly stated and ESE is still primarily taught in science class. Yet, these subjects are not simply scientific issues, they are complex systemic problems that involves socio-cultural systems, ethics, politics, psychology, communication and language (Cox, 2023).

There is also little clarity on how existing ESE resources align with BC's curriculum standards or how to develop curriculum that meets these standards. Additionally, relevant and appropriate ESE resources are often difficult to find and access, with missing copyright information, making it unclear whether they can be adapted or shared. As a result, teachers struggle to find high-quality, locally relevant materials that not only address environmental issues but also integrate effectively into their specific learning framework (S. Newton, personal communication, April 26, 2024).

### ***Environmental and Sustainability Education Recommendations***

Several recommendations to overcome these barriers have been identified in different studies. These include:

- having government policy both at the federal and provincial levels that clearly identify and support environmental and climate action as core curriculum components (Bhattacharya et al., 2021; Brant, 2020; Field et al., 2023; Government of New Brunswick, 2022; P. Schwartzberg et al., 2022; S. J. Schwartzberg & Acton, 2025; UNESCO, 2021),
- having a centralized, organized, curated and accessible repository of applicable and relevant content (BC Ministry of Education, 2007; Berger et al., 2015; European Commission, 2022; Government of Canada, 2024a; Lê, 2021; Okada & Gray, 2023) that is localized, contextualized and flexible (Bhattacharya et al., 2021; Brant, 2020),
- ensuring an integrated and interdisciplinary approach to ensure the education is effective (BC Ministry of Education, 2007; Bhattacharya et al., 2021; Bieler et al., 2017; Brant, 2020; Field et al., 2023; Government of Canada, 2024a; Government of New Brunswick, 2022; Hargis & McKenzie, 2020; Kwauk & Casey, 2021; Orr, 1991), and
- providing pre-service and in-service (professional development) training to prepare and support teachers to deliver environmental education (Babayemi et al., 2021; Bhattacharya et al., 2021; European Commission, 2022; Field et al., 2023; Government of Canada, 2024a; Kwauk & Casey, 2021; Lê, 2021; Marchant et al., 2019; P. Schwartzberg et al., 2022; Trott, 2021; UNESCO, 2021).

An example of how ESE can be successfully integrated into BC curriculum is the now mandatory Indigenous-focussed education. This began in 2015 with government policy where the

Government of Canada and BC's Ministry of Education committed to the Tripartite Education Framework Agreement, an agreement with the First Nations Steering Committee to improve outcomes of First Nations students (Ministry of Education & First Nations Education Steering Committee, 2015). Curriculum was then created to integrate Indigenous perspectives, knowledges and worldviews across all K-12 subject areas. This was followed by mandatory in-service teacher training to ensure that redesigned curriculum was fully implemented and a core part of teacher practice by 2019. A 2025 survey on Canadians perspectives on climate change education shows that a similar approach would support teachers in ESE delivery through policy, resources, and training (S. J. Schwartzberg & Acton, 2025).

### ***Environmental and Sustainability Education and OER***

Based on several of the resource recommendations above, OER represent a promising solution in the form of accessible materials that are reusable, adaptable and can be tailored to specific contexts and used across disciplines, thereby addressing multiple barriers simultaneously (Blomgren, 2018; Kimmons, 2016). For example, an existing OER can reduce the workload of already overworked educators while, at the same time, alleviating pressures on tight resource budgets. The flexibility of OER allow educators to customize their resources to meet the individual needs of their students and courses, thereby ensuring that materials are current and contextual. Currently, a curated list of OER for environmental education does not exist in Canada.

### **Ideal Age for Environmental and Sustainability Education**

A popular saying attributed to Wendell Berry (1970) states, "we do not inherit the Earth from our ancestors; we borrow it from our children." Just as I inherited the environmental impacts of those before me, my children are amongst those who will inherit the damage done by my generation and future impacts. As a result, children are one of the most vulnerable groups when it

comes to protecting their rights to a healthy environment. In addition, eco-anxiety has been identified as a public health crisis in Canada. According to Albrecht (2011), eco or climate-anxiety refers to the worry that is caused by environmental threats to the planet because of climate change. Today's youth are particularly susceptible to eco-anxiety because they've been most exposed to the climate crisis and bear the weight of rising climate impacts (Government of Canada, 2022). Thus, there is an urgent need to equip them with knowledge, skills, and coping mechanisms to address and adapt to ongoing environmental challenges (Government of Canada, 2024a).

Although ESE is essential throughout K-12, studies indicated that the ideal age for introducing environmental literacy and promoting social action is between 10 and 13 years, corresponding to Grades 5 to 7 (Brant, 2020; Field et al., 2019; Harker-Schuch, 2019; Trott, 2021). This age range was deemed particularly significant because children at this stage are developing greater self-awareness, social responsibility, critical thinking and collaboration skills (Brant, 2020; Teacher On Demand, 2023). During this period, children are intellectually and emotionally ready to understand the importance of environmental issues (Trott, 2021) and are in the process of forming their values and behaviours towards the environment (North American Association for Environmental Education, n.d.). Furthermore, Harker-Schuch (2019) stated that young adolescents are at a pivotal age for cultivating public opinion and broadening awareness of climate science.

Trott (2021) found that 10- to 12-year-olds feel empowered by their knowledge and are eager to learn more and take action. A notable example of this is Greta Thunberg who, at the age of 11, became deeply concerned about climate change and the lack of action being taken (Queally, 2019). By 15, she had initiated her school strike campaign, which led to a global movement involving schoolchildren worldwide.

Based on these findings, it appears that this age group is particularly receptive to environmental education and social action initiatives. As such, focussing on ESE during this development stage can have a significant impact on future actions and behaviours.

### Summary

OER support the integration of ESE within K-12 settings by overcoming barriers such as limited teacher knowledge, resource accessibility, and lack of policy support. Although OER are freely available and can be adapted to meeting specific learning needs and contexts, their uptake in K-12 is limited due to awareness and support challenges. Meanwhile, current research, reports, and surveys clearly indicate that ESE is a vital part of addressing local and global environmental issues through literacy and social responsibility, yet several challenges persist. Although BC has redesigned curriculum and instituted ESE and climate change education policies, OER can provide a practical solution for teachers to incorporate high-quality, relevant, and adaptable resources for ESE. To date, OER for ESE is an underrepresented and under researched area, thus this study is relevant and timely.

The ideal target age range for ESE is 10 to 13 (Grades 5 to 7), when students develop key cognitive and social skills. Furthermore, just as children grow and evolve, so too must the resources being used to teach them, this makes OER ideally suited as resources that can be modified, adapted, and changed to suit shifting circumstances.

The review of current literature shows a significant gap between OER usage in higher education and the K-12 sector. Research engaged with these topics has existed for over a decade in higher education while equivalent research in K-12 is largely absent. Post-secondary studies, although limited, started as early as 2012 with Teixeira et al. (2012) demonstrating how OER could provide access to climate change education to a wider range of students in terms of ages, social

groups and ethnicities. More recent post-secondary research conducted by Luis et al. (2025) focussed on OER and sustainable practices. Their research was part of a project promoting local sustainability awareness through open educational innovations, and undergraduate students created OER that incorporated principles of a circular economy (Luis et al., 2025). The absence of K-12 research is notable because practical development of K-12 OER is accelerating. Institutional initiatives such as the OER Project's (2025) climate course and the Massachusetts Institute of Technology (Newton, 2025) open climate learning programs, and OER repositories like the OER Commons Climate Hub (n.d.-b) and BCcampus (J. Gray, n.d.) indicate a considerable rise of content. The disconnect between the growing availability of resources and the lack of related academic literature constitutes a significant gap. This study aims to address this gap by identifying and evaluating these existing resources, ultimately producing a curated, accessible list for BC educators. The way in which the study is conducted to achieve this is described in Chapter III.

### Chapter III. Methodology

#### Introduction

This chapter provides a description of how my positionality and worldview influenced my approach to the research. It also details the research design and ensuing research process and methods used for collecting and analyzing OER data, including the use of an AI tool called Google Gem. To conclude the chapter, I discuss the important aspects of the study's reliability, validity and ethical considerations.

#### Research Approach

According to Creswell and Creswell (2022), a research approach is selected based on the research problem being addressed, the researcher's worldview, and the audience. In this case, I explored the availability of OER to address the issue of BC educators' lack of access to high-quality, locally relevant resources to teach ESE.

The two central questions to my study are "To what extent do Open Educational Resources for environmental education exist for Grades 5 to 7?" and "How well do they align with British Columbia curriculum standards?" These questions are based on a real-world educational need, which aligns with a pragmatic focus on practical solutions. A pragmatic approach emphasizes "what works" in practice, rather than adhering strictly to a single philosophical stance (Creswell & Creswell, 2022).

#### Positionality

I acknowledge that my background and experiences influenced how this research was approached, conducted, and interpreted. My perspective is based on my experience as a privileged, educated, middle-aged female of European descent. I grew up in a large, blended family

living in cities and rural areas across Canada and have settled in a small mountain town in southern British Columbia. I would like to acknowledge the sngaytskstx tum-xula7xw (Sinixt), Secwepemcúl'ecw (Secwépemc), Ktunaxa ʔamakʔis, and Syilx tmixw (Okanagan) Nations. This area, also known as Revelstoke, was historically a meeting place for these nations. I am learning more about the original caretakers of the area and am working to include that learning as a mother, educator, community member, and now, as a researcher. My parents were also educators and instilled a commitment to learning and respect for education. As a result, I have been a lifelong learner and worked in the outdoor industry as an educator and guide. Part of my learning included an introduction to open education, systems thinking, and UNESCO's (n.d.-a) Sustainable Development Goals.

I am not a K-12 teacher; I came into education through outdoor learning and instructing a range of ages from children to adults in a variety of settings and contexts, most recently the snow and avalanche industry. I studied Forest Resources Management to better understand why BC used certain forestry practices and, over the years, I have educated myself on sustainable practices, both industrially and personally. This learning included the concept of degrowth, a term coined by Andre Gorz, where endless capital growth is unsustainable and we must reduce our consumption of resources (Diez-Gutiérrez et al., 2024). I brought these perspectives into my research.

My topic of study and research design are also influenced by my status as a widow and solo mother of two school-aged children where I seek to meaningfully address issues that directly impact my family. My worldview is further influenced by my strong environmental ethics and belief that education at an early age is essential for making meaningful change; these are central to my personal values and professional interests.

As a result of environmental values and ethics, tensions arose between my commitment to minimize my ecological footprint, and the energy demands of AI technology. To reconcile these values, I took a very intentional approach. I limited my AI usage to the development of high-impact, open access materials that can be used repeatedly, and crafted thoughtful, specific and detailed prompts to minimize the number of iterations required to produce high-quality outputs, for example the flowchart found in Appendix 3. Worldview

Creswell and Poth (2018) asserted that a researcher's values influence the philosophical perspective, approach, and method they employ. Likewise, research questions can be a determinant of the approach taken (Creswell & Plano Clark, 2017). In this case, neither my perspective nor the research questions fit with either a positivist or interpretive epistemology, therefore a pragmatic approach was the logical choice. The central questions to my study are "To what extent do Open Educational Resources for environmental and sustainability education exist for Grades 5 to 7?" and "How well do they align with British Columbia curriculum standards?" By answering these questions, I aimed to identify gaps in existing resources and compile a curated list of OER for environmental and sustainability education for BC teachers. Thus, I took a pragmatic worldview in my research because the aim was to find a practical solution to a real-world problem.

My positionality promotes inherent biases in my research. My privilege may limit my ability to understand experiences outside of my own, while my environmental ethics may predispose me toward certain interpretations or solutions. However, in recognizing and acknowledging these biases, I maintained self-awareness throughout the research process, engaged different perspectives through peer review, and incorporated reflective practices including maintaining a research journal throughout the study.

## Research Design

Based on the literature, research conducted on OER and ESE as separate topics are primarily qualitative in design. This is largely due to the complexity of social interactions, perceptions, and behaviours associated with these topics which are difficult to quantify (Creswell & Poth, 2018). Thus, qualitative methods are appropriate where researchers take an exploratory approach and focus on interpreting experiences and perspectives. This method also acknowledges the influence of researcher bias, which can influence research outcomes.

To address the central questions, I conducted a document analysis by systematically reviewing and categorizing Open Educational Resources based on their relevance to environmental education and alignment with BC core curriculum standards. As a result, I developed an understanding of the current state of OER for environmental education in BC. My findings not only describe the current landscape but also generate recommendations for educators and policymakers to address gaps in resources. As a result, this qualitative study took an applied and pragmatic research approach (Creswell & Creswell, 2022).

## Research Method

To determine the availability and alignment of OER for environmental education in BC, qualitative document analysis was deemed the most suitable research method. Document analysis is “a systematic procedure for reviewing or evaluating documents” (Bowen, 2009, p. 27; Fischer, 2006) where documents can include a variety of formats, including digital and text based (Fischer, 2006). For this study, the analysis of OER from major repositories provided a greater understanding of what is available and increased knowledge with regards to the state of OER in the K-12 context when it comes to the delivery of environmental education.

Different document analysis strategies and procedures exist and are applied based on the research questions and type of research conducted (Chanda, 2021). For this study, documents were selected based on pre-determined criteria (see Appendix 2) to identify OER suitability including age-appropriateness for Grades 5 to 7, language options, currency, and licensing for use and adaptation. The content of these documents was then evaluated for their alignment with BC educational standards using a curriculum alignment checklist (see Appendix 1). This checklist was verified and validated by three independent and experienced BC teachers for accuracy and relevance. This type of systematic review using pre-determined criteria is called a content analysis which determines the presence of certain words and concepts within texts (Chanda, 2021).

### ***Limitations of Document Analysis***

Although document analysis is normally used to supplement data or verify findings from other sources, as achieved using triangulation between multiple data sources, it can also be used as a stand-alone method (Bowen, 2009; Morgan, 2022). This study was conducted at a master's level and explored a narrow research question aimed at analyzing textual content, thus document analysis on its own is appropriate. Furthermore, given the limitations of time and resources as a graduate student project, document analysis is efficient, cost-effective and provides a logical way to obtain data and highlight the current state of ESE in OER in BC using readily available and public documents. According to Morgan (2022), using pre-existing documents as data reduces time and is relatively simple to conduct. The methodology of this study is designed to be easily reproduced by others using different subjects and in other provinces.

Limitations of using document analysis as the sole research method include the potential for bias in document selection resulting in an incomplete collection (Bowen, 2009). In addition, documents by themselves do not provide direct evidence or a complete understanding of what actually takes place in local districts, schools, and classrooms when it comes to using OER for

delivering environmental education. Likewise, relying on pre-existing texts can result in limited data in line with the research problem and may not provide the content needed for the research (Morgan, 2022). To reduce bias and ensure a comprehensive data set, as large a selection as possible was used, and each document was verified for authenticity, credibility, accuracy, and representativeness using a transparent and reproducible checklist of criteria.

### Research Process

The research process included four phases which are summarized below, then described in detail. To ensure this research process was reliable and valid, Athabasca University's OER Librarian, Dan Cockcroft was consulted. This consultation included verifying the research process phases and determining OER and material type exclusion and inclusion criteria.

#### **Phase I: Criteria Development and Validation**

1. **Identified** OER Suitability Criteria (see Appendix 2)
2. **Developed** BC Curriculum Alignment Checklist (see Appendix 1)

#### **Phase II: Data Collection and Sampling**

3. **Searched** major OER repositories and platforms to identify resources related to environmental education for Grades 5 to 7 using targeted terms: *climate change*, *environmental literacy*, *conservation*, *sustainable development*. Additional search parameters used are described in detail in Appendix 3.
4. **Compiled** raw data onto an Excel spreadsheet.

#### **Phase III: AI-Assisted Data Analysis**

5. **Created** a Google Gem prompt to run targeted, one-by-one queries of website and PDF information for each OER.

6. **Conducted** an initial document analysis of OER using Google Gem to determine alignment with four areas of BC curriculum, CC license type, language, and grade levels.
7. **Compiled** AI generated comma-separated value (CSV) data onto a spreadsheet.
8. **Verified** AI outputs to ensure accuracy and reliability of information.

#### **Phase IV: Data Findings**

9. **Identified** trends, gaps, and patterns in the available OER (number that meet BC curriculum, license types, subjects represented)
10. **Developed** actionable recommendations for improving OER distribution in BC for the purpose of delivering environmental education.

#### **Phase I: Criteria Development and Validation**

OER Suitability Criteria (see Appendix 2) parameters included resource type (lesson or unit plan), age-appropriateness, currency (created within the last decade), and licensing for use and adaptation (must allow for the 5Rs of OER). The BC Curriculum Alignment Checklist (see Appendix 1) was based on the Ministry of Education BC Curriculum website and the work of Younghusband et al. (2025). This checklist assessed OER alignment with Core Competencies, Big Ideas, Learning Standards, and the First Peoples Principles of Learning.

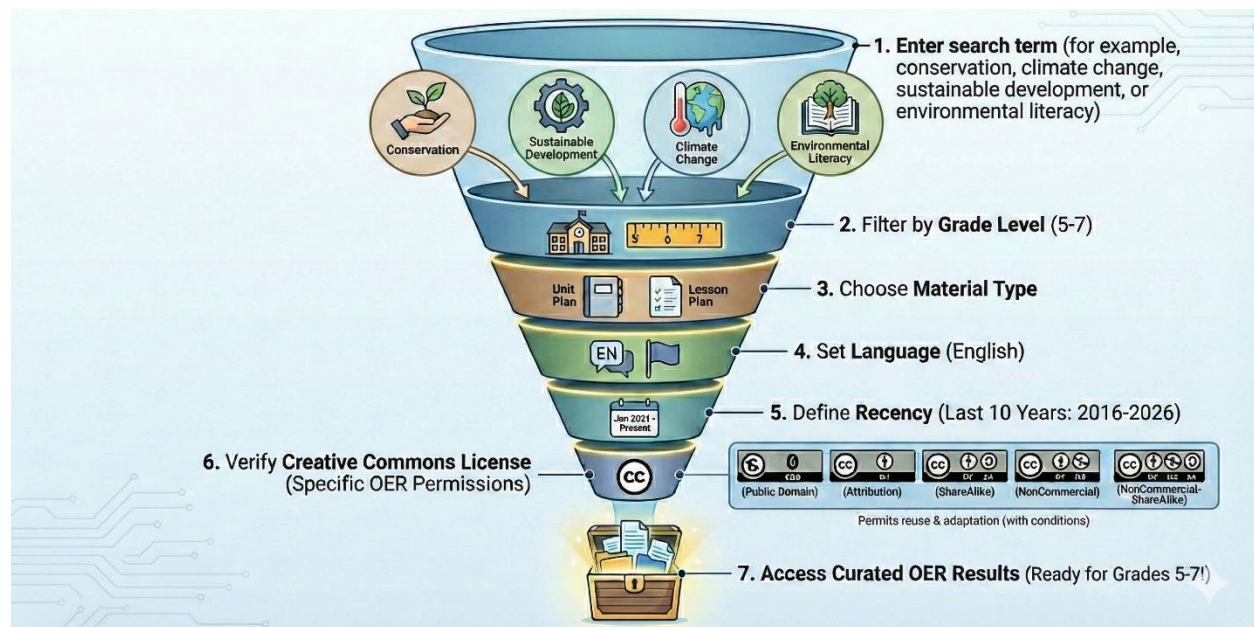
To ensure validity, these criteria were reviewed and verified by Dan Cockcroft and three experienced BC educators with over 60 years of combined teaching experience (N. Ford, personal communication, January 14, 2026; S. Newton, personal communication, January 6, 2026; M. Paskevicius, January 13, 2026). Standard definitions for material types were obtained from the OER Commons website where a lesson plan is “a teacher-facing description of a course of instruction” (2019, line 13) and a unit plan or unit of study is “a plan of instruction on a particular concept; it contains multiple lessons that are related” (2019, line 22).

#### **Phase II: Data Collection and Sampling**

Using the OER for Environmental and Sustainability Education: Search Parameters and Filters (see Appendix 3), raw data was compiled onto a spreadsheet with the following headers: OER title, persistent URL, link to lesson/unit plan, author, repository. Individual lesson or unit plan PDFs were then downloaded to a desktop folder. Figure 2 illustrates the general search process used for collecting resources from the selected repositories.

**Figure 2**

*OER for Environmental and Sustainability Education: Search Parameters and Filters*



Note. Infographic displaying the search process for finding OER for environmental education. Created with Nano Banana Pro.

### **Phase III: AI-Assisted Data Analysis**

Dr. Soroush Sabbaghan (University of Calgary, 2025) is the creator of an AI tool, smartie.dev, which is used to generate lesson plans that align with BC curriculum. Sabbaghan (personal communications, Nov. 11, 2025), suggested that Google Gemini, or similar AI models, be used for content analysis to run targeted queries that collect alignment insights. Initial trials using the prompt, “Compare this OER [paste link] with the following checklist items [paste Appendix 1: BC Curriculum Alignment Checklist]. Summarize findings in a table containing each of the checklist

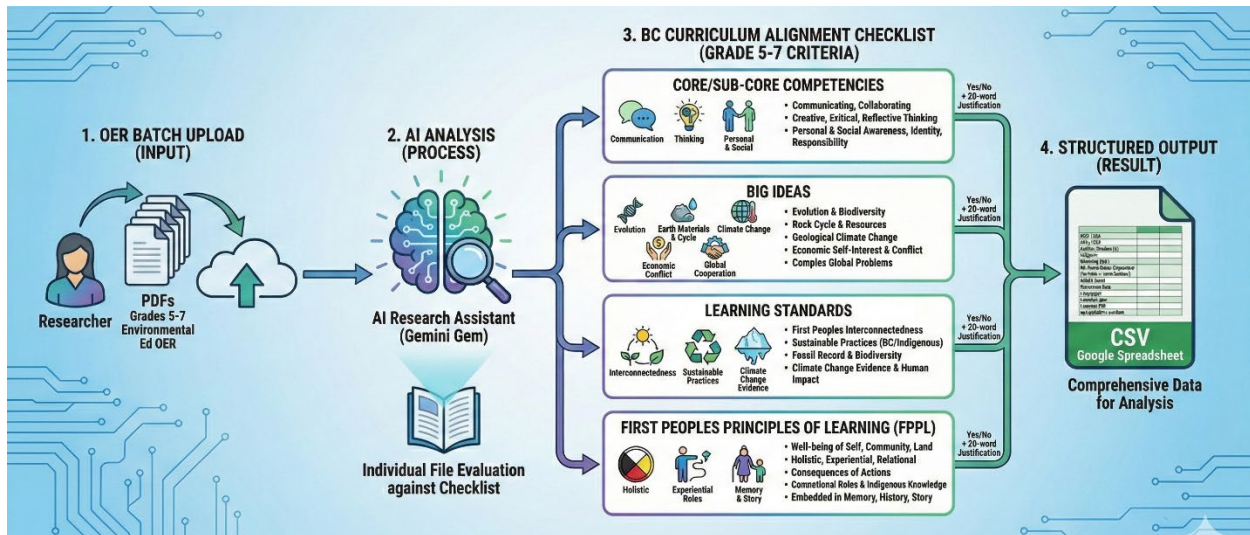
*items*”, showed that Google Gemini produced similar results to my own. Further guidance from Sabbaghan (personal communication, January 9, 2026) was to use Google Gemini Pro’s custom AI tool, called Gems, to assist with initial data analysis.

Gemini Gems enable users to provide “highly detailed prompt instructions” (Google, n.d.-a, para. 2) with uploaded files. These prompts and customized tasks can be saved and used repeatedly (Google, n.d.-a) unlike Gemini alone. I followed detailed instructions on how to create a custom Gem using the Gemini Apps Help website (Google, n.d.-b). The resulting Gem includes a lengthy prompt that describes the role the Gem was to play (research assistant); what the Gem was to do (analyze each file against specific criteria); the criteria (see Appendix 1: BC Curriculum Alignment); and specific formatting for the outputs (CSV).

These prompt components are reiterated by Gray (2025) who also recommends defining the audience and treating the first AI response as a draft that can be improved through iterations. Three iterations were performed and the final prompt and description of the workflow can be found in Appendix 4 and summarized in Figure 3 below.

**Figure 3**

Workflow for Analysis of OER using Artificial Intelligence



Note. Infographic displaying the workflow using Gemini Gem for research analysis. Created using Nano Banana Pro.

To ensure reliability of the AI outputs, I manually conducted a comprehensive analysis of 13% (21 out of 165) of the OER and cross-checked my results with those generated by Gemini Gem. Specific outcomes of this endeavour are described in Chapter IV Results.

### Phase IV: Data Findings

#### Reliability and Validity

The quality of research is based on its reliability and validity. Research validity, or accuracy, can be verified using a number of strategies throughout the research process (Creswell & Poth, 2018). For this study, the following procedures were implemented:

- using as many OER repositories as possible to obtain the highest number of resources,
- disclosing researcher biases that influence the interpretation of the data,
- validating the research process with an OER librarian,
- verifying BC curriculum criteria with active classroom teachers,
- validating OER suitability with OER librarians' requirements,

- maintaining detailed records of search strategies, file naming conventions, content analysis process, and reflective notes, and
- debriefing with and having peers and supervisors review the data.

All data was compiled in a non-proprietary comma-separated values (CSV) spreadsheet format and securely stored in three places, Athabasca University's SharePoint, a folder on my personal password-protected computer, and an external hard drive kept in a home office. Accompanying this spreadsheet is a data dictionary, created as a plain text (TXT) file, that describes and defines the column headers or variables (see Appendix 6). In addition, a readme file describes how data was collected and organized, file naming convention, search strategies, licensing, main contact, and methodology (see Appendix 7).

As a research method, document analysis must be conducted meticulously to produce valid and reliable research (Morgan, 2022). According to Morgan (2022) and Bowen (2009), critical elements of document analysis are to ensure documents are authentic, meaningful, and well represented. Prior to starting the study, I could not determine the number of documents needed for sufficient data to fulfill this criterion. This depended on finding resources that met the initial OER Suitability Criteria (see Appendix 2). A sufficient dataset was only determined once OER repositories began producing repeat and redundant results and I had collected more than 200 documents from which to gain insights on gaps, trends, and themes (Merriam & Tisdell, 2016).

Reliability, on the other hand, shows that the researcher's procedures and analysis are consistent between different researchers and projects (Gibbs, 2018). For this study to be consistently applied, I provide detailed descriptions of the data-handling, OER Suitability Criteria, BC Curriculum Alignment Checklist, and content analysis processes as recommended by Creswell and Poth (2018).

To increase the trustworthiness of this research, I provide a clear rationale for sampling design decisions, determination of data saturation, and ethical considerations in research design (Marshall, 1996).

## Ethics

As stated by Merriam and Tisdell (2016), document analysis reduces ethical concerns compared to other qualitative methods. According to Morgan (2022), when content is considered public, there is less need to protect the confidentiality and privacy of the individuals who created it, especially if creators are not children or other vulnerable groups. In this case, the resource authors and creators intended for the materials to be public and have granted different levels of access and usage through Creative Commons licenses. These licenses are based on traditional copyright; however, they give more options to creators in terms of how others use their work (*What Is Creative Commons?*, n.d.). Likewise, as per the Tri-Council Policy Statement exemptions, the study does not involve human participants, or their data, and the research uses readily available and open resources.

## Summary

This chapter presented a detailed description of the research approach, design, method, and process used to determine the availability and suitability of existing OER for Grade 5 to 7 environmental education in BC. It included my positionality and worldview, both of which influenced all aspects of the research. All information presented in this chapter is intended to increase the transparency, reliability, credibility, and validity of the study. In the next chapter, I present my findings and answer each of the central and sub-questions.

## Chapter IV. Results

### Introduction

This chapter describes the findings of the study, detailing the availability and curriculum alignment of OER for environmental education in Grades 5 to 7. It summarizes how I collected and analyzed data, including the initial Gemini Gem analysis and the final analysis of the compiled data. The results are organized to first address the research sub-questions, followed by a description of how they answer the central questions, as listed below.

I also discuss the implications for each result with regards to OER, K-12 and ESE, and how the results either relate to existing research or introduce a new perspective. Additional findings regarding OER repositories and AI as a research assistant are likewise discussed.

### Sub-questions:

- What OER are currently available for teaching environmental education to students in Grades 5 to 7?
- To what degree do the identified OER align with the four key areas outlined in the BC curriculum for environmental education?
- What gaps, if any, exist between the available OER and the requirements of the BC curriculum for environmental education?

### Central questions

- To what extent do Open Educational Resources for environmental education exist for Grades 5 to 7?
- How well do these resources align with British Columbia curriculum standards?

### ***Data Collection***

To determine what OER are currently available for teaching Grades 5 to 7 environmental education, I began with finding suitable repositories. The search for OER for environmental education revealed a significant gap in usability in current OER repositories. While numerous repositories exist, many fail to meet the needs of K-12 educators.

**Repository Options.** To identify potential OER repositories for K-12 resources for environmental education, I consulted with OER experts, including three OER Librarians and an Associate Professor and Program Director who specializes in open education. Of the 12 recommended repositories, the majority were excluded due to poor user experience (challenging navigation and not intuitive), limited search functionality, a focus on textbooks only, or a lack of K-12 materials. Consequently, only four repositories were used to identify suitable OER (Table 3). These were selected for their search functionality, filter options, quality and quantity of outputs, and availability of K-12 lesson and unit plans.

**Table 3**

*Selected OER Repositories for Environmental Education*

<b>Repository / Browser</b>	<b>URL</b>	<b>Rational for Selection</b>
OER Commons	<a href="https://oercommons.org/">https://oercommons.org/</a>	Excellent filters, high volume of resources
Share My Lesson	<a href="https://sharemylesson.com/">https://sharemylesson.com/</a>	Extensive teacher-contributed resources
Subject to Climate	<a href="https://subjecttoclimate.org/">https://subjecttoclimate.org/</a>	Comprehensive, high-quality environmental content
Advanced Google Search	<a href="https://www.google.ca/advanced_search">https://www.google.ca/advanced_search</a>	Extensive filter options

It is worth noting that, of the four options listed above, two (Share My Lesson and Subject to Climate) required creating an account to access lesson and unit plan resources. Also, there were

approximately 30 OER that were found in both the OER Commons and Subject to Climate repositories.

**License Type Filter.** Initial searches using the OER for ESE Search Parameters and Filters (see Appendix 3) generated 226 results, however only 165 of these met the 5R requirements of OER. Approximately 37% (61 out of 226) of resources initially found were omitted from the final list to be analyzed due to having a traditional copyright or No Derivative (ND) clause. These were not excluded at the outset due to limitations on repository search functionality, for which license type could not be filtered.

This finding implies that while there is an abundance of free resources, there are far fewer that are truly open content in the form of OER. This distinction is fundamental; as Elder notes, “OER should be able to exercise all the 5Rs of open content” (2019, para. 4). Without the ability to remix or revise, educators cannot make changes to resources based on their local environmental contexts or specific learner needs.

### ***AI-Assisted Initial Analysis***

To determine the degree of alignment between identified OER and the four areas of BC curriculum: Core/Sub-core Competencies, Big Ideas, Learning Standards, and First Peoples Principles of Learning, Gemini Gem was used for initial analyses. Additionally, Gemini Gem was tasked to detect the: year produced, author, grade level, and license type.

**Gemini Gem Analysis.** My original prompt for Gemini Gem included OER webpage addresses (URLs) and links to Google Docs or a webpage for each OER unit or lesson plan. This resulted in inaccurate data for most AI outputs, including OER titles, BC curriculum alignment, year produced, author, and license type. This was largely due to Gemini Gem's inability to access Google Docs and an excess of information to analyze at one time. Likewise, OER information regarding the license type, author, and year produced was inconsistently listed on the webpages and Google Docs.

To rectify this issue, I downloaded individual PDFs of lesson plans into a desktop folder and renamed them as necessary for traceability. These steps were taken so that the Gemini Gem analysis of individual PDFs was authentic, linked to the primary source, and could be easily traced back to the original OER (Morgan, 2022). Further testing and analysis using Gemini Gem was conducted by uploading batches of 20 or less individual PDFs. This produced more reliable results with fewer errors, especially with regards to the four areas of curriculum alignment.

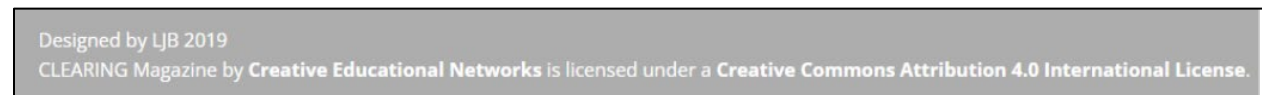
To assess the reliability of the automated analysis, I first conducted a manual cross-check of 10% of the total OER (15 out of 165). The curriculum-alignment results generated by Gemini Gem showed a high degree of inter-rater reliability, corresponding with my manual analysis 94% of the time. Based on a recommendation from one of my supervisors, Dr. Cynthia Blodgett-Griffin, I analyzed an additional five resources, increasing the sample to 13 % (21 out of 165). With the inclusion of these additional OER, inter-rater reliability increased to 96% (81 out of 84 responses). It was evident that, like my analysis method, the AI tool searched for common terms and made thematic connections between the OER and curriculum parameters provided. This similarity was substantiated by the 20-word justifications that I required of Gemini Gem for each alignment decision.

The high alignment accuracy may be largely attributed to the broad, conceptual nature of BC curriculum. Because the provincial standards are designed to be flexible, identifying alignment between OER and curriculum areas is straightforward. As indicated earlier, to date BC teachers independently determine whether a resource can be used in their class based on their professional interpretation of BC Curriculum. Additionally, OER were deemed to be in alignment with a BC curriculum area if it met one or more of the criteria, as listed on the BC Curriculum Alignment Checklist (see Appendix 1). Given that there are several criteria options for each curriculum area, it is straightforward to find alignment with at least one of the criteria. Given these conditions, I deemed 96% reliability sufficient to accept the unverified AI responses for curriculum alignment.

**Gemini Gem and Repository Limitations.** In contrast to the high accuracy with curriculum alignment, the Gemini Gem generated incorrect license types approximately 50% of the time, highlighting a critical limitation. The inaccuracies were most evident when license specifications were embedded as footers on webpages or when repositories provided contradictory information. For instance, in the resource *Using Stations to Increase Student Independence*, where the license information was contained in a website footer (Figure 4), the Gem identified the license as CC BY-SA 4.0, misreading the actual CC BY 4.0 designation. Further errors were noted within the Share My Lesson repository, where the AI frequently misidentified CC BY-NC-ND as either Public Domain or standard Copyright.

#### Figure 4

*Example of License Information in Website Footer*

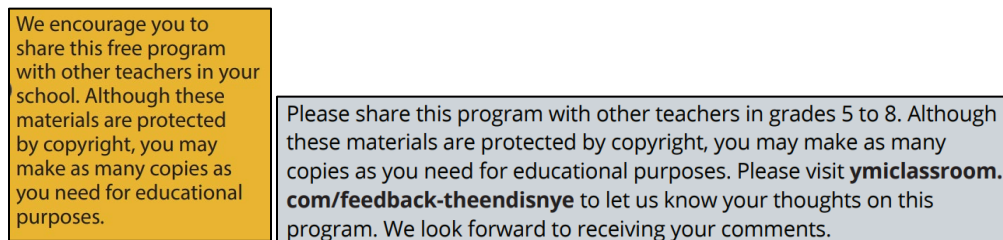


*Note.* License information in the footer of the Clearing Magazine website.

These inaccuracies were compounded by unreliable repositories themselves. On the Share My Lesson platform, several resources were labelled as CC BY-NC-ND, yet the internal lesson plans clearly stated that they were protected under traditional copyright by third-party organizations such as *Young Minds Inspired* and the *National Frozen and Refrigerated Foods Association* (Figure 5)

### Figure 5

#### *Traditional Copyright Statement Examples*



*Note.* Screenshot from Share My Lesson PDFs describing license information.

Similarly, Subject to Climate displayed CC BY-NC on its landing pages, while the downloadable PDFs were labelled CC BY-NC-SA. Given the unreliability of Gem and discrepancy within repositories when it came to identifying license type, I manually verified each license designation to ensure accurate and reliable results.

These results suggest that detailed prompts with defined criteria and small batch PDF processing effectively minimize bias and misinformation for AI to conduct thematic content analysis. The high accuracy in BC curriculum alignment can be attributed to the broad and interpretative nature of the provincial standards; thus, thematic connections can successfully be made. However, AI lacks the precision for legal and technical metadata verification and, in combination with the inaccuracies in license labelling, even within repositories themselves, human oversight and verification is necessary.

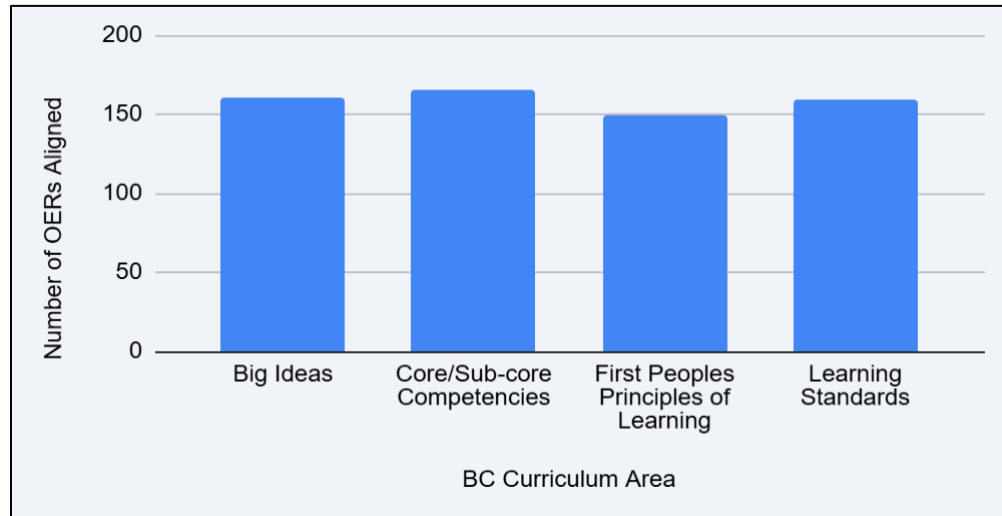
#### ***OER Alignment with BC Curriculum***

The central questions of this study asked: “*To what extent do Open Educational Resources for environmental education exist for Grades 5 to 7?*” and “*How well do these resources align with British Columbia curriculum standards?*”.

Based on a comprehensive analysis of the data there are many OER for environmental education available. Most OER, despite being created for a general or international audience, show a surprisingly high degree of alignment with BC Curriculum, especially in three of the four major areas, namely Core Competencies, Big Ideas, and Learning Standards (Figure 6).

### Figure 6

*Distribution of OER Alignment with BC Curriculum Areas*



The highest area of alignment were the Core/Sub-core Competencies (165 matches). OER focussed on environmental and sustainability education naturally lends itself to competencies that include “Critical Thinking” and “Communication.”

Big Ideas and Learning Standards (161 and 159 matches) also showed strong alignment, likely because environmental topics such as evolution (changes over time), biodiversity, and evidence of human impacts are strongly represented in science curriculum.

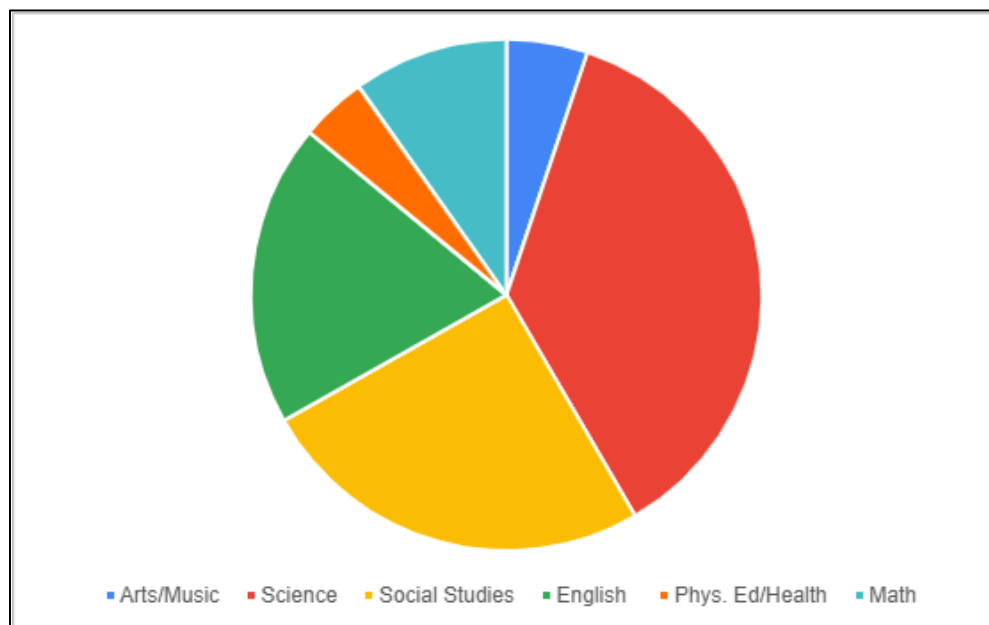
While lower than other areas, the First Peoples Principles of Learning (149 matches), was higher than anticipated. This was due to thematic connections made between OER content and the principles to do with community, well-being, interconnectedness between all beings, and consequences of one's actions.

### ***OER Distribution by Subject, License Types, and Repository***

Even though OER availability is high, they are not evenly distributed across all subjects (Figure 7), vary widely with user permissions, and are more easily found using specific repositories.

**Figure 7**

*Distribution of OER by Subject Area*



*Note.* Distribution of OER is shown across six standard subject areas, Arts/Music, Science, Social Studies, English, Physical Education/Health and Math.

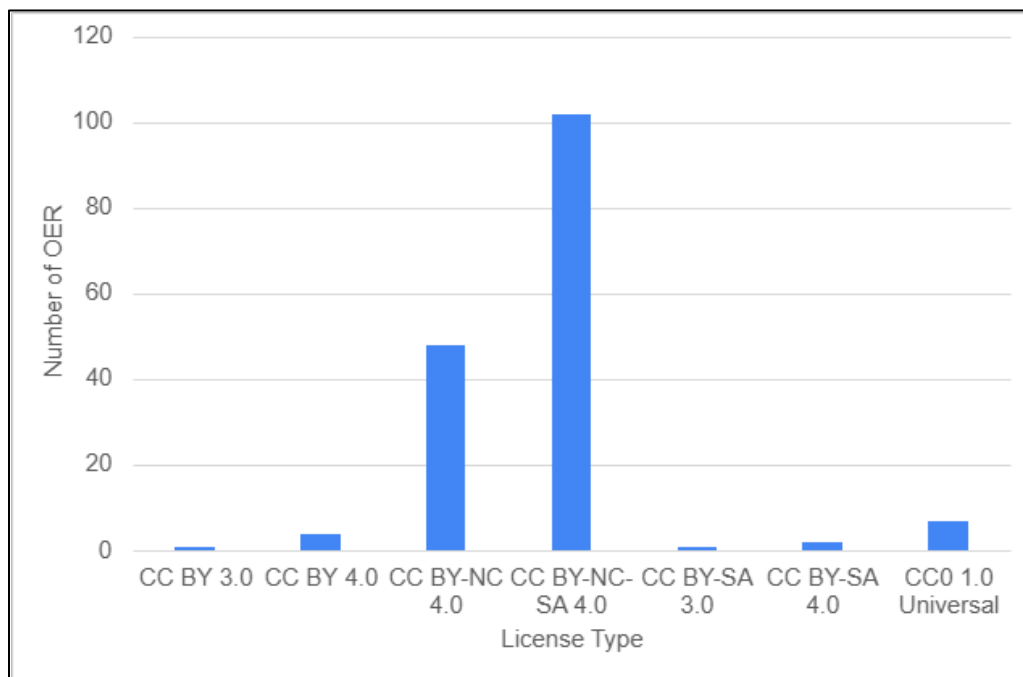
Analysis by subject area confirmed that ESE is still dominant within the sciences (78 OER). The least represented subjects include Math (21), Fine Arts (11), and Physical Education (9). These findings are consistent with prior literature where ESE is often viewed as a science rather than a

cross-curricular topic. This suggests an opportunity for developing interdisciplinary resources that integrate climate and environmental education into numeracy and applied arts.

As mentioned earlier in this chapter, 37% of the resources were excluded from the final analysis due to a No Derivative (ND) or traditional copyright clause. Within the remaining 165 OER, CC BY-NC-SA 4.0 was the predominant license type with 102 (Figure 8). This license gives users the ability to adapt, modify, and copy the resources for non-commercial purposes. The resource can also be redistributed as long as proper attribution is provided, and it is shared using the same license as the original (i.e. SA = ShareAlike). (Creative Commons, n.d.)

**Figure 8**

*OER Distribution by License Type*

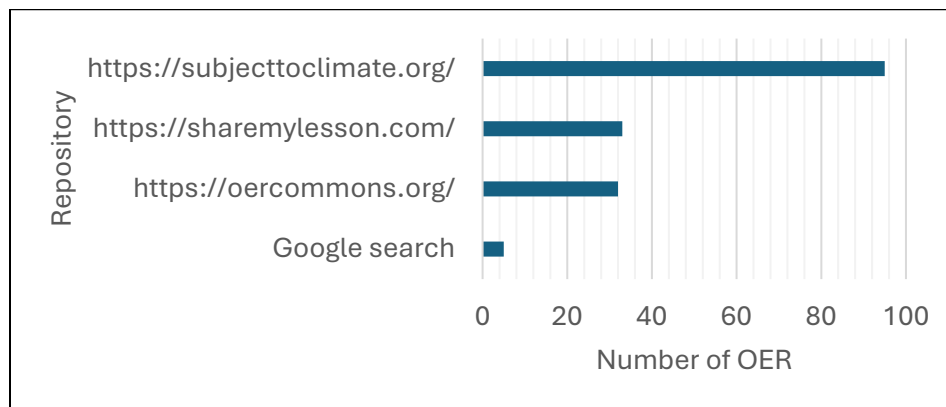


Not surprisingly, 90% of OER (150 out of 165) included a non-commercial requirement such that the resources are intended for free educational purposes (Creative Commons, n.d.) In contrast, and as shown in Figure 8, only 12 OER had no restrictions on their usage (CC BY 3.0, CC BY 4.0, CC0).

Data were also analyzed based on distribution of resources across the selected repositories. Findings clearly show a high concentration of content within specialized platforms. As illustrated in Figure 9, Subject to Climate is the primary source, contributing over half of the curated OER (57.6%). In contrast, Share My Lesson and OER Commons provided a moderate amount of resources, 20% and 19.4% respectively. Most notable, despite its broad reach, an advanced Google Search produced only 3% of the results.

**Figure 9**

*Distribution of OER by Repository*



Of note, if combined with OER Commons' comprehensive search functionality, Subject to Climate would be the ideal repository for finding suitable resources for environmental education. Instead, it lacks a filter for license types, therefore search results include resources with No Derivative limitations.

Results displayed in Figure 9 suggests that while general search engines and broad OER repositories are useful for initial exploration, specialized repositories focussing specifically on climate and environmental literacy provide the most effective and efficient way of finding relevant, high-quality resources.

## Dissemination

The above results along with the analyzed data and infographics on search filters for ESE and how to use Gemini Gem as part of content analysis will be shared with several parties who have indicated interest. A summary of what will be shared and with whom is contained in Table 4 below.

**Table 4**

*Dissemination of Research Findings and Curated Resources*

<b>Stakeholder Category</b>	<b>Intended parties</b>	<b>Resources Shared</b>
K-12 Educational Organizations	School District 19 (Revelstoke); BC Teachers' Federation Environmental Educators Professional Specialists Association; BC Teachers' Federation Committee for Action on Social Justice	BC Curriculum Alignment Checklist; Curated OER Database
Global OER Communities	OER Commons – Climate Hub; Learning Equality	Curated OER List (CSV)
Post -Secondary Programs	BC Ministry of Education – <u>approved teaching programs</u> (UVic, UBC, TRU, UNBC, VIU, SFU, TWU, UFV)	OER for ESE Search Parameters and Filters; Curated OER Database
Research Conferences	Open Education Conference; Athabasca University – Graduate Research Conference; Open Education Global; Outdoor Learning Leadership Conference	Research findings

Given that no such tool exists, the School District 19 District Vice-Principal suggested that the BC Curriculum Alignment checklist be made available to school and district administrators to use when obtaining resources for their schools (N. Ford, personal communication, January 14, 2026). In addition, the openly licensed (CC-BY 4.0) curated list of OER will be sent as an Excel spreadsheet with a tab outlining the benefits of OER and links to Creative Commons license

description. Pending the timing of completion, the Excel spreadsheet may be replaced with a direct hyperlink to the OER Commons – Climate Hub where the resources will be made available.

### Summary

In Chapter IV, I presented findings from the AI-assisted data analysis and interpretation based on the study's central and sub-questions. The analysis revealed a significant limitation within repositories and OER materials themselves in terms of lacking license filters and a prevalence of restrictive license types (No Derivative and traditional copyright). The use of Gemini Gem for document analysis indicated that AI is a proficient tool for making thematic connections between OER and BC curriculum areas. However, the AI was unable to achieve technical accuracy with information such as license types, author(s), and year produced. Consequently, manual verification was required to ensure the legal and technical information was accurate. In Chapter V, I discuss the implications of these findings, limitations of the study, and suggest further areas of research, exploration, and opportunity.

## Chapter V. Discussion

### Introduction

OER represent a promising solution as accessible resources that are reusable, adaptable, and can be tailored to specific contexts and used across disciplines (Blomgren, 2018; Kimmons, 2016). As such, OER are ideal for teaching about contemporary and localized issues such as climate change, loss of biodiversity, sustainable development, ecological impacts of humans, and pollution. This research sought to identify OER that align with BC's environmental curriculum standards for Grades 5 to 7. A central finding of this study is that while an overwhelming number of environmental education resources exist, they are widely spread across the Internet and most fall under traditional copyright. This spread of materials and limitations on their use are significant barriers for educators seeking adaptable materials for their classrooms. However, of the identified OER, there is great potential for BC K-12 teachers to incorporate environmental and sustainability education.

In this final chapter, I discuss the implications and limitations of this study's unique findings in relation to OER, environmental education, and the K-12 context. I follow this with describing potential future research and development opportunities.

### ***Fully Open versus Partially or Completely Closed***

Many websites offering freely available teaching and learning resources for ESE were excluded from this study because even though the resources are indicated as "free", they still fall under copyright. This renders their use more limited especially when it comes to using the entire resource, versus only 10% or one chapter, as permitted by the Fair Dealings law. Likewise, educators are unable to adapt, mix, or modify these resources for specific places, contexts, and learner needs.

Furthermore, as noted in the results, 37% of the resources initially identified did not meet the 5R criteria of OER. A high volume of materials from repositories, particularly those on platforms like Subject to Climate, include a No Derivative clause. In addition, many of the No Derivative resources refer to specific states or cities, primarily in the United States. In an environmental and sustainability education context, these are significant limitations. ESE is fundamentally local, where a lesson on water conservation in the arid regions of BC must be significantly different from the same lesson delivered on the west coast of Vancouver Island. The ability to modify, remix, and adapt resources for instruction is essential. For example, OER for teaching a topic like climate science allows for: updating of data sets, adaptation to local climate topics, collaborating with community organization, and creating individual relevance and urgency (Newton et al., 2025; Schmizzi et al., 2025). Thus, the prevalence of No Derivative clauses warrants further research as to why resource creators chose these more restrictive Creative Commons licenses.

### ***Google Search Failure***

One of the study's most surprising outcomes was the ineffectiveness of an Advance Google Search, which produced only 3% of the final dataset. This was replicated with an experimental query using Google Gemini with the OER for ESE Search Parameters and Filters (see Appendix 3), which came up with only three viable OER. These poor results correspond with the findings of Muthu and Cheng (2019) where discoverability is one of the primary barriers to finding suitable resources. When there's a lack of metadata, neither humans nor machines can easily find the materials sought (Muthu & Cheng, 2019).

### ***OER Repositories***

OER are an effective way to provide widespread, instant, and constant access to environmental and sustainability education resources which can then be adapted, modified, mixed, and shared. However, no single repository serves as a source of OER for ESE; instead, users

must navigate multiple platforms to find relevant resources. While OER-specific search engines like the Mason OER Metafinder attempt to bridge this gap by searching well-known OER repositories based on metadata (Mason Publishing Group, n.d.), their effectiveness is limited by the inconsistent quality of existing metadata.

### ***Recommendations***

To overcome these barriers, I propose a three-pronged approach which aligns with the Dubai Declaration on Open Educational Resources (UNESCO, 2024b) recommendations:

1. improvement of metadata standards for current OER,
2. establishment of a specialized and sustainable K-12 hub, and
3. pre-service and in-service teacher training.

To improve metadata, a K-12 OER hub should have curriculum-specific filters, such as those aligned with the BC Curriculum, allowing educators to search by:

- topic,
- grade level,
- subject area,
- type of content (lesson plan, activity, video, image, podcast, etc.),
- educational standard (e.g., BC curriculum),
- language,
- educational use,
- primary user,
- media format, and most importantly,
- license type.

To achieve this single repository approach (i.e. a specialized and sustainable K-12 hub) requires more than this study's curated list of resources; there must be a sustainable, funded

system, similar to California's Education and Environment Initiative. California's initiative involves ongoing government and administrative support to maintain a repository for teachers focused on climate change and environmental justice (Newton et al., 2025). For educators outside of California, OER Commons offers a viable structure to serve as a go-to hub for ESE. The site is supported by the William and Flora Hewlett Foundation and the Institute for the Study of Knowledge Management in Education (ISKME), and as previously mentioned, its metadata and filter options are the most comprehensive. By disseminating this study's curated list to OER Commons along with the BC curriculum standards, this research provides an immediate point of entry for teachers. However, a long-term sustainable system cannot be based on digital storage alone; it requires clear policies to support the creation, use, maintenance, and storage of OER, as well as a commitment to teacher professional development.

It is widely agreed that teacher training must be provided at the pre-service and in-service levels, focusing on both digital literacy and environmental pedagogy (Arispe et al., 2025; DeBarger, 2019; Paskevicius, 2023). As demonstrated by the ClimaTePD project (Antonova et al., 2024), educators must be proficient in not only finding resources for climate education, but in the legal and technical skills to:

- identify and interpret Creative Commons licenses,
- adapt and remix OER to suit local environmental contexts, and
- redistribute and share modified resources back to the community (Bowen, 2009).

Pre-service and in-service teacher training on copyright and digital literacy, including OER awareness, establishes values, skills, and knowledge that can be applied to any teaching area. The Canadian website [www.openteacherab.ca](http://www.openteacherab.ca) is agnostic with regards to K-12 subject areas in order to support broader OER understanding. By using this site, teachers are guided through the legal

and technical skills outlined above, thus providing them with a starting point for discovering K-12 OER and how to use them.

Given that existing professional development and teaching programs are already intensive, additional learning objectives involving OER and ESE may be overwhelming. However, as was done in 2019 with the integration of Indigenous-focussed education across BC, these subjects can also be successfully introduced (Ministry of Education & First Nations Education Steering Committee, 2015). Additionally, generative AI tools may be well-suited to assist teachers with adapting and modifying existing resources through translation, summarization, simplification, adaptation for specific grade levels, or generating learning checks.

Ultimately, the recommendations for OER and ESE delivery are perfectly aligned. Both fields call for a centralized, curated, and accessible hub that provides flexible resources that can be contextualized and localized. Likewise, there is widespread agreement that pre-service and in-service training is needed to prepare and support teachers to deliver ESE (Arispe et al., 2025; DeBarger, 2019; Paskevicius, 2023). In other words, meeting the above recommendations would not only promote the use of OER, but it would also support environmental and climate action as core components of the K-12 curriculum.

## Limitations

While this study provides a comprehensive overview of OER for environmental education in BC, several limitations must be acknowledged.

### ***Methodological Limitations***

A primary methodological limitation of this study was the reliance on document analysis as a stand-alone method. While documents provide evidence of what resources are available, they do not reflect how these materials are actually implemented in the classroom (Bowen, 2009). In

addition, although the initial search for OER included 11 repositories and an advanced search using Google (see Appendix 3), the final analysis focused on four selected repositories that were deemed more user-friendly. This selectiveness may have excluded high-quality resources from repositories with poor search functionality or those requiring accounts.

### ***Technical Limitations***

The use of an AI tool for data analysis introduced specific technical limitations. As described by Dr. Yuen (2026), AI tools work well for data analysis with large data sets, along with the provision of detailed context, clear parameters and specific prompts. Although Gemini Gem achieved 96% accuracy in curriculum alignment, its broad analysis may have exaggerated alignment. BC curriculum is relatively general, therefore, Gemini Gem often identified positive alignment based on keywords rather than recognizing instructional strategies and lesson plan design. Likewise, Gemini Gem's inaccuracy with license, year created, and author detection is a significant technical constraint. The errors and false answers generated by AI required a complete manual verification of these details to ensure accuracy.

### ***Content Quality Limitations***

Although this study identified many BC curriculum-aligned resources, it was limited to resources created within the last decade and those suitable for Grades 5 to 7. Also, it did not determine the quality of the content in terms of instructional design, opportunities for deeper learning, learner activities, or accessibility. The temporal and grade-level limitations may have excluded OER that remain relevant and applicable to a broader audience.

This study did not determine the quality of the OER. Content quality is best determined by educators themselves; the audience for whom the resources are intended. As the OER Commons site currently does, I recommend that teachers be granted the ability to rate and review OER available in the platform (Muthu & Cheng, 2019). When combined with a sort by rating function,

higher rated, better-quality resources can be made more evident. In addition, for those unfamiliar with OER, specific rubrics exist for evaluating OER objects (see Appendix 5). In combination with teacher ratings and OER evaluation rubrics, a single repository would greatly simplify the search for superior resources.

#### Future Research and Development

With the release of this study, many research and development opportunities arise. These are described below.

##### ***Future Research***

Future research on OER for ESE could utilize a rubric for evaluating OER objects (see Appendix 5) to determine which resources lead to deeper learning. Mixed-methods studies could also be employed combining document analysis with focus groups or classroom case studies to evaluate the actual impact or effectiveness of these OER on student learning and the desired educational outcomes. Furthermore, one could determine the effectiveness of the identified OER on student behaviour and their sense of stewardship.

Another research project could explore why so many authors uploading their work to Subject to Climate opted to include a non-derivative (ND) clause with their resource, because this puts significant limitations on how the educational resource can be used or not.

Further exploration can be done to develop openly licensed AI prompts to help teachers modify OER for their area, students, purpose, or contexts (BCcampus OER Production Team, 2021; Kimmons et al., 2025; Ossiannilsson et al., 2024). Or, as David Wiley suggested in a recent presentation, creating OER prompts for students to enter into generative AI for interactive, formative, and educational sessions (Takahashi, 2025). However, with any of these endeavours, it

is imperative to be aware of the ethics, pragmatics, and environmental impacts of AI use (Calvo et al., 2024; Leffer, 2023; Wu et al., 2022; Yuen, 2026).

### ***Development Opportunities***

To meet UNESCO and Canadian government recommendations to embed climate and environmental education across all subjects (Field et al., 2019, 2023; LSF-LST, 2025a; P. Schwartzberg et al., 2022), I recommend OER be created and adapted beyond the sciences, in particular fine arts, physical education, and math. This development should be done in close collaboration with Indigenous climate leaders and curriculum writers to ensure the integration of the First People Principles of Learning and Indigenous knowledge systems, as these are integral to addressing environmental and climate issues while meeting BC curriculum requirements (Chrona, 2022; Government of Canada, 2025; Nakashima et al., 2018; UNESCO Canadian Commission, 2021).

OER access relies on users having a computer, internet connection and electricity. This is a significant limitation, creating resource inequalities, not only in remote areas of BC, but around the world. Organizations such as Learning Equality have created off-line digital platforms that provide equitable access to OER (Learning Equality, n.d.). They have also created tools for “matching resources to specific objectives and topic areas within a target curriculum” (Alexandre, 2023). With a list of curated OER, Learning Equality can provide ESE resources more widely, thereby working to achieve UNESCOs SDG 4 (*quality education for all*), SDG 12.8 (*ensure that people everywhere have the relevant information and awareness for sustainable development*) and 13.3 (*improve education, awareness, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning*) (Ossiannilsson, 2023; UNESCO, n.d.-a).

## Summary

In this final chapter, I highlighted the potential for OER to address the urgent need for localized, adaptable environmental and sustainability education in BC. Based on the study's findings and the current OER and environmental education context in BC, I described several implications, recommendations, and future opportunities for research and development. I conclude with final thoughts and summarize the study in the following section.

## Conclusion

Using a document analysis methodology, this study identified existing resources, gaps, and areas for improvement, ensuring that OER can be effectively integrated into the BC K-12 curriculum. It also provided a systematic process for analyzing OER that can be applied to other K-12 subjects and provincial educational standards, including the use of AI technologies to analyze resources. Results from this research are intended to be used as a starting point for future higher-level investigations involving interviews, surveys, or focus groups. Consequently, the more complex process of triangulation can be done, potentially extending the study to consider the effectiveness of these resources for both teachers and students. For example, further qualitative or mixed methods of studies can determine whether the use of the identified OER improve students' sense of stewardship and responsibility towards the environment.

The use of AI as a research tool assisted with efficient analysis of curriculum alignment. However, it is imperative that researchers are aware of the detailed prompt information required, ethical considerations, environmental impacts, and limitations of this technology.

The findings from this study confirm that many resources exist and the alignment with BC curriculum is strong, particularly in the science and social studies subject areas. However, the degree of access to these materials is often compromised by restrictive licensing, poor metadata, and repository search filter limitations. Proposed solutions include improving metadata standards, establishing a specialized and sustainable K-12 OER hub, and providing teacher training.

To deliver effective environmental and sustainability education in BC, teachers must move beyond merely finding resources to creating a sustainable system of sharing through the creation and use of OER. In doing so, educators adopt the principles of degrowth by moving away from proprietary and resource-intensive production cycles (e.g., textbooks and proprietary software)

and toward democratization of learning resources which remain useful indefinitely through the user's ability to retain, reuse, revise, remix, and redistribute.

This unique applied qualitative research addresses the pressing need for ESE in the face of escalating environmental challenges. By identifying and curating OER for Grades 5 to 7, the study provides educators with accessible and adaptable resources to teach ESE effectively. This ultimately contributes to the development of environmentally conscious and empowered citizens in British Columbia and supports UNESCOs SDGs, including promoting ongoing dialogue on the role of OER in K-12 and the importance of environmental education across all subjects.

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### Appendix 1: BC Curriculum Alignment Checklist

Core/Sub-Core competencies<sup>1</sup>

Are any of the CORE COMPETENCY - Sub-Core competencies addressed in the resource?	Yes / No
COMMUNICATION – communicating <ul style="list-style-type: none"> <li>Do students share or exchange information, experiences, and ideas?</li> </ul>	
COMMUNICATION – collaborating <ul style="list-style-type: none"> <li>Do students work together to pursue a common purpose or goal?</li> </ul>	
THINKING – creative thinking <ul style="list-style-type: none"> <li>Do students generate novel and/or innovative ideas and concepts?</li> <li>Do students reflect on existing ideas and concepts?</li> </ul>	
THINKING – critical thinking <ul style="list-style-type: none"> <li>Do students examine their own thinking and that of others based on reasoning, where students consider options, analyse options, and draw conclusions?</li> </ul>	
THINKING – reflective thinking <ul style="list-style-type: none"> <li>Do students reflect on and assess their experiences, thinking, learning processes, work, and progress in relation to their purposes?</li> </ul>	
PERSONAL AND SOCIAL – personal awareness and responsibility <ul style="list-style-type: none"> <li>Do students make connections between personal and social behaviours and well-being to make constructive and ethical decisions?</li> </ul>	
PERSONAL AND SOCIAL – positive personal and cultural identity <ul style="list-style-type: none"> <li>Do students make connections between who they are and what they value?</li> <li>Do students identify their personal strengths and abilities?</li> <li>Do students make connections between their relationships and cultural contexts, and how they shape who they are?</li> </ul>	
PERSONAL AND SOCIAL – social awareness and responsibility <ul style="list-style-type: none"> <li>Do students develop an awareness of their social, physical, and natural environments, and how their decisions, actions, and footprint impact these?</li> <li>Do students identify different perspectives on issues?</li> <li>Do students generate, use, and/or evaluate strategies to resolve problems?</li> </ul>	

<sup>1</sup> Based on: Younghusband, C. H., Banack, H., Lautensach, A., Litz, D., Crandall, J., & Thielmann, G. (2025). Climate education in teacher education: Researching our way into teacher leadership. In *Canadian research in teacher leadership: Transformative and contextualized agency* (pp. 642–672). Canadian Association of Teacher Education. <https://prism.ucalgary.ca/items/037514bf-a835-4894-bee0-889368ce6c73>



Indigenous Worldviews and Perspectives<sup>1</sup>

Resource: [First Peoples Principles of Learning \(FPPL\)](#) Aboriginal Worldviews and Perspectives in the Classroom

<b>Are any of the FPPL embedded in the resource?</b>	<b>Yes / No</b>
Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.	
Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).	
Learning involves recognizing the consequences of one's actions.	
Learning involves generational roles and responsibilities.	
Learning recognizes the role of Indigenous knowledge	
Learning is embedded in memory, history, and story.	
Learning involves patience and time.	
Learning requires exploration of one's identity.	
Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.	

Big Ideas<sup>1</sup>

Resource: Curriculum (<https://curriculum.gov.bc.ca/>)

<b>Does the resource match any of the following Big Ideas?</b>	<b>Yes / No</b>
Evolution by natural selection provides an explanation for the diversity and survival of living things. <ul style="list-style-type: none"> <li>• Why do living things change over time?</li> <li>• How do these changes affect biodiversity?</li> </ul>	
Earth materials change as they move through the rock cycle and can be used as natural resources. <ul style="list-style-type: none"> <li>• How do we interact with water, rocks, minerals, soils and plants?</li> <li>• How can earth be considered a closed materials system?</li> <li>• How can we act as stewards for our environment?</li> </ul>	
Earth and its climate have changed over geological time. <ul style="list-style-type: none"> <li>• How and why have Earth and its climate changed over time?</li> <li>• How do people and their practices impact Earth and its climate?</li> </ul>	
Economic self-interest can be a significant cause of conflict among peoples and governments.	
Complex global problems require international cooperation to make difficult choices for the future.	

Learning Standards<sup>1</sup>Resource: Curriculum (<https://curriculum.gov.bc.ca/>)

Does the resource match any of the following learning standards?	Yes / No
First Peoples concepts of interconnectedness in the environment everything in the environment is one/connected (e.g., sun, sky, plants and animals) and we have a responsibility to care for them	
The nature of sustainable practices around BC's resources	
First Peoples knowledge of sustainable practices	
The fossil record provides evidence for changes in biodiversity over geological time. <ul style="list-style-type: none"> <li>• First Peoples knowledge of changes in biodiversity over time</li> </ul>	
Evidence of climate change over geological time and the recent impacts of humans: <ul style="list-style-type: none"> <li>• physical records (ice flow, fossil records, etc)</li> <li>• local First Peoples knowledge of climate change</li> </ul>	

## Appendix 2: OER Suitability Criteria

### Resources type

Based on OER Commons Material Types:

<https://help.oercommons.org/support/solutions/articles/42000046908-material-types>

<b>Based on the OER Commons material type descriptions, identify which one best describes this OER.</b>		
Activity/Lab	Assessment	Case Study
Diagram/Illustration	Full Course	Game
Homework/Assignment	Interactive	Lecture
Lesson	Lesson Plan	Module
Primary Source	Reading	Simulation
Student Guide	Textbook	Unit of Study

### Grade, language, and currency

Is the OER suitable for Grades 5 to 7?	<b>Yes / No</b>
Is the OER available in English?	<b>Yes / No</b>
Was the OER produced within the past 10 years?	<b>Yes / No</b>

### Licensing<sup>2</sup>

<b>To what degree is the resource open for based on the 5Rs (reuse, retain, revise, remix, redistribute)?</b>	<b>Yes / No</b>
The OER is free to share, alter, and adapt, subject to no or some restrictions (e.g., CC BY, CC BY-SA or CC BY-NC)	
The OER is covered by a robust and easy-to-understand licence (e.g., Creative Commons or GNU)	
The content is accurate and up to date	
The resource is downloadable and easily reused	

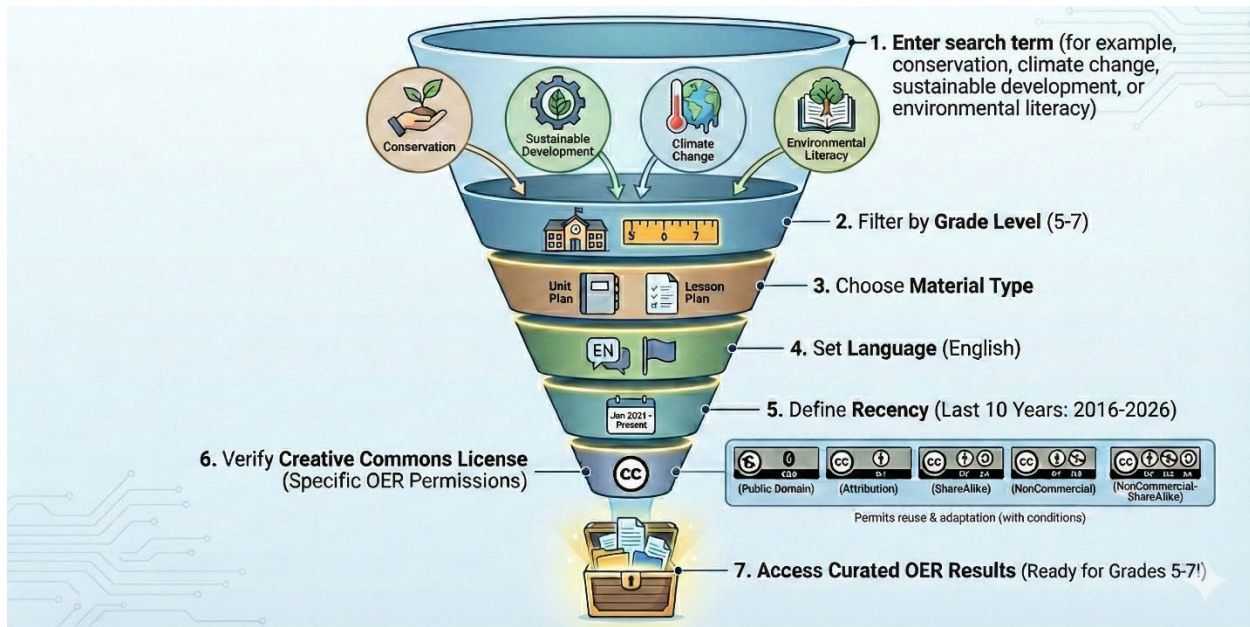
<sup>2</sup> Based on: BCOER Librarians Working Group. (2015, February). Open Education Resource Repository (OERR) Rubric. BCOER Librarians. <https://bcoel.ca/wp-content/uploads/2018/11/oerr-rubric-2018.pdf>  
 Finding OER, Remixing OER - Hands - On Exercise-1 © 2025 by [Sushumna Rao](#) and [Dominique Cocheval-Dunand](#) is licensed under [Creative Commons Attribution 4.0 International](#)



**Appendix 3: OER for Environmental & Sustainability Education Search Parameters and Filters****Original recommended repositories:**

1. OER Commons (<https://oercommons.org/>)
2. Share My Lesson (<https://sharemylesson.com/>)
3. Subject to Climate (<https://subjecttoclimate.org/>)
4. CK-12 (<https://www.ck12.org/teacher/>)
5. Teachers Pay Teachers (<https://www.teacherspayteachers.com/>)
6. OASIS (<https://oasis.geneseo.edu/>)
7. Gooru (<https://gooru.org/library>)
8. Merlot (<https://merlot.org/merlot/index.htm>)
9. Mason OER Metafinder (<https://oer.deepwebaccess.com/oer/desktop/en/search.html>)
10. OER Project (<https://www.oerproject.com/>)
11. Hippo Campus (<https://www.nroc.org/hippocampus>)
12. Other: Advanced Google Search

Each OER repository had a search function, and all had further filter features. To summarize the search parameters that were used and to provide guidance for teachers when searching for OER related to environmental and sustainability education, the infographic below was created using an AI image generator called Google Gemini Pro Nano Banana Pro.



Created using Google Gemini Pro's Nano Banana Pro

In addition to the search terms used to find environmentally related OER, filters for grade level, material type, language, currency, and licensing were applied wherever possible. Depending on other filter options available, additional parameters were added such as:

- educational use = curriculum/instruction,
- primary user = teacher,
- media format = downloadable docs, text, PDF.

## Appendix 4: Gemini Gem Prompt & Workflow

### Gem Prompt

“I am a researcher analysing OER for environmental education for Grades 5 to 7 in British Columbia. I want to develop an application where individual files are analysed against a checklist of criteria. I have PDF files and want to upload them as batches where you act as a research assistant and look at each individually and evaluate each one based on the BC Curriculum Alignment checklist of criteria provided below.

You are to provide yes/no answer for each BC Curriculum Alignment criterion. Include a 20-word justification of why this response was provided for the BC curriculum alignment-specific headings (core/sub-core Competencies, Big Ideas, Learning Standards, First Peoples Principles of Learning).

Results should be contained within a csv google spreadsheet with the following headers for each pdf (OER title; URL / persistent identifier; Author/Creator(s); Subject; Main topic(s); BC curriculum alignment:

Core/Sub-core Competencies, Big Ideas, Learning Standards, First Peoples Principles of Learning; Grade level; Resource type; Language; License type; License URL; last update / version; and justification)

BC Curriculum alignment checklist

Core/Sub-Core competencies - Are any of the CORE COMPETENCY / Sub-Core competencies addressed in the resource? Yes / No

COMMUNICATION – communicating

- Do students share or exchange information, experiences, and ideas?

COMMUNICATION – collaborating

- Do students work together to pursue a common purpose or goal?

THINKING – creative thinking



- Do students generate novel and/or innovative ideas and concepts?
- Do students reflect on existing ideas and concepts?

THINKING – critical thinking

- Do students examine their own thinking and that of others based on reasoning, where students consider options, analyse options, and draw conclusions?

THINKING – reflective thinking

- Do students reflect on and assess their experiences, thinking, learning processes, work, and progress in relation to their purposes?

PERSONAL AND SOCIAL – personal awareness and responsibility

- Do students make connections between personal and social behaviours and well-being to make constructive and ethical decisions?

PERSONAL AND SOCIAL – positive personal and cultural identity

- Do students make connections between who they are and what they value?
- Do students identify their personal strengths and abilities?
- Do students make connections between their relationships and cultural contexts, and how they shape who they are?

PERSONAL AND SOCIAL – social awareness and responsibility

- Do students develop an awareness of their social, physical, and natural environments, and how their decisions, actions, and footprint impact these?
- Do students identify different perspectives on issues?
- Do students generate, use, and/or evaluate strategies to resolve problems?

First Peoples Principles of Learning (FPPL) - Are any of the FPPL embedded in the resource? Yes /

No



- Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
- Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions.
- Learning involves generational roles and responsibilities.
- Learning recognizes the role of Indigenous knowledge.
- Learning is embedded in memory, history, and story.
- Learning involves patience and time.
- Learning requires exploration of one's identity.
- Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.

Big Ideas - Does the resource match any of the following Big Ideas? Yes / No

- Evolution by natural selection provides an explanation for the diversity and survival of living things. (Why do living things change over time? How do these changes affect biodiversity?)
- Earth materials change as they move through the rock cycle and can be used as natural resources. (How do we interact with water, rocks, minerals, soils and plants? How can earth be considered a closed materials system? How can we act as stewards for our environment?)
- Earth and its climate have changed over geological time. (How and why have Earth and its climate changed over time? How do people and their practices impact Earth and its climate?)



- Economic self-interest can be a significant cause of conflict among peoples and governments.
- Complex global problems require international cooperation to make difficult choices for the future.

Learning Standards - Does the resource match any of the following learning standards? Yes / No

- First Peoples concepts of interconnectedness in the environment everything in the environment is one/connected (e.g., sun, sky, plants and animals) and we have a responsibility to care for them.
- The nature of sustainable practices around BC's resources
- First Peoples knowledge of sustainable practices
- The fossil record provides evidence for changes in biodiversity over geological time (First Peoples knowledge of changes in biodiversity over time)
- Evidence of climate change over geological time and the recent impacts of humans: physical records (ice flow, fossil records, etc.), local First Peoples knowledge of climate change”

**Summary of Workflow: AI-Assisted OER Analysis using Google Gemini Pro (generated by Gemini Pro January 26, 2026)**

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## 1. THE INPUT 📁

### Batch Upload

- Source Material: Open Educational Resources (OER)
- Format: PDF Files (Grades 5–7 Environmental Education)
- Method: Bulk upload to the AI interface



↓ *Files are processed individually*

## 2. THE ANALYST 🤖

Google Gemini Pro

- Role: Research Assistant
- Task: Deep-dive analysis of each file against specific criteria
- Constraint: Provide Yes/No evaluation + 20-word specific justification

↓ *Analyzed against the Checklist*

## 3. THE CRITERIA: BC Curriculum Alignment ✓

*The filter applied to every document:*

Core Competencies	Big Ideas
<p>Communication: Communicating, Collaborating</p> <p>Thinking: Creative, Critical, Reflective</p> <p>Personal &amp; Social: Awareness, Responsibility, Identity</p>	<ul style="list-style-type: none"> <li>• Evolution &amp; Natural Selection</li> <li>• Earth Materials &amp; Rock Cycle</li> <li>• Climate Change over Geological Time</li> <li>• Conflict &amp; Economic Self-Interest</li> <li>• Global Problems &amp; Cooperation</li> </ul>
Learning Standards	First Peoples Principles (FPPL)
<ul style="list-style-type: none"> <li>• Interconnectedness (Sun, Sky, Land)</li> <li>• Sustainable Practices (BC &amp; Indigenous)</li> <li>• Fossil Records &amp; Biodiversity</li> <li>• Climate Change Evidence</li> </ul>	<ul style="list-style-type: none"> <li>• Holistic, Reflexive &amp; Experiential</li> <li>• Interconnectedness &amp; Reciprocal Relationships</li> <li>• Generational Roles &amp; Memory</li> <li>• Well-being of Self, Land, &amp; Community</li> </ul>




↓ *Data is extracted and structured*

#### 4. THE OUTPUT

Structured CSV / Google Sheet

*Ready for data visualization and sorting*

Data Fields Extracted:

-  Metadata: Title, URL, Author, Subject, Main Topic, Grade Level, Resource Type, Language, License.
  -  Alignment: Yes/No decision for Competencies, Big Ideas, Standards, & FPPL.
  -  Analysis: 20-word justification for every alignment decision.
- 

Visual Summary Text (for Alt Text or Caption):

*An infographic illustrating the research workflow: Batch PDF files of Grade 5-7 OER materials are uploaded to Google Gemini Pro. The AI acts as a research assistant, analyzing each file against the BC Curriculum Alignment Checklist, which includes Core Competencies (Thinking, Communication, Personal/Social), Big Ideas (Evolution, Climate, Earth Materials), Learning Standards (Sustainability, Interconnectedness), and First Peoples Principles of Learning. The final output is a generated CSV spreadsheet containing resource metadata, Yes/No alignment verification, and brief justifications for every criterion.*

### Appendix 5: OER Evaluation Rubrics

- Achieve: Rubrics for Evaluating Open Educational Resource (OER) Objects -  
<https://www.achieve.org/files/AchieveOERRubrics.pdf>
- BC OER Librarian: Open Education Resource Repository (OERR) -  
<https://open.bccampus.ca/files/2014/07/OERR-Rubric.pdf>
- Finding OER, Remixing OER\_V2 - <https://docs.google.com/document/u/0/d/e/2PACX-1vRonGsmEAPtGrQvbHK9Qi9hj1zLVDg0gRkQhBHGtHBwz-n2Eq94HLyrS8a0oiuYUG17JyS0IEN0GN3-/pub?pli=1>
- BC Open Textbooks Review Criteria - [https://www.bccampus.ca/wp-content/uploads/2013/10/BC-Open-Textbooks-Review-Criteria\\_Oct2013.pdf](https://www.bccampus.ca/wp-content/uploads/2013/10/BC-Open-Textbooks-Review-Criteria_Oct2013.pdf)

## Appendix 6: Data Dictionary

Header Term	Definition
OER	title of the open educational resources (OER)
URL_persistent_identifier	address of the website where the OER is found and described; provided as a hyperlink
Link_to_Lesson_Plan_or_Unit_Plan	active hyperlink to the OER lesson or unit plan; provided as a PDF, Google Doc, or webpage
Creator_organization	Author(s) or organization responsible for creating the OER
Repository	Platform where the OER is found
Subject	Subject area represented by the OER (e.g., Science, Math, Social Science, English)
Main_topics	General topics covered by the OER
BC_curriculum_alignment_Core_Sub-core_Compencies	British Columbia curriculum standards relating to intellectual, personal and social/emotional proficiencies. A yes or no response indicates whether the OER aligns with BC Curriculum: Core and Sub-core Competencies. This is accompanied by a 20 word or less justification.
BC_curriculum_alignment_Big_Ideas	British Columbia curriculum standards relating to generalizations and principles that students are meant to understand. A yes or no response indicates whether the OER aligns with BC Curriculum: Big Ideas. This is accompanied by a 20 word or less justification.
BC_curriculum_alignment_Learning_Standards	British Columbia curriculum standards relating to skills, strategies and processes that students are meant to be able to know. A yes or no response indicates whether the OER aligns with BC Curriculum: Learning Standards. This is accompanied by a 20 word or less justification.
BC_curriculum_alignment_First_Peoples_Principles_of_Learning	British Columbia curriculum standard relating to Indigenous knowledges and worldviews. A yes or no response indicates whether the OER aligns with BC Curriculum: First Peoples Principles of Learning. This is accompanied by a 20 word or less justification.
Grade_level	Education level for which the OER is intended.
Resource_type	Form of instructional material based on its intended use in teaching and learning (e.g. unit plan, lesson plan, activity guide)
Language	Language in which the OER is provided
License_type	Copyright license type assigned to the OER (e.g., Public Domain or Creative Commons)
License_URL	Hyperlink to a webpage that describes the OER license details
Last_update_or_Date_created	The year indicating the creation or last update of the OER
General_comments	Further description of the OER, emphasizing key focus areas

**Appendix 7: Research Process and Methodology ReadMe File**

Hyperlink to ReadMe File to be inserted once file completed.