Thesis for DPhil in Education:

Constructing Local Ecological Knowledge: How Children in the Galápagos Islands Learn about their Environment

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Dedication

This thesis is dedicated and in thanks to the hundreds of Galápagos children who shared their time, ideas, knowledge, emotions, and trust.

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Contents

Abstract

The Galápagos Islands is both a National Park of Ecuador and a UNESCO Natural World Heritage Site. But, in addition to a plethora of intriguing species in the more-than-human natural world, the islands are also home to ~7,500 children, who are members of a recently established human population living near nature. In the context of the gravity of human impact on global ecosystems through the environmental polycrisis, the assertion that all parts of the ecosphere have inherent value and knowledge of the ecosphere is valuable, and the lack of research with children in Galápagos on child-centric environmental education and knowledge, this research investigates how Galápagos children construct and use Local Ecological Knowledge (LEK). Participants were fifth graders across two Galápagos Islands. Mixed methods used included a survey, go-along interviews, and focus groups, through which children helped to answer the following research questions: 1) What is the state of Local Ecological Knowledge of children living in the Galápagos Islands? 2) How do children describe the sources from which they learn about their Galápagos environment? 3) Where do children perceive that they learn about the environment? 4) What content do children describe learning about their Galápagos environment? The research is situated within an interpretivist constructivist epistemology, and within the frameworks of Childism (Wall, 2022); Indigenous standpoint theory; and the combination of ecocentrism, Sumak Kawsay, deep ecology, and post-anthropocentric theories. Knowledge children shared demonstrated rapidly and readily constructed robust LEK, along with corresponding environmental emotions and ecocentric worldviews. Children learned through a complex network of sources including time in nature, family members, local organisations, and peers. Discussion of findings

support the importance of community support for environmental conservation and sustainability, the decentring of adults for topics of environmental concern and ability of children and recently established human populations to develop robust LEK.

1. Introduction

The Galápagos is a small archipelago of 21 main islands located about 1,000 km off the coast of Ecuador. One hundred years after the islands were made famous by Darwin's *On the Origin of Species*, they were declared a National Park of Ecuador (*Parque Nacional Galápagos*, n.d.) and subsequently added to the list of UNESCO Natural World Heritage Sites in 1978 ('2 COM VIII.38 - Decision, Review of Nominations to the World Heritage List', 1978) both actions drawing more international attention to the enchanted isles. Additionally, as 97% of the landmass of the archipelago is protected as National Park land, leaving 3% for urban development, the flora and fauna of the islands are unsurprisingly a core topic of academic research. In addition to a plethora of intriguing non-human species in the natural world, the islands are also home to ~30,000 human residents, and within that number, ~7,500 school aged children, who live near the internationally renowned natural space. However, social aspects for island residents have received little academic attention. In particular, the opportunity to understand how local children learn about, engage with, and feel about their local environment is vast and is under-explored by the academic community.

This research is important not only for informing and furthering conservation efforts in the Galápagos, but essential for questions of how children engage with environmental concerns, what their worldviews and knowledge are and how adults might use data produced from children to best equip them and adult-run programs to lead stewardship and conservation locally and globally. As Durham (2021) notes, "Galápagos is a valuable test bed for the sustainability challenges facing the whole of planet earth" (p. 302). Ecuador has made national efforts to prioritize and increase conservation and management of the Galápagos as a national park, and UNESCO consistently promotes and expects effective conservation for all UNESCO Natural World Heritage Sites, including the Galápagos. Because of the stated and actual efforts of these two bodies, conservation is one of the top priorities for the islands. I believe that research with children in the Galápagos that produces actionable insights into how to support further Environmental Learning and thus increased LEK will directly and positively impact conservation efforts in the Galápagos. This is supported by the literature in studies that show the importance of LEK and connected components of Environmental Literacy (EL) in effective conservation and sustainable environmental management strategies (Ajaps & Forh Mbah, 2022; Aswani et al., 2018; Joa et al., 2018; Linstädter et al., 2013). It is important to note that the current and permanent Galápagos human population was recently established, with semi-permanent habitation in the 1800s and permanent uninterrupted habitation since the early 1900s, and as such is not Indigenous to Galápagos. As Durham (2021) explains, "because human settlement is not even 200 years old, human social and cultural adaptations to the archipelago remain actively under way today, with key implications for sustainability" (p. 297). This recency and lack of Indigeneity to the islands has impacts on the design and impetus for research as, unlike other island communities, the human populations do not hold a body of Galápagos-centric Indigenous Ecological Knowledge (IEK), which is why I focus in this study on the construction of LEK. Additionally, the Galápagos is a conservation-oriented ecoregion - "a relatively large unit of land or water [with] a distinct assemblage of natural communities, sharing a large majority of species, dynamics, and environmental conditions" (Dinerstein et al., 2000, p. 15) – which is bounded geographically and evolutionarily (as a well-insulated archipelago), politically (as a province), and socially (as a regulated community with restrictions on movement and migration), making it a space where trends in environmental knowledge, values, and other human-environment components may be more easily analysed and where these components may develop more readily and recognizably.

In the context of the gravity of the environmental polycrisis, all parts of which have been instigated and exponentially worsened by human impact, exploitation of the ecosphere, and anthropocentric global human powers, I am keenly interested in how Galápagos children construct and use Local Ecological Knowledge (LEK) to engage in ecocentric stewardship of the ecosphere and "[return] to the protection of nature for nature's sake" (McCauley, 2006, p. 27). Polycrisis is a recently popularised term through policy, academic, and social spheres which references simultaneous, overlapping, and often co-exacerbated crises, which are often positioned within the Anthropocene, or age of unsustainable human growth and (mis)use of planetary resources (Brosig, 2025; Mark et al., 2025; Scheffran, 2025). The "interconnectedness heightens the chances of widespread adverse outcomes or disasters, affecting various systems and triggering cascading effects" (Mark et al., 2025, p. 1). In this thesis, I highlight the environmental polycrisis, or 'nature crisis' (*5 Key Drivers of the Nature Crisis*, 2022) which includes climate change, deforestation, biodiversity loss, ecosystem collapse, ocean acidification, and others, to purposefully engage with ecocentrism (discussed in further sections) as an essential human philosophy to address the polycrisis (Picard & Kloetzer, 2024; Ritter & Sägesser, 2025). This 'ecocentric turn' (Picard & Kloetzer, 2024, p. 26) places value in both protecting the environment for its own sake, but also building environmental knowledge, and LEK, for its own sake.

There is also a paucity of research on Galápagos residents' knowledge and affectations about their local environment, including a lack of research with children about their LEK and as such, I believe that this research will benefit the local Galápagos communities, leaning on children as legitimate and active citizens to inform the often adult-run conservation programs and narratives in Galápagos. The example that Galápagos children provide will also benefit conversations in the international community for ways to involve, listen to, and leverage child-led knowledge for the purpose of creating more sustainable human systems. The research is situated within an interpretivist constructivist epistemology, and within the frameworks of Childism (Wall, 2022) to centre child voices and question and mitigate adultism; Indigenous standpoint theory which prioritize non-Western and Indigenous communities and highlights the importance of measuring LEK to comprehensive and impactful bodies of IEK; and the combination of ecocentrism, Sumak Kawsay, deep ecology, and post-anthropocentric theories which centre the ecosphere and moves away from a hierarchical approach to humans and nature.

To obtain a holistic understanding of how Galápagos children construct LEK through environmental learning, I used a mixed methods approach and conducted four types of data collection during fieldwork: a 25-question written survey, semi-structured go-along interviews through outdoor spaces in schools, outdoor focus groups, and observational field notes. The stories and knowledge that children shared through these data collection methods helped to answer the following research questions:

1. What is the state of Local Ecological Knowledge of children living in the Galápagos Islands?
2. How do children describe the sources from which they learn about their Galápagos environment?
3. Where do children perceive that they learn about the environment?
4. What content do children describe learning about their Galápagos environment?

Stories and knowledge that children shared illuminated the contribution to knowledge that local populations, particularly children, despite a lack of indigeneity to their local environment, are capable of rapidly and readily constructing robust LEK, along with correspondingly high environmental emotions and ecocentric worldviews. As a note, LEK is described in this way to indicate the speed (rapidly) of high quality LEK (robust) that children seem to enthusiastically choose to construct (readily) and does not indicate that low-quality LEK has been constructed 'too fast' or in a manner that is inferior to LEK constructed through longer timespans. This finding and contribution offer hope for structuring spaces for local children in other protected areas or fragile ecosystems to engage with and build robust bodies of LEK and corresponding components of EL for the purpose of engaging with and fuelling local stewardship and environmental sustainability. Children also described learning through a complex network of sources including solo exploration, family members, local organizations, and peers, which, combined, greatly supported children's rapidly and readily constructed LEK, referencing the speed, agility, accuracy, and depth of LEK that Galápagos children apparently have chosen to construct per the findings of this study. Discussion of findings support the importance of whole-community engagement in and support for environmental conservation and sustainability. Additionally, the decentring of adults, especially on topics of environmental concern, is vital both for the fulfilment of the rights of the child as outlined by the UN, and as children in this study and others exhibit more ecocentric worldviews which demand the decentring of adult-fuelled 'industrocentrism' and anthropocentrism as main drivers of the environmental polycrisis (Kopnina, 2019). Findings will be shared with the Galápagos school district and NGOs who assist with teacher training programs to explore how Galápagos schools can design or deepen environmental education programs for children, and how organizations concerned with conservation on the islands can utilize and work with various social actors in the community in addition to directly working with children to help them continue to construct and act on LEK. Findings will also be published on academic and non-academic platforms to continue to centre Galápagos children's stories and knowledge within broader discussions on environmental sustainability, regional conservation efforts, and on rights of children in the mitigation of the destruction of our collective ecosphere.

Before designing and undertaking new research on Galápagos children's LEK, it was key to explore and understand the current array of literature on Environmental Education and LEK for residents of the islands, particularly children, and determine if there is a gap in such scholarship. To do this, I mapped the field of research on the Galápagos by conducting a scoping review. While there is evidence of a recent slight increase in academic interest in the education system within the Galápagos, and on LEK of community members, results show that there has been and still is a significant gap in social sciences literature on Galápagos, and a further paucity of literature focusing on residents as research participants, especially in studies of education, environmental education, and children's perceptions and experiences. Furthermore, research within education, environmental education, or on topics related to LEK, have not thus far centred children as actual research participants or voices to be listened to. This gap in the research is one that I attempt to lessen with this research. Full details of the scoping review can be found in Appendix A.

2. Situating Within the Literature

2.1 Chapter Introduction

In this chapter, I gather literature that speaks to many of the central terms used in this study and bring readers up to speed on issues and bodies of knowledge essential for situating this study within the fields of educational, socio-environmental, and child-centric research. I cover foundational ideas such as the words environment, nature, sustainability, anthropocentrism, and ecocentrism; explain types of environmentally related education; cover a key umbrella term, Environmental Literacy, in which LEK sits; and cover examples of community and child-led and centric studies and programs.

Much of the literature and information cited in this chapter is from an adult lens, as most sources cited are written by adults. This often unquestioned and unrecognized phenomenon can perpetuate exclusionary research that sidelines or fails to acknowledge and create co-narratives with, for, by, and about children. This adult-centric approach is something I work to mitigate and actively recognize throughout this thesis to continuously centre children when discussing environmental concepts and the Galápagos. To that end, I include child centric literature, prioritizing that which includes child voices and ideas within each of the sections of this literature review.

2.2 Foundational Ideas

2.2.1 Environment and Nature

While the central term of this thesis is LEK, it sits within a broader conversation that uses the terms nature and environment frequently. Because of the nebulous connectedness of these terms, both environment and nature are essential to briefly unpack. The word environment, in both English and Spanish, has flexible connotations and at once can mean something that shifts across built and non-built spaces, and something rigidly reflective of the 'natural' or non-human. In this study, I use the word environment only to refer to global and local ecosystems, that houses global and local ecology, and what some might refer to as nature. I do not use it to refer to more narrow applications such as a 'home environment' or 'work environment'. The first definition that the Cambridge Dictionary offers for the word environment is, in fact, one that describes the natural environment as "the air, water, and land in or on which people, animals, and plants live" ('Meaning of Environment in English', 2025). The use of environment in this thesis might be clearer to some readers if 'natural environment' was used, but as the environment is a central entity throughout this study and constitutes the key space about which research questions are asked, I believe that clarification beyond this paragraph is not necessary. The environment, in this thesis, further aligns with terms like environmentalism, which "refers to concerns for environmental protection, particularly from the harmful effects of human activity," (*Environmentalism*, n.d.) a term that also uses the word environment sans any modifier like natural to clarify its position.

The word nature evokes similar chameleon qualities as the word environment, as it can refer to many things. Even the definition of environmentalism cited above, later includes the word nature but in a context that makes it incongruous to the word environment, stating that environmentalism "encompasses ethical, political, and scientific questions about the nature of the environment, the purpose of protection, and the establishment of harm" (*Environmentalism*, n.d.). Nature's related word, natural, again can draw up contested debates around the separation of humans from this other entity, nature, and arguably false dichotomies of natural vs. unnatural. Nature, used in this thesis, is defined as a term interchangeable with the term environment, citing similar inclusions in its common definitions. However, definitions of nature as the environment include more information about what it is in a human context. Definitions from the Cambridge Dictionary, Collins Dictionary, Britannica, and other state that nature is something like this: "all the animals, plants, rocks, etc. in the world and all the features, forces, and processes that happen or exist independently of people, such as the weather, the sea, mountains, the production of young animals or plants, and growth" ('Meaning of Environment in English', 2025).

While this clarifies that the words nature and environment can be used interchangeably, which they will be predominantly in this thesis as nature was a frequent term used by children to refer to the environment, it highlights the inhumanness of nature, which claims a separation of humans from nature. Indeed, as of the writing of a 2024 article in the Guardian describing a recent press conference at the environmental organization, the Eden Project, "all English dictionaries define nature as an entity separate from and opposed to humans and human creations – a perspective campaigners say perpetuates humanity's troubled relationship with the natural world" (Gayle, 2024). Beyond just

English, many national dictionaries, including Spanish dictionaries which have particular weight as this study looks at an environment in Ecuador, state similar clear omissions of humans from what nature is, such as this definition in the Diccionario de la lengua Española: el "Medio físico en el que coexisten los seres vivos y los inertes al margen de la vida urbana" (*translated: the physical environment in which living and non-living beings coexist outside of urban life)* ('naturaleza | Diccionario de la lengua española', n.d.).

Children's perceptions of nature and the environment are assessed in some studies, adding valuable insight into how children define and contextualize these terms. A study by Keliher (1997) with 6–7-year-olds in Australia collected drawn and verbalized accounts of what nature was and meant to children. Participant responses included broad statements such as "nature is 'everything in the world!'" (Keliher, 1997, p. 241) to unanimous inclusion of both animals and plants in nature. Similar to the definitions provided above from adult sources, children in this study also presented an idealized version of nature, noting that "real nature is pristine and peaceful" (Keliher, 1997, p. 241). This further aligned with the separation of human and nature in adult definitions, confirming that children often also thought that there was a distinct "nature of 'natural places', relatively untouched by human influence" (Keliher, 1997, p. 241). Another study, by Burgess and Mayer-Smith (2011) worked with 10–11-year-old children attending a Mountain School and analysed their written and verbalized perceptions of nature. Children in this study emphasized similar components of nature, highlighting flora and fauna (2011). Animals and participation in nature was emphasized by one child who noted "'It [nature] is beautiful, there are lots of animals to watch and there is a bunch of things to do'" and one observed a lack of human-created objects, and instead an emphasis on nature as alive when noting

"'Everything's green like the trees and everything's living like you and it's not like technology, no robotics or anything, it's all living!'" (Burgess & Mayer-Smith, 2011, p. 36). The focus on biotic and perhaps lack of recognition of abiotic elements of nature is distinct from the adult definitions provided above.

As a final example, a study by Rejeski in 1982 worked with children asking them to draw and write accompanying perceptions of what nature is to them. The 9–10-year-olds included flora and fauna in their drawings and additionally, wrote in descriptions of what nature was to them that included both biotic and abiotic features, while some children maintained that living things were nature – an example of a lack of the human-environment separation noted in the adult definitions (Rejeski, 1982). The insistence from many children that humans are a part of nature was balanced by cautionary notes that humans also hurt nature, one child noting "I think people ruin nature" (Rejeski, 1982, p. 37).

In this thesis, the terms nature and environment refer to spaces in which humans move but which can be sustained without humans, and that encompass ecological systems that include biotic and abiotic features such as flora and fauna and global geology. The environment and nature are entities that are gravely at risk due to modern and distinctly Westernized modes of production and pace of use and human growth.

2.2.2 Sustainability

As Kopnina (2014) points out in a critique of sustainability, "the word 'sustainability' became so ubiquitous; it can mean almost anything and apply to almost anything" (p. 932).

Anthropocentrism is championed as the central ethics to sustainability across various organisations and movements. In 1987, "the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"" (*Sustainability*, n.d., para. 2). This definition has fed the creation of the 17 UN Sustainable Development Goals (SDGs), which were developed in 2015 as part of the 2030 Agenda for Sustainable Development (*THE 17 GOALS | Sustainable Development*, n.d.). The SDGs go beyond just environmental education and sustainability to encompass sustainability and equity within economic and social spheres as these are inherently connected with the ability of any country to develop sustainably.

Wals and Jickling (2002) highlight the multiplicity of ways of defining 'sustainability', especially those that are anthropocentric, offering "'industrial ecology', 'business ecology', 'Cradle to Cradle', 'green capitalism', 'eco-efficiency', 'social and environmental responsibility', and the triple bottom line (People, Planet, Profit)" (p. 932) just a few terms synonymous with anthropocentric sustainability. Essentially, "different types of sustainability may thus exist regarding what to primarily sustain" (Schaubroeck et al., 2015, p. 602) - ecosystems or human systems. This conflict is explored further in the following section.

Sustainability as a term is fraught with underlying assumptions and perspectives, and much like most concepts, is defined by adults. This adult-centric lens is particularly important when discussing a topic that inevitably speaks to future states - sustainability being something we enact to change potential futures. Futures are the space of current children, less so of current adults. And while there are practical reasons for adults to lead and define future-centric terms as they tend to have greater agency to enact them in the current state of the world, it is deeply troubling and misguided to exclude child voices, definitions, and perceptions from something like sustainability which will be something that affects them significantly more than any current adult actor. This critique of exclusion aligns with the recent 2022 UN Convention on the Rights of the Child (UNCRC) which states children's right to a clean and safe environment ('What Does the UNCRC Have to Say about the Environment?', n.d.; *What Is the UN Convention on Child Rights?*, n.d.).

Children's definitions of sustainability are infrequently included or given credence though. Some studies have addressed the need to understand and include children's perceptions of sustainability both as a matter of ethics, and as a way to effectively develop educational programs for children about sustainability and to implement effective behaviour-change programs (Fretes et al., 2021; Green, 2017; Spiteri, 2022). In Spiteri's (2022) study, 3–7-year-old Maltese children were consulted via interviews and asked to draw perceptions of what environmental sustainability was and how to achieve it. A six-year-old noted that sustainability was "doing something good for the environment" and a seven-year-old noted it was to "keep the Earth healthy" (Spiteri, 2022, p. 19). In a study by Fretes et al. (2021) Chilean 8–9-year-olds participated in online focus groups to share their thoughts on sustainability, food, and nutrition. During focus groups, a child said "[Taking care of the planet means] not throwing garbage in the street, not throwing it in the sea, or the bottles in the garbage can because it also pollutes" (Fretes et al., 2021, p. 5). Green (2017) worked with 9–13-year-olds in Australia and participating children engaged in interviews and created artefacts to embody their perceptions of sustainability. Examples of understanding that sustainability is systemic or global included a child noting that sustainability is "'happening all around us'" (Green, 2017, p. 155). A tenyear-old child also noted "'I think sustainability means keeping the world going, so going through all the steps and keeping it healthy. So we've got to do different things to keep it healthy so we can live in it'" (Green, 2017, p. 157). Importantly, this is distinct from the UN SDGs which imply the need to ensure perpetual human growth vs human survival and living (*THE 17 GOALS | Sustainable Development*, n.d.).

2.2.3 Anthropocentrism and Ecocentrism

There is a persistent global domination of anthropocentrism over ecocentrism in sustainability work. An anthropocentric view is one that prioritizes human lives and systems, asserting that human needs are paramount and therefore, other animals and broader environment needs should only be preserved for the purpose of aiding in the preservation of human life (Washington et al., 2017). Ecocentrism, conversely, "is the broadest term for worldviews that recognize intrinsic value in all lifeforms and ecosystems themselves, including their abiotic components" (Washington et al., 2017, p. 35). Many Indigenous and non-Western philosophies are ecocentric, noting that the natural world has value independent of its usefulness to humans (Washington et al., 2017). The term deep ecology was developed with ecocentrism in mind and notes that "the well-being of non-human life on Earth has value independent of any instrumental usefulness for limited human purposes" (Devall & Sessions, 1985, p. 69). Washington (2015) explains the historical underpinnings of modern 'sustainability', noting what he recognizes as 'old sustainability' - something that drove and continues to drive movements that would be associated with words like 'tree hugging', and "the deep ethical and spiritual concerns that have driven people for thousands of years to speak of how we should 'live in harmony' with Nature" (p. 7).

Ultimately, current dominant global narratives use anthropocentric definitions of sustainability and other environmental movements. Ecocentrism is not as present in dominant political or social channels, though it has strong historical roots both in the pre-Judeo-Christian West and in historic and contemporary non-Western human cultures which will be discussed in the following section. Anthropocentrism prioritises humans, which may imply that the counter term (ecocentrism) is in some way anti-human, as claimed by the Chair and Senior Fellow at the Discovery Institute's Center on Human Exceptionalism, Wesley J. Smith (2014) in his non-academic book *The War on Humans*. Conversely, academics such as Stan Rowe (1994) instead remind that ecocentrism:

> is not an anti-human argument nor a put-down of those seeking social justice. It does not deny that myriad important homocentric problems exist. But it stands aside from these smaller, short-term issues in order to consider Ecological Reality (para. 13).

Furthermore, ecocentrism does not sideline social justice and human rights issues, but places them within a broader context and holds that social justice and ecojustice are intertwined (Washington et al., 2017). What ecocentrism contradicts is capitalism, as capitalism promotes infinite human production and growth which is inherently anthropic despite causing significant disruption and harm to collective human survival long term (Foster, 2022). Where critics may be confused is in the assumption that to be pro-human, one must also be pro-capitalism, thus branding anything opposite of anti-capitalist (such as ecocentrism) as anti-human.

Instead of branding ecocentrism as anti-human, I agree with Kidner (2014) who notes that anthropocentrism is not anthropocentric (here using the latter term to indicate care and survival for all humans). Kidner (2014) describes anthropocentric thought as evolved through and from a recent (in relation to all human history) human and Western cultural drive towards industrialism (2014). Industrialism, whose partner is capitalism, and whose assistant in the last thousand years has been colonization, has been placed as the ultimate goal of human development and survival. As such,

> [th]e concept of anthropocentrism, then, serves the ideological purpose of deflecting awareness away from the invasive character of industrialism, hindering understanding of the predicament of both human and nonhuman nature. anthropocentrism has created crises that deeply endanger the human race (Kidner, 2014, p. 465).

The current prioritization and insistence that human economic systems are the conduit for human survival, instead of placing human and environmental survival above economic systems, grew out of the emergence of pre-industrial Europe when, “the traditional hostility of natural philosophy towards commercial arrangements caused a good deal of soul-searching and conflict during the thirteenth and fourteenth centuries” and as a result of desire for economic growth, natural philosophy and indeed science changed in the late 13th century “[s]cholastic natural philosophers began to create a new model of nature, one that could comprehend the order and logic of the marketplace ... It was within this new model of nature that science emerged” (Kaye, 1998, p. 14). This post-renaissance thinking links neatly with the anthropocentric framework of ecosystem services, a concept pushed within conservation biology in the past two decades (Suarez & Dempsey, 2018). Ecosystem services is an approach to conservation through the human economic valuation of nature, listing the benefits to people of global ecosystems (Reid et al., 2005; Suarez & Dempsey, 2018), thus defining nature's value as only that which benefits humans – antithetical to ecocentrism and thus reflective of both anthropocentrism and capitalism. This unfortunate 'if you can't be them, join them' approach to conservation aligns 'conservation with the multiple, competing priorities of sustainable development' and translates 'what nature does into economic language' (Suarez & Dempsey, 2018, p. 175). As McCauley (2006) notes, this approach implies '—intentionally or otherwise—that nature is only worth conserving when it can be made profitable' (p. 28). This turns environmental conservation into a pandering to capitalist (and, as explained, anti-human-wellbeing) structures, instead of an inversion of them, as

> 'conservationists are now compelled to speak in economic language, think in market categories, and create arrangements that either do not challenge or outright perform capitalist imperatives— arguably, the very processes implicated in driving environmental degradation and biodiversity loss' (Suarez & Dempsey, 2018, p. 177).

Not only has anthropocentrism, expedited through industrialization, exposed a fundamental shift in how dominant human cultures view nature, it is also the fuel and root cause of the environmental polycrisis that puts humans, especially those in the global south, at risk. In this way, anthropocentrism, as used through modern history, is a term promoted and used by Western forces, much like the term colonization, and industrialization. What this means is that anthropocentrism perpetuates hierarchies of humans and hierarchies of purpose which harm humans and the ecosphere

(Kidner, 2014). Anthropocentrism at its core is inherently anti-human, and thus is a risky term to centre sustainability and environmental conservation around (Kidner, 2014). Instead, in this research, I mirror the ecocentrism of local Galápagos institutions, such as the Galápagos National Park and various non-profits, and mirror the ecocentrism of most of the child participants in this study.

Children may have distinctly different patterns of environmental values and attitudes than adults, especially along the lines of either anthropocentric or ecocentric thinking. Overall, studies suggest that there is considerable propensity of children to think and act ecocentrically, but that there are variations in volume of anthropocentric attitudes often aligned with age group (Almeida et al., 2011, 2012; Atabey, 2021; Kopnina, 2014; Özen Uyar & Yılmaz Genç, 2016; Simsar et al., 2021). Simsar et al. (2021) worked with Syrian preschool children to determine their environmental attitudes. Children exhibited more anthropocentric attitudes when asked about consumption patterns such as saving water or electricity, while they exhibited significantly ecocentric attitudes when asked questions about environmental protection including questions about animals and plants (Simsar et al., 2021). The anthropocentric lean around consumption could be explained by the fact that children were living in refugee camps where consumption of resources was directly related to personal and family survival.

Özen Uyar & Yılmaz Genç (2016) also worked with preschool children, in Turkey, who exhibited ecocentric attitudes when asked about environmental protection (Özen Uyar & Yılmaz Genç, 2016). Kopnina (2014) worked with Dutch elementary school children and noted that the curriculum that children were being taught in schools at that point did not present any ecocentric views, instead focused on the need to sustain the human industrial complex. Discussions with children prompted a challenge to this anthropocentric lens, with some children noting conflict between human needs and rights of the environment.

Almeida et al. (2011) found higher rates of non-anthropocentric attitudes within their study with primary school children in Portugal. Some children produced an "idea of nature being a complex network of relationships which depends on the presence of all elements to work well" further emphasizing ecocentrism instead of anthropocentric needs (Almeida et al., 2011, p. 326). Almeida et al. (2012) used a similar study approach again with primary school children in Portugal and produced similar results - again noting high frequency of ecocentric attitudes among participating children. Atabey (2021) worked with middle schoolers and noted that ecocentrism was present when discussing general environmentally related behaviours, but anthropocentrism was more present when discussing consumption patterns. Overall, when directly questioned about protecting the environment, all studies indicated presence or predominance of ecocentric attitudes.

2.2.4 Addressing the West

It is important to make distinctions here between Western and non-Western and Indigenous philosophies and environmental ethics. This is especially important when discussing anthropocentrism, and the current era of the Anthropocene, one which is certainly dominated (per the name) by humanity as a singular force, which might lead one to then assume that all individuals of the human species historically and presently share equal weight and responsibility for the current environmental polycrisis. This is incorrect as "not all human groups throughout history have caused (or are causing) such an upheaval" (Pelizzon, 2025, p. 62) and because "[t]he notion that man is destined to dominate nature is by no means a universal feature of human culture" (Bookchin, 1982, p. 43). As a very brief statement on what is a deeply important topic both within and outside of academia (another point of separation that may perpetuate imbalance of thought and dominance of Western ideas) is that Western philosophies and thinking have historically been and continue to be globally dominant, though the recent support for decolonizing these spaces has served to recognize this dominance and attempt to address it (Maldonado-Torres et al., 2018; Mika, 2015). It is also important to remind that while a Western worldview, including philosophies related to human and nature relations, "may be politically and economically dominant," it is "by no means, universal—notwithstanding its modernist belief in its own neutrality, objectivity and scientificity" (Pelizzon, 2025, p. 63).

Amongst the areas of thought that have been and continue to be dominated by Western ideals is that of conceptualizing human's relationship with what we term nature or the environment. In this thesis, I focus on early modern Western philosophical thought, as classical Greek philosophy had differing views of the natural world than early modern and modern Western thought (Attfield, 1991). In Western spheres, philosophy has historically implemented strict hierarchies of rights. This hierarchy, which we can also call white supremacy, placed white, Western, male, heteronormative individuals at the pinnacle, and subjected others not included in this demographic as below or less than that top group (Mills, 2003). Beyond a hierarchy within the human race, Western thought also placed non-human elements of the world (such as non-human animals, other biological components, and abiotic ecological components) below and thus less than most human groups as an expression of anthropocentrism.

Here I recognize and address the frequent and persistent mistreatment of non-white groups by white supremacists historically and currently and the removal of humanity and agency by white supremacists from non-white humans. White supremacy and anthropocentrism are both relics of and legacy problems within Western philosophy and are intertwined and thus both important to address when discussing current environmental challenges and the ethics of environmentalism in the Galápagos. As succinctly put by Bookchin (1982), “[t]he very notion of the domination of nature by man stems from the very real domination of human by human” (p. n7). As historian Lynn White Jr. states in his 1967 essay, ‘The Historical Roots of Our Ecologic Crisis’, the ultimate source for the current environmental crisis is fuelled by the Judeo-Christian tradition as beliefs in these religions claim a separation between human and nature - very strikingly in the belief that man was created in God’s image, and God created the rest of the ecological sphere “explicitly for man’s benefit and rule: no item in the physical creation had any purpose save to serve man’s purposes” (p. 1205). And even more explicitly, in contrast with paganism and many non-Western belief systems, Christianity in particular “not only established a dualism of man and nature, but also insisted that it is God’s will that man exploit nature for his proper ends” (White, 1967, p. 1205). It is key to explain here that individuals who hold Judeo-Christian beliefs are not singled out as the issue, but that the historical domination of Judeo-Christian beliefs that Western cultures spread through imperialism and colonialism perpetuate the notion that humans are separate from and above nature, thus fuelling exploitation of ecological spaces for human use.

This is not to say that humans as a species have only had an impact on the global environment through the channel of Judeo-Christian belief and practice, as humans have modified and had considerable impact on surrounding environments for millennia. However, the Western philosophical and Judeo-Christian thought system has concretized a separation from, and othering of nature from humans, which has exacerbated and encouraged environmental exploitation for the purpose of prioritizing human growth. The separation of human from nature has not only been employed for direct environmental destruction, but also for the purportedly positive protection of the natural world. The implication here is that Western thought recognizes the Western-driven exploitation of the environment and thus employs the same separatist ethic to attempt to preserve it. This perpetuates not only a separation between human and nature, but the Western humans above other humans hierarchy, with a notable example being the forced removal of Native Americans from what became US National Park land (Kantor, 2007; Klein, 2020; Patterson & University, 2019), and globally, this approach, termed 'fortress conservation' has been used with the construction of protected areas (PAs) on various continents - producing millions of conservation refugees (Fletcher, 2017). This example also exemplifies the Western idea of 'wilderness' - conceptualized in the US Wilderness Act of 1964 as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions" (*Complete Text of the Wilderness Act - Public Law 88-577*, 1964, para. 3). As Indigenous ethnoecologist, Enrique Salmon, reminds, "The notion of wilderness then carries the notion that humans are bad for the environment" (as quoted in Dowie, 2019, para. 28) which is not a universal or unavoidable truth.

Non-Western modern philosophy is inherently influenced by Western thought due to centuries of imperialism and colonization which served to spread and dictate Western ideals in non-

Western spaces. However, there are distinctly non-Western philosophies that support a less anthropocentric and thus more ecocentric worldview such as various bodies of thought from the African continent ranging from Ubuntu to other nature-relatedness philosophies (Etieyibo, 2017; Ibanga, 2023; Tangwa, 2005). Additionally, Indigenous philosophies from around the world often include ecocentric language and stated beliefs. Distinct from Western traditions, many Indigenous philosophies do not use hierarchies when conceptualizing humans in relation to an environment, instead offering lateral relational connections such as kinship and equal footing. For example, the Tarahumara, an Indigenous group in what is now north-western Mexico, have a worldview of kincentric ecology, a term coined by Tarahumaran ethnoecologist Enrique Salmon (Dowie, 2019). As Salmon explains, "[w]e are immersed in an environment where we are at equal standing with the rest of the world [...] They are all kindred relations — the trees and rocks and bugs and everything is in equal standing with the rest" (Dowie, 2019, para. 22). This worldview, as it lacks a human-pinnacle and hierarchy, is not anthropocentric, but ecocentric. It is not that Indigenous groups do not use natural resources, but that the philosophy that Indigenous groups (not all individuals - as we must not paint ever member of a group with the same brush) hold approaches use in a sustainable way (here using a more 'traditional' definition of sustainable as discussed in the previous section) because of the lateral relational view of humans within, part of, and on equal footing with other biological and ecological components of an environment.

Another example of ecocentric Indigenous philosophy is Sumak Kawsay, the Kichwa philosophy that literally translates to 'good living' or 'beautiful life'. Kichwa is the name of the language of the collectively most populous Indigenous groups in Ecuador and Peru - though there are distinct Indigenous groups within this demographic that share a common language (Knapp, 2019). Sumak Kawsay is a worldview, or illanay in Kichwa, of the Amazonian Kichwa (Vásquez Bustamante et al., 2021) that both predates (though the term itself was coined in the 90s by Indigenous scholars) and counters the presumptions and aspirations of capitalism (*ILLANAY - ¿Cosmovisión o Filosofía?*, n.d.). It is a philosophy for human life, emphasizing horizontal communities which directly counter narratives of modernization, domination, and dehumanization – which aligns with my desire to decentre hegemonic systems in this research and to centre delegitimized and often foundational voices. Sumak Kawsay also includes ecological concepts and holds that there is no dichotomy of human vs human or human vs nature, and instead focuses on parity and harmony within broader systems - pointedly, it stresses the essentialism of a healthy ecological system that includes humans, thus transcending, or indeed preceding the globally dominant 'nature/society dichotomy' (Malo Larrea et al., 2024, p. 1). Harmony within the ecological sphere is supported by the belief that all ecological components have spiritual presence and importance and that humans are a part of, not apart from, world ecosystems (Andy Alvarado et al., 2012; Cuestas Caza, 2019). This focus on the socio-ecological components of Sumak Kawsay does not seek to diminish or simplify the 'cosmovision that implies a philosophy, a worldview, a social organisation, and a set of socio-ecological relations with their related practices' (Malo Larrea et al., 2024, p. 1). Indeed, it is the cherry-picking of elements and single assertions and simplification of Sumak Kawsay mentioned below that fails to represent the cosmovision's complexity and entirety of meaning, but also creates injustice for those who have built and hold + practice the cosmovision. I recognize that I am also attempting to understand and learn from Sumak Kawsay as an outsider and insist that even the care-full discussion here be read with the knowledge that this cosmovision is best understood and portrayed by Indigenous voices.

In Ecuador, the federal government has both translated and transformed Sumak Kawsay, into the dominant political discourse, at once removing the Indigenous cosmovision from its linguistic, cultural, social, and philosophical space into a politicized, simplified, Castellano (as the term 'Buen Vivir' in Spanish), Mestizo platform by inscription of Buen Vivir into the 2008 Ecuadorian Constitution (Coello, 2022; Malo Larrea et al., 2024; Muyolema C., 2001; Vásquez Bustamante et al., 2021). As Coello (2022) details, even the use of the translated term 'Buen Vivir' or 'Good Living' fails to recognize the similarity of Buen Vivir with intentionally destructive programs of similar names following WWII, which problematized the '"rural" population—a descriptor used for Indigenous, Afrodescendant, and Afro-Indigenous peoples or Ancestral Pueblos' (p. 202) as peoples in need of 'bettering' and must be solved to fit national and capitalist narratives of development. While on the face, the governmental co-option of Buen Vivir proposes positives in terms of betterment for all in Ecuador, a departure from European development and modernization narratives, and destructive human to human and human to environment philosophies and patterns, it fails to follow through on these promises and indeed twists back into the very ruts it claims to want out of, effectively misusing and abusing both the Kichwa cosmovision and Indigenous and 'rural' minorities (Coello, 2022). Similarly, Malo Larrea et al. (2024) remind that traditional, or western science has 'appropriated elements of ancestral knowledge as long as they are useful for accumulating capital and knowledge within capitalism and its dynamics' and that learning from Sumak Kawsay is beneficial within western, traditional scientific, and modernization spaces as 'it offers an epistemic possibility to rethink the nature/society dichotomy' (pp. 1-2). Muyolema (2001) deepened this discussion of appropriation of Sumak Kawsay by looking more broadly at the entirety of the appropriation of histories and spaces and the subjugation of original peoples in Abya Yala, the Guna people's name for what Western history names the Americas. This original stealing of space, history, and story was done in many ways, but Muyolema highlights language as one of the most pernicious offenders, as Westerners created whole lexicons to describe from one invading perspective, the lives and realities of the original peoples of these continents, and that perspective others and misconstrues and erroneously represents Indigenous realities and ignores multiple perspectives (Muyolema C., 2001). The misrepresentation, then, of Sumak Kawsay through the insistence that it be morphed into Spanish and pushed through a non-Indigenous lens of interpretation seems an uncanny continuation of the original Western language domination Muyolema discusses.

The theme of appropriation and misrepresentation of components of Sumak Kawsay once transformed into Buen Vivir are also noted in the political interpretation and application of such components to a state that aims to increase GDP to attain some of the more socialist principles of Buen Vivir and 'better' life for all (Vásquez Bustamante et al., 2021). Paradoxically, governmental reforms driven by the appropriation of Buen Vivir in 2008 doubled down on extractivist economic principles and practices, particularly for primary resource extraction and exploitation, as a means to an end of growing the Ecuadorian economy for the goal of then redistributing wealth and encouraging advancement of all citizens – while simultaneously acting against often-Indigenous-promoted and demanded reduction in extractivism and the due rights of Indigenous peoples to land and resources (Vásquez Bustamante et al., 2021). In short, while the appropriation and (mis)interpretation of an

Indigenous cosmovision drew a potentially beneficial focus to Indigenous philosophies and Indigenous groups in Ecuador, Buen Vivir masquerades as an attempt at establishing a new national order distinct from neoliberalism while inherently creating tensions economically, socially, and politically that continue to perpetuate unresolved inequities and mis-align values of perpetual growth with Sumak Kawsay (Vásquez Bustamante et al., 2021).

Much like groups of adults around the world, children of Western, non-Western, and Indigenous cultures exhibit similarly distinct views of nature, environment, and sustainability as outlined from adult sources above (S. C. Almeida, 2020; Boeve-de Pauw & Van Petegem, 2012; Exenberger et al., 2018; Inoue, 2020; Mosanya & Kwiatkowska, 2023; Somerville & Hickey, 2020, 2020; Van Petegem & Blieck, 2006). However, scales and studies used with children in differing geographical and philosophical regions show distinct child-centric trends in attitudes towards the environment. In a study with 13–15-year-old children in both Belgium and Zimbabwe, Van Petegem and Blieck (2006) used the New Ecological Paradigm (NEP) scale, an instrument used to measure philosophical and attitudinal views towards the environment originally for adults. Both groups of children displayed ecocentric attitudes, within an ecological worldview, but Belgian children viewed humans as less dominant over the environment than did Zimbabwean children (Van Petegem & Blieck, 2006). Later, Boeve-de Pauw and Van Petegem (2012) used the same instrument again with children in Belgium, Zimbabwe, and Vietnam, and noted cultural differences in environmental worldviews between children in what they term developed (Western) vs developing (non-Western) countries, which they explain by referencing Maslow's hierarchy of needs, "according to which as one kind of need is satisfied another kind arises" (p. 7). Differing from these results, Mosanya and

Kwiatkowska (2023) worked with non-Western third culture kids (TCKs) using the same NEP scale and the children they worked with demonstrated strong ecological worldviews. The researchers posited that "TCKs' exposure to cultural diversity during developmental years might support global issues engagement and ecocentric worldviews" (Mosanya & Kwiatkowska, 2023, p. 103). These studies recognized that not only do children as a group hold distinct ecological views from adults, but that Western and non-Western children often have further distinct attitudes towards the environment which are worth understanding for the sake of developing programs that fit the needs of those children.

2.3 Types of Environmentally Related Education

2.3.1 Environmental Education

Environmental Education (EE) is the main field in which this study is situated, and thus it is important to define and describe EE and give examples of related terms in this section. Before doing this, though, it is important to note that there are various defined forms of education, including formal, informal, and non-formal education and associated learning. All three forms of learning are included in this study, though I do not focus on explicit distinctions between them. Though I worked with children while they were physically within school grounds, this study does not only look at LEK accessed within formal educational spaces, and instead simply looks at all LEK from all sources. What we think of as school or classroom learning can be defined as formal education, or education with a set curriculum or structure that is intentional by both the instructor or teacher and participants or students (Johnson &

Majewska, 2022). Non-formal learning may be structured but takes place outside of formal schools though might be within other structured spaces, and learning is intentional and recognized by the learner, such as learning that might occur from signs at a National Park site or within a museum (Johnson & Majewska, 2022). Informal learning is unstructured and unintentional and may be unrecognized by the learner (Johnson & Majewska, 2022). Gerber et al. (2001) note that: "in essence, the informal learning can be defined as the sum of activities that comprise the time individuals are not in the formal classroom in the presence of a teacher" (p. 570) and could be learning from experience or observations in any space. Environmental Education can be accessed or provisioned in all three contexts.

Various international and governing bodies have attempted to define EE and its "essential concepts" (A. G. Gough, 1993). The definition drafted by the International Union for the Conservation of Nature and Natural Resources (IUCN) in 1970 states that:

> Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision making and self-formulating of a code of behaviour about issues concerning environmental quality (Pritchard, 1971, p. 1).

Because the Galápagos are a UNESCO Natural World Heritage Site it seems appropriate to also consult a definition for EE created by UNESCO. According to the Tbilisi Declaration in 1978, which remains one of the most well-recognized international statements on environmental education:

> The goals of environmental education are:

a. To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;

b. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;

c. To create new patterns of behaviour of individuals, groups, and society as a whole towards the environment (*Intergovernmental Conference on Environmental Education, Tbilisi, USSR, 14-26 October 1977: Final Report*, 1978, pp. 26–27)

Additionally, the declaration described the components of EE, which I draw on for this study, especially in my decision to focus on knowledge, or more specifically Local Ecological Knowledge:

The categories of environmental education objectives:

Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

Knowledge: to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment, and the motivation for actively participating in environmental improvement and protection.

Skills: to help social groups and individuals acquire the skills for identifying and solving environmental problems.

Participation: to provide social groups and individuals with an opportunity to be actively involved at all levels in working towards resolution of environmental problems. environment (*Intergovernmental Conference on Environmental Education, Tbilisi, USSR, 14-26 October 1977: Final Report*, 1978, pp. 26–27)

The purposes of EE have also been addressed by many, in addition to the learning outcomes listed above. Conservation and sustainability are two of the main purposes or drivers for implementing or increasing EE (Ardoin et al., 2020; Saylan & Blumstein, 2011). Saylan and Blumstein (2011), in their recent critique of the perceived failure of Environmental Education, remind us that "not only must environmental education teach people about their physical environment, it must go further to teach how to live and flourish in sustainable ways" (p. 2). Ardoin et al. (2020) explicitly state that EE is "a conservation strategy" (p. 1) and in their systematic review of 105 peer reviewed articles in English about EE and EE programs, they also note that "environmental education research and practice contribute to transformative activity that can impact environmental quality through a variety of avenues—and, indeed, we can all benefit from those impacts, in the short and long term" (p. 11). In resource-depleted regions, studies also highlight the important benefits of empowering and enabling human communities to survive and grow through the implementation of non-formal environmental education. In Uganda, Brazil, and Ethiopia, for example, non-formal environmental education programs have supported local communities to gain skills and connections to solve environmental and micro economic and social challenges to improve quality of life in addition to protecting local environments (Calvente et al., 2018; Mucunguzi, 1995; Zikargae et al., 2022).

The definitions of EE, most notably the outline from UNESCO, allow us to choose elements of EE to focus on that may be considered proxies for overall EE for children in the Galápagos. I will primarily be using two terms in this study that relate to EE, Ecological Knowledge and Environmental Learning, to more directly engage with children and explore the state of their exposure to broader EE on the islands. Ecological Knowledge is, per the definitions described in the next section, one of the components of Environmental Education, i.e., comprehensive EE will include Ecological Knowledge. Environmental Learning, described further in the subsequent review sections, is a process which may result in Environmental Education or be a process used within Environmental Education programs.

Environmental Education with and for children has been a significant focus for researchers, parents, teachers, and various international governments alike for decades now for many different reasons. A critical review of EE research in by Hart and Nolan (1999) described the sharp increase in attention to EE in both research and policy first in the heavily resourced West but quickly spreading around the world which paralleled increased environmental concerns within governments and international organizations such as branches of the UN, and on the heels of the Tbilisi declaration. In general, environmental concerns gained traction through the 1970s and have continued to be present in international spotlights since (Lucas, 1972). In the Galápagos, this was also reflected with the islands being named one of the first 12 UNESCO Natural World Heritage sites which incurred increased environmental attention and consideration by the Ecuadorian government as to how to protect the local environment ('2 COM VIII.38 - Decision, Review of Nominations to the World Heritage List', 1978). More recently, Ecuador has established a national Environmental Education plan (currently covering 2017-2030) for the purpose of sustainable development, which includes mention of strengthening environmental education within all levels of schooling (Estrategia Nacional de Educación Ambiental Para El Desarollo Sostenible 2017-2030, 2018).

In much of this attention, the purpose of EE for children was closely tied to the push for environmental sustainability and to achieve this, the promotion of environmentally responsible behaviour driven by acquisition of environmental knowledge and connection to nature at a young age (Otto & Pensini, 2017). The goal of effective EE was long term sustainability, and as education reflects the goals of any community or nation, EE was given more attention and resources through both formal and non-formal channels especially through the 1990s (Tilbury, 1995). A complementary purpose was flagged by the publication of Last Child in the Woods by Richard Louv (2005) which alerted American adults to decreased time spent in and exposure to the natural world for 21st century American children and the negative impacts that deficit presented for child development. Indeed, researchers addressed nature deficit disorder as one of the main purposes of environmental education, noting that "[c]oncerns regarding the profound physical, social, and psychological problems associated with childhood nature deprivation have catalyzed extensive growth in nature-based education programs" (Larson et al., 2010, p. 95). Beyond general sustainability and the wellbeing of children, environmental literacy (defined in the following section) is also seen as a purpose and goal of environmental education (Stern et al., 2014). These purposes and outcomes of environmental education were all noted in a systematic review of early childhood EE research by Ardoin and Bowers (2020), which found that the top three outcomes across studies were environmental literacy development, cognitive development, and social and emotional development for children.

As a final note, while this thesis focuses on EE, it is worth considering the long-debated and often challenging relationship between EE and science education (SE), and the presence of calls to converge or rethink the relationship between the two. While both EE and SE overlap in a purpose of educating for environmental sustainability, Wals et al. (2016) outline that SE 'focuses primarily on teaching knowledge and skills' while EE, in addition to these components, 'also stresses the incorporation of values and changing behaviors' (p. 357). With distinct political, economic, and social impetuses, EE and SE have grown more distant as disciplines in recent decades (Wals et al., 2016). Here, I remind that the use of the term 'science' in SE from the sources cited above refers specifically to western scientific traditions, and thus excludes (in most curricula) Indigenous and broader sciences and epistemologies, which accentuates the existing issue of inequality in and lack of accessibility to western SE (Graves et al., 2022; Lerman, 2017; Snively & Corsiglia, 2001). Given this, and the often 'static nature of [western] science education practices' instead of the often-pushed idea of inserting EE into established SE programs, I agree with Gough in that 'it might be time to reconsider science education's function as a 'host' for environmental education and try to imagine a more mutualistic relationship' (2002, p. 1201).

2.3.2 Connected Terms: Environmentally Related Education

There are many terms related to EE, such as outdoor education, nature-based education, and place-based education which often have similar aims and provisioning styles. Outdoor education grew out of camping education in the 1940s US context, later encompassing education in and about the out-of-doors, which could include elements of environmental education, but which also may include education on how to do outdoor-specific activities (Adkins & Simmons, 2002). The term, coupled with outdoor learning, currently is used within educational spaces to mean “play, teaching, and learning that take place in natural environments for children in formal education and care settings” which could include environmental education that takes place outside, but which does not inherently imply any environmental education taking place (Waite, 2020, p. 1). Nature based education is often education that is dual coded as outdoor education, implying that it is education that takes place outdoors, specifically in natural environments, and encourages substantial time within nature, but again, does not require formal environmental education content to be delivered or received (Larimore, n.d.; Mann et al., 2021). Place based education mirrors the situated nature of nature-based and outdoor education, but “its aim is to ground learning in local phenomena and students’ lived experience” (G. A. Smith, 2002, p. 568). The place-centric nature of this type of education means prioritizing and spending time in local spaces, which could be local environments, but again does not inherently entail environmental education happening within this type of education (Gruenewald & Smith, 2008).

Other terms in the environmentally related education space include Education for Sustainability (EfS), Education for Sustainable Development (ESD), and Climate Change Education (CCE). These three terms specifically are more recent adoptions within the environmentally related education space, as they follow the adoption of sustainability as a widely used term within national and international governance spaces, and the increased recognition of and work to mitigate human-caused climate change in the 21st century. Differences in definition and scope of the two sustainability related education terms from environmental education mirror the evolution of interpretation of the term sustainability as described in previous sections.

EfS "is an approach that prepares children and young people in coping with, managing and shaping social, economic and ecological conditions characterised by change, uncertainty, risk and complexity" (Green, 2017, p. 152). ESD "empowers people with the knowledge, skills, values, attitudes and behaviors to live in a way that is good for the environment, economy, and society. It encourages people to make smart, responsible choices that help create a better future for everyone" (*Education for Sustainable Development | UNESCO*, n.d., para. 2). Both extend the interpretation of sustainability to include sustaining human social, political, and economic systems beyond the scope of environmental sustainability, and share focus between environmental concerns and issues of human equity. ESD is the more widely used term of the two sustainability-oriented education types, as it's aligned with the UN Sustainable Development Goals and thus has garnered significant international attention by member states and related organizations (*Education for Sustainable Development | UNESCO*, n.d.; *Sulitest - Mainstreaming Sustainability Education Worldwide*, n.d.). EfS originally aligned with traditional definitions of sustainability in its implication of environmental focus, thus maintaining an ecocentric interpretation rather than an anthropocentric one though has since been adopted as a form of education with sustainable development as a desired outcome (Huckle & Sterling, 1996).

Climate change education, often associated with programs of environmental education, is also a more recently used term, with the number of studies on CCE increasing by more than a factor of 10 from the 1990s through the early 2000s (Rousell & Cutter-Mackenzie-Knowles, 2020). CCE is both education about climate change as a human-induced phenomenon, and education to mitigate further and future effects of climate change, and thus is interdisciplinary in nature and focused not only on knowledge acquisition but on affective competencies such attitudes and values that lead to behaviour change (*Climate Change Education | UNESCO*, n.d.).

Despite being the people who contribute the least to its exponential worsening, children are disproportionately impacted by climate change. Climate change, one branch of the environmental polycrisis, is a worsening global condition and thus will have increasingly damaging effects into the future, on people who are currently children. UNICEF names climate change as a 'child rights crisis' as "[n]early half of the world's children (1 billion) live in countries that are at extremely high risk from the impacts of climate change" (*The Climate Crisis Is a Child Rights Crisis*, 2021, para. 1). Increasing CCE in general is deeply important to mitigate and slow climate change and its detrimental effects on global ecosystems, not only because it gives children the knowledge, skills, and affective competencies to change behaviour and effect policy, but often has "multiplier effects, where families and communities benefit when individuals share what they have learned" (Stevenson et al., 2017, p. 67). Additionally, providing CCE to children is an issue of children's rights, and poses a chance to include children's voices as prominent stakeholders in any future state of the planet. As Cutter-Mackenzie and Rousell (2019) explain, climate change surfaces "the issue of generational injustice, as children and young people are currently inheriting social and ecological problems which they have had very little part in creating" (p. 90).

2.3.2 Ways of Provisioning Education and Ways of Learning

Beyond related types of education and the complexity of the broader space of environmentally related education, there are also different forms of crafting and delivering or provisioning environmentally related education generally and for children. Inclusion of environmental education within curricula in formal school systems remains infrequent but often researched in terms of ways of including EE within formal curricula. In Australia, for example, there have been efforts to include EE within the national curriculum, often competing for space and time with science education (Gough, 2011). In Aotearoa/New Zealand, though inclusion of core topics including the environment were covered in a 1988 curricular reform, the interpretation of the definition of environment and what content was then covered about it has been deeply influenced and shaped by successive political realities (Chapman, 2011). Other formal education challenges extend to how broadly to include environmental education within the curriculum, such as the inclusion of transversal themes about the environment in the 2013 Indonesian national curriculum, instead of a core subject (Prihantoro, 2014).

Experiential learning as a provisioning method for environmental education, and a method of learning, draws on elements of Dewey's, Piaget's, Lewin's, and Kolb's work on learning theory that highlights the effectiveness and indeed necessity of combining didactic and experiential learning to construct knowledge and behaviour change (Kolb, 1984; Miettinen, 2000). For example, Dewey's model of learning explicitly includes experience, and notes a necessary mixing of experience and observations with conceptual understanding and action (Dewey, 1938; Kolb, 1984). Experiential learning is hands-on, action-oriented, and allows learners to experience and reflect on that experience to construct knowledge, as guided by Dewey's concept of 'learning by doing' (Dewey, 1938; Gaffney & O'Neil, 2019). Relatedly, Pestalozzi, Eroebel, and Montessori also asserted that children greatly benefited from learning through direct contact with materials, particularly in nature, pointing to more experiential educational styles (Davis, 1998). Pestalozzi particularly noted that learning from, and thus within, nature itself was essential and important for children especially, stating "I wish to wrest education from the outworn order of doddering old teaching hacks…and entrust it to the eternal powers of nature herself" (Silber, 1965, p. 134).

Experiential education has been used frequently for environmentally-related education provisioning both formally and informally and has shown to be impactful for learners because it allows them to learn within an environment that they are learning about - immediately pairing direct experience with contextual information and encouraging the development of both knowledge and affective competencies including environmental values and attitudes (Corscadden & Kevany, 2017; Dunkley, 2016; Fazey et al., 2006; Gaffney & O'Neil, 2019). Learning through experience has been shown to form strong foundations of learned information, whether it's learning something new without prior experience, or learning something new by connecting new experience to previous experience (Wolfe, 2011). Both children and adults learn through experience, and the effectiveness of experiential learning forming new neural networks extends beyond early childhood throughout someone's life (Wolfe, 2011). This emphasis on the importance and effectiveness of experience for learning is echoed succinctly by Kolb when he stated that learning is a "process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). While neuroscience clearly illuminates that learning does happen directly from experience, Dewey reminds that further learning continues to happen when experience is mediated by reflection, outlining an experience-reflection-learning process, during which experience is analysed through reflective thought (Felten et al., 2006).

Modelling as a way of provisioning environmentally related education, and the paired learning strategy, observation of the modelling, is another keyway for many, including children, to construct environmental knowledge (Eberbach & Crowley, 2009, 2017; Gaskins & Paradise, 2010; Niskač, 2013). Observation is a well-documented and dominant form of learning in childhood, and thus employing and encouraging observational learning by children about environmental concepts is a useful tool (Gaskins & Paradise, 2010). Another option for provisioning and accessing environmentally related education is one exemplified in many Indigenous communities in the transmission and sharing of Indigenous Ecological Knowledge (IEK), a concept that will be discussed in later sections. Often, this environmentally related education is transmitted through mediated hands-on experience, often modelling by family and community members and observation by children of that modelling, and through oral instruction and sharing of information, blending didactic and experiential provisioning of education (Gallois et al., 2017; Setalaphruk & Price, 2007). In this study, I agree with and ground my work with children and around learning in the theory of experiential learning, observational learning, and the socially mediated learning exemplified within many Indigenous communities.

2.4 Environmental Literacy

Environmental Literacy (EL) as a term was first used in 1968 in a curriculum guide by Charles Roth, submitted to the then active federal US Department of Health, Education, and Welfare. In this, he states that it is the responsibility of the formal education system to help develop "environmentally literate citizens who will be able to make decisions and choices as producers, consumers, voters, and recreationalists that will sustain a liveable environment," (Roth, 1968, p. 6). From the very outset of the use of this term, children were seen as the obvious targets for developing environmental literacy, as the future stewards of the global environment (Roth, 1968). From that initial use, the term was often uncritically used, which some claim muddied the definition and usefulness of the term. To ground the use of EL, Roth conducted a study in 1992 looking at the evolution of the term and concluded that an environmentally literate person "recognizes environmental problems when they arise. This means acquiring a basic understanding of the fundamental interrelationships among people and the bio-geo-chemical environments" (1992, p. 18). EL is a foundational umbrella term and is seen as the goal of environmental education, in that someone who has received effective and comprehensive environmental education will be environmentally literate (Fang et al., 2023; Hollweg et al., 2011). One of the main goals of developing EL of a population is changed behaviour, which is often presumed to come from increased environmental knowledge, sharing and cultivating of environmental attitudes and values, and a sense of ability to affect change (Fang et al., 2023). EL is, in effect, the "learning motivations, awareness and sensitivity, values and attitudes, mobilization skills, mobilization experience, environmental behaviour, and aesthetic literacy in the cultivation of literacy" (Fang et al., 2023, p. 93). While I do not directly work with the term EL in this study, it is inherently connected to the primary component I ask about: ecological knowledge. Therefore, understanding the position of EL in relation to other environmental and educational concepts is helpful. The North American Association of Environmental Education (NAAEE) has refined and promoted a detailed explanation of EL, mirroring the four broad components of EL that Fang et al. (2023) also outline: competencies, knowledge, dispositions, and behaviour (Hollweg et al., 2011). Within competencies, Hollweg et al. describe an environmentally literate person as someone who can:

- Identify environmental issues,

- Ask relevant questions,
- Analyze environmental issues,
- Investigate environmental issues,
- Evaluate and make personal judgments about environmental issues,
- Use evidence and knowledge to defend positions and resolve issues, and
- Create and evaluate plans to resolve environmental issues (2011, p. 3)

The knowledge component of EL entails knowledge of: "physical and ecological systems; social, cultural and political systems; environmental issues; multiple solutions to environmental issues; and citizen participation and action strategies" (Hollweg et al., 2011, p. 3) including both ecological knowledge and human system knowledge in relation to ecological functions. This definition reflects many of the same components and goals of ESD and Sustainable Development, as explored in previous sections, and again implies a distinction between 'natural' or ecological systems and human systems. The dispositions component includes environmentally oriented "sensitivity; attitudes, concern, and worldview; personal responsibility; self-efficacy/locus of control; and motivation and intentions" (Hollweg et al., 2011, p. 4). These affective pieces of EL are something that appeared readily through data collection and findings in this study, though they were not explicitly captured by the research questions. The close relationship between knowledge and affections, specifically expression of emotions, about that knowledge will be explored later. The definition of environmentally responsible, or pro-environmental behaviour (PEB) is often contested, though the NAAEE outline different types of behaviour that they include within the components of EL:

ecomanagement, persuasion, consumer/economic action, political action, legal action, environmental activism, non-activist behaviors in the public sphere, private sphere environmentalism, and other environmentally significant behavior (Hollweg et al., 2011, p. 4).

While first used in the US, EL is a global term, and has been measured and used in studies with children and adults alike around the world. Studies on adult EL often focus on adults who regularly interact with children, like parents or teachers, for the purpose of understanding their EL in relation to passing on to children (Iwaniec & Curdt-Christiansen, 2020; S.-Y. Liu et al., 2015; L. Rodríguez et al., 2023; Swanepoel et al., 2002). Others look at provisioning or measuring EL for or in adults for the purpose of broadening EL and EE for the general adult populace (J. Rodríguez et al., 2018; Vogelfanger & Virginia Mas, 2021). Many contemporary studies of EL and children focus on measuring EL levels by using survey instruments designed to include questions about each of the main components of EL. These surveys, such as the Middle School Environmental Literacy Survey (MSELS) (McBeth & Volk, 2009) or the Environmental Literacy Instrument for Adolescents (ELI-A) (Szczytko et al., 2019) are usually very general, allowing researchers and governments alike to administer the instrument and compare results between groups of children and students over broad regions. These studies rely on quantitative, measurable data, and it seems few studies use or value qualitative methods of data collection, the exception being studies with much younger children for whom surveys may be a challenge (Basile & White, 2000). Some studies also note that when measuring EL and sources that could help children develop it, school curricula alone were not sufficient to provide the knowledge or encourage the affective and behavioural components of EL (Amin et al., 2019; Takyi et al., 2023).

Components of EL also align with a theory of environmental learning by Eiss and Harbeck (1969, as cited in Iozzi, 1989) "indicating that an individual's response to the environment is based on three domains: affective, cognitive, and behavioral" (Pooley & O'Connor, 2000, p. 712). These three domains, which reflect three of the four EL domains noted by NAAEE, and which align with Fang's three components of EL, will be explored below.

2.4.1 Local Ecological Knowledge

In this section, I describe what is meant by environmental knowledge, with particular emphasis on the term Local Ecological Knowledge (LEK). Ecological knowledge is a key element within EE and component of EL. Ecological knowledge is multi-defined and is often aligned with ecology which is a branch within the Western science tradition of biology (Inglis, 1993). However, that narrow scope leaves little space for knowledge that is about ecological spaces that is held by those who are not formal ecologists or operating within a Western system. Inglis adopts the broader foundational concept of ecology as "the knowledge, however acquired, of relationships of living beings with one another and with their environment" (1993, p. 17), which I use here as it allows us to capture all pieces of environmental knowledge about ecological spheres beyond Western science.

With this in mind, three main types of ecological knowledge dominate the environmental management and education field: Scientific Ecological Knowledge (SEK), Indigenous Ecological Knowledge (IEK), and LEK (Dabezies, 2018; Kimmerer, 2012; Nash et al., 2016). SEK is based on

Western science's information about an environment and may commonly be associated with the content of general ecology curricula and is based on abstract traditions of thought (Berkes et al., 2000; Kimmerer, 2012). While SEK does play a role in overall EE and EL, it is not specifically geared towards children' knowledge of their home environment. Other research that looks at ecological knowledge often includes the role of IEK, or Traditional Ecological Knowledge (TEK), defined as knowledge held and developed by the Indigenous community in that space (Inglis, 1993; McMillen et al., 2016). A more detailed conceptualization of IEK is outline by Inglis below:

> TEK is a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment. Further, TEK is an attribute of societies with historical continuity in resource use practices; by and large, these are non-industrial or less technologically advanced societies, many of them Indigenous or tribal (1993, p. 17)

It should be noted that the above definition presents and perpetuates staticisation of Indigenous cultures as it implies that Indigenous cultures must remain pre-modern or not adopt technological advances. It is deeply important to engage with the fact that Indigenous cultures, as all cultures, evolve, but also often have bodies of IEK that are experience and time-informed, and have been built through considerably more iterative processes than Western science has had time or capacity to do. With these advantages, IEK bodies of knowledge are often best-fit to address adaptation and environmental management strategies to reduce the impact of climate change and mitigate environmental degradation caused by industrialized and often Western societies (Millán-Rojas et al., 2016). On a similar note, the term 'traditional' in TEK can imply a fixed type of knowledge or activity and as such could perpetuate historicization of Indigenous cultures and the implicit denial of their distinct cultural evolution. Some studies have used other alternate terms interchangeably with TEK, such as ethnoecologial knowledge (Guest, 2002), supporting that there is not yet an agreement academically on which term is most apt. As such, the alternate term IEK proposed by Inglis and used by subsequent studies is the term I will use in this study to describe knowledge held by Indigenous groups (Aswani et al., 2018; Inglis, 1993; McCarter et al., 2014). IEK differs from SEK in that it is based on historically-informed traditions of thought (as opposed to abstract), "which include systems of knowledge possessed by people outside Western science, knowledge that often becomes encoded in rituals and in the cultural practices of everyday life" (Berkes et al., 2000, p. 1251) and which "is rich in prescriptions for the philosophy and practice of reciprocal, mutualistic relationships with the earth" (Kimmerer, 2012, p. 317).

While IEK is useful in the discussion of ecological knowledge of Indigenous groups, and while there are communities in Galápagos of migrant Indigenous peoples, there is no population Indigenous to Galápagos, which means that there is no substantial presence yet of Galápagos-specific IEK. LEK then, is the most useful term for this specific study to describe knowledge held by Galapagueños about their local islands, which encompasses knowledge held by those who are ethnically and racially Indigenous and those who are not. However, it is the hope that LEK can mimic some of the most valuable and time-rich credible parts of IEK, though LEK, especially in Galápagos, is lacking in longevity and iterative generational refinement. As such, I will make comparisons between the LEK of

Galápagos children and examples of IEK in other spaces as IEK is a gold standard by which to measure other ecological knowledge.

LEK is similar to IEK, in that it is held through many types of learning, including experiential learning, by a specific group of people about their local area, or, per the definition given by Joa et al. (2018) is "site-specific ecological knowledge that can be practically applied" (p. 521). While Joa et al. and others use IEK (or TEK) and LEK as interchangeable terms (Da Silva Costa et al., 2023; Garavito-Bermúdez, 2020; Joa et al., 2018), I use LEK here as a distinguishable term highlighting the ecological knowledge of a non-Indigenous group of local people, an approach that is supported by other literature in the space (Beaudreau & Levin, 2014; Pogutz & Winn, 2016; Dabezies, 2018; Nash et al., 2016). This choice is to highlight the non-indigeneity of Galápagos residents to the islands, and to ensure that IEK as a body of knowledge, expertise, beliefs, and research remains unmuddied by mixing it with bodies of knowledge constructed or held by non-Indigenous groups, as Indigenous groups already face significant erasure and challenges beyond this linguistic distinction. To the former point, the term 'traditional' "usually refers to cultural continuity transmitted in the form of social attitudes, beliefs, principles and conventions of behaviour and practice derived from historical experience" as defined by Inglis (1993, p. 17) which then begs the question what historical experience might mean.

Inglis (1993) notes that IEK is often based on thousands of years of acquired and transmitted knowledge. For Galápagos human residents, who moved to Galápagos in waves of migration through the 20th century, the term historical does not describe their presence as it would an Indigenous population to a specific place. To avoid historicizing the term unintentionally, Guest (2002) helpfully highlighted that bodies of what can be termed TEK or IEK do change over time, and that there can be a clear distinction made between historical IEK that has been passed down over significant lengths of time through periods of cultural continuity, and newer bodies of Indigenously held or local ecological knowledge when that continuity shifts. For example, Guest (2002) looks at the introduction of commercial shrimp fishing in an Indigenous community in Palestina in northern coastal Ecuador and noted that pre-existing and long-developed bodies of what he termed TEK appeared to degrade with the introduction, however, new distinct bodies of knowledge, which he termed LEK, developed after the economic and cultural shift. Unlike the necessity of long-term generational sharing of knowledge for IEK, this new LEK was still “locally distinct” and could be “acquired within a relatively short time frame” (Guest, 2002, p. 39). Similar to the TEK, this new LEK was “socially distributed” highlighting the importance of sharing LEK once acquired to increase its construction and use by community members (Guest, 2002, p. 39). This shows that LEK (not IEK) could potentially accelerate through the “integration into the market economy through an economic activity based in the natural environment” (Reyes-García et al., 2007, p. 371).

However, other research points out that both LEK and IEK have been degraded through colonization and acculturation and continue to degrade through broader trends of cultural degradation and the enforcement of industrial systems including schooling and the market economy (Aswani et al., 2018; McCarter et al., 2014; Reyes-García et al., 2007). Studies that highlight degradation of LEK or IEK also note that younger generations often have less of this knowledge compared with older generations of the same group, due to a reduction in transmission or reception this knowledge from older generations to younger, and/or from a decrease in access to experiential learning, or a general decrease in experience, which is an integral part of building and maintaining IEK or LEK (Ianni et al., 2015; Okui et al., 2021). Others point to acculturation, or the assimilation into a different or dominant (non-traditional) culture, of younger generations as the nexus point for this lack of experience or a desire for the commodities associated with spaces that don't require LEK or IEK (Souto & Ticktin, 2012). In this latter case again, it is emphasized that often, older generations hold more IEK or LEK than younger and that lack of transmission of such knowledge and lack of access to or desire for experience by younger generations, help to degrade IEK or LEK over time (Souto & Ticktin, 2012).

Many studies highlight the importance of using either IEK or LEK to inform conservation strategy and sustainable environmental management (Da Silva Mourão et al., 2020; Joa et al., 2018; Nash et al., 2016; Pogutz & Winn, 2016) which makes LEK of children in the Galápagos an important interest for continued and improved conservation on the islands. LEK, like IEK, must be understood to include both passive knowledge, such as species names and observations of ecological patterns, and active knowledge or skills such as strategies for management, use, and conservation (Berkström et al., 2019; Okui et al., 2021; Reyes-García et al., 2007).

As noted in previous sections, and as echoed by the literature, research on both IEK and LEK often focuses on adult holders, and children are often excluded from literature and discussions around these knowledges and within the broader scope of ethnoecologies (Bulnes, 2013; Carrière et al., 2017). Here we look to literature that explicitly centres and asks questions around children's IEK and LEK. Literature notes that children acquire IEK specifically through various informal channels, including transmission or instruction from adult family members, social and cultural activities that they take part in, observation of others engaging with ecological practices, artistic cultural traditions (such as song, stories, visual arts, or dance), or other experiential instances (Bulnes, 2013; McCarter & Gavin, 2011;

Sumarwati et al., 2020). Explicitly, literature categorized the learning of IEK in childhood as one that took place through informal educational channels, through which experiential learning was always present but often accompanied by non-experiential learning (Bulnes, 2013). This was echoed by a study in rural Thailand with children which investigated their plant IEK (Setalaphruk & Price, 2007). Here, transmission from family members, often through parents and if parents were not present, grandparents were equally effective, but also from child peers (Setalaphruk & Price, 2007).

Addressing peer to peer learning for IEK or LEK is not common in the literature, but Setalaphruk and Price's (2007) findings indicated that learning from friends of the same age was particularly important, especially for children who didn't have as much transmission or contact with familial adults, even going as far as to say that "during [plant] collecting trips with other children, knowledge is shared and learned among them. For children especially at the ages of 10–12, the peer group is observed to be a crucial channel of knowledge acquisition" (p. 8). This was also found by Rogoff (1981) when working with rural children in Guatemala, and by Cruz García (2006) working with Indigenous and non-Indigenous children in India. Both studies confirm that peers are "another important avenue in the communication and exchange of local knowledge" (Setalaphruk & Price, 2007, p. 8). This is complemented in a study by Pretelli et al. (2022) of ecological knowledge acquisition for youth from ages 5-26 in Tanzania which found that "Knowledge acquisition appears in our data to be fastest during middle childhood, between 7 and 12 years" (p. 11). From these studies, we see that there is a peak in knowledge acquisition and an importance of diversification of learning sources.

Relatedly, Carrière et al. (2017) remind that children also produce their own LEK through their own observation, participation, and interpretation of their living environments, and that "[c]hildren are both producers and repositories of ecological knowledge and societal values" (p. 1). The acceptance that children themselves are also capable of constructing LEK without the influence of adult actors is key for understanding and centring children's agency in learning about and developing strategies of interaction and care for their environments.

In a 2013 study with children in an Indigenous group in Honduras, Bulnes used Charazo's model of Native Pedagogy to observe and interpret channels of IEK learning for local children, noting that approaching IEK through Western lenses of learning would not be appropriate. Others focused on working with adults in Indigenous communities to discuss how to bolster IEK by integrating it into the formal schooling system, which was often Westernized. Sumarwati et al. (2020) worked with adults in Tawangmangu, in Central Java and noted the support of local Indigenous adults for the integration of IEK into schools for the purpose of increasing IEK, but also noted the complexity of bodies of IEK and the necessity to use appropriate teaching methods such as field trips and other experientially based practices. In this case study, there was a trend of younger generations acculturating to dominant Westernized and urban practices and not partaking in IEK transmission Sumarwati et al., 2020).

Similarly, McCarter and Gavin (2011) worked with local Indigenous adults on Malekula Island, in Vanuatu, discussing ways that IEK could be bolstered by integration into the formal school system for children. In this case, however, the decrease in youth IEK was directly pinned on the introduction of a Westernized formal school system and the fact that IEK was largely incompatible with the structures of Western education and learning because of the 1-1, experiential (in situ), intimate nature of much of the local IEK and integration could potentially further degrade or misrepresent and mis-teach IEK to children (McCarter & Gavin, 2011). In both cases, it was clear that valuable ecological knowledge sat outside of formal classrooms and that experience and transmission from experts, which were older Indigenous adults, often not teachers, would be most effective in transmitting this knowledge. In a similar challenge with formal school systems, work by Aziz et al. (2022) in Northern Pakistan looking at youth LEK in rural mountain communities indicated that the standardized formal school curriculum did not include local ecologies, which then reduced the LEK that children could acquire. Through data collection with students and local adults who all saw the biocultural value of LEK for sustainability of both environment and culture, Aziz et al. (2022) determined that a lack of the local in formal schooling had 'isolated' youth from LEK sources and learning. They explored how to remedy this division and effective strategies included place-based and localized education, access to experiential learning about the local environment, along with biocultural activities and competitions (Aziz et al., 2022).

In addition to the value of IEK for general local ecological and cultural knowledge acquisition for the purposes of cultural preservation and resource management, it has been called on as a resource to help bolster children's knowledge of biodiversity for the purpose of global conservation efforts. Adom (2022) specifically noted the importance of encouraging IEK transmission and participation of children in biodiversity projects rooted in IEK for the purpose of Ghanaian conservation efforts. Adom (2022) called for the inclusion of IEK around biodiversity across many channels, including within formal schooling. Notably, Adom (2022) insisted that children be included in large-scale conservation projects aimed at mitigating biodiversity loss and that this type of IEK and LEK was something children were able to understand and, per the UN Rights of the Child, something that children's voices should be included on, not least because children are the inheritors of environments at risk of further biodiversity loss.

2.4.1.1 Topics of LEK

LEK is often assessed through knowledge of species (Riat, 2016; Setalaphruk & Price, 2007) and species knowledge, both in species identification and in-depth knowledge about species, have declined in various global child and student populations, along with an observed decline in child contact with nature spaces (Gerl et al., 2021; Louv, 2005). Complementary to this general decline, research on local species knowledge, distinct from general knowledge of global biodiversity, indicate that children may know more about exotic flagship species and less about their local biodiversity (Genovart et al., 2013). This was echoed by a study with Basque children who predominantly named exotic species, which the authors posited was due to a saturation of non-Indigenous animal representation and encounters in everyday life, media, and at school (Díez et al., 2018). This experiential element is noted by Patrick and Tunnicliffe (2011) who also indicate that most children have a low frequency and volume of interaction with species in their daily lives. Contrastingly, a study with Scottish primary school children indicated increases in knowledge of both exotic and Indigenous fauna as children age, with general and LEK peaking around age nine (Huxham et al., 2006). In the Balearic Islands off the coast of Spain, high school students were found to have more knowledge of exotic, non-local fauna despite the attention paid in conservation work to local biodiversity and the preservation of the local island ecosystems (Genovart et al., 2013). Studies like these encourage increased direct time in local environments to bolster species knowledge through experiential learning (Genovart et al., 2013).

Some studies have found that species knowledge is an effective proxy for general LEK including broader ecosystem knowledge (Härtel et al., 2023). Species identification, as a distinct component of species knowledge can also be correlated with more in-depth species knowledge, though this knowledge may have gaps and thus species naming should be supplemented with questions around broader species knowledge when used as a proxy for LEK (Hooykaas et al., 2022). When acquiring species knowledge, one study points to direct and often senses-based experiences recalled as the first encounter with flora and fauna for mid-elementary school aged Swiss children, but subsequently notes the importance of third parties such as family members, for the actual name knowledge shared with children (Jaun-Holderegger et al., 2021). This experiential memory coupled with the name provided by other sources, and often with emotional responses from children to those first flora and fauna encounters, led to higher recall of local species names (Jaun-Holderegger et al., 2021, 2022).

Within species knowledge, there are notable differences in fluency of species knowledge of animals vs plants, with species knowledge about animals often much better than about plants (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018). This is often explained through the phenomenon of 'plant blindness' recorded for both children and adults, which observes a general lack of attention to plants (Jaun-Holderegger et al., 2021; Wandersee & Schussler, 1999). It should be noted that the term 'plant blindness' was originally conceived based on observations of Western, non-Indigenous peoples. Reasons for plant blindness include a lack of auto-movement by plants, making them seem static and as a singular background compared with animal counterparts which auto-move through environments and appear as distinct individuals (Jaun-Holderegger et al., 2021). Additionally, plant matter may be seen as a collective green mass, as "edge-detection is difficult due to chromatic and spatial homogeneity and the overlap of green leaves" (Jaun-Holderegger et al., 2021, p. 2; Wandersee & Schussler, 1999). Studies focused on children's concept of life or 'alive' have shown that youth up through high school may attribute more life to humans then animals, then plants in a hierarchy of 'aliveness' (Yorek & Aydın, 2009) and note a tendency for children to mis-classify plants as not alive based on animalistic metrics of life such as movement (Yorek & Aydın, 2009; Zogza & Papamichael, 2000).

Within animal species, research indicates that mammals are more well-known (higher rates of identification) by children, followed often by birds and other vertebrates (Díez et al., 2018; Huxham et al., 2006; Jaun-Holderegger et al., 2021; Torres-Merchán et al., 2018). Some studies posit that this tendency to hold more mammal knowledge is because of a natural human tendency to have affinity towards animals in their same grouping, mammals (Huxham et al., 2006; Kellert & Kellert, 1997). As mentioned previously, time spent in environments where local animals live produces higher rates of naming knowledge about those animals (Wold et al., 2023). A study in Norway found that young children more accurately placed and named animal species from local forest environments where they spent more time weekly than in other types of environments (Wold et al., 2023).

Within plant species, research notes a higher fluency in naming brightly coloured, edible, medicinal, or toxic plants (Juan-Holderegger et al., 2022). Additionally, children in rural areas tended to name higher numbers of plant species in comparison with urban children, including native plants (Díez et al., 2018; Eyssartier et al., 2017). In a contradiction to the stated usefulness and effective proxy label of names for species knowledge and LEK, studies with Indigenous children show both higher rates of plant species knowledge than previously-mentioned studies, and note that knowledge about plant species related to their use and characteristics was often greater than name knowledge, indicating that perhaps especially for Indigenous communities (Hunn, 2002), the "use-context is more culturally relevant, salient or easier for children to remember than names" (Wyndham, 2010, p. 87). Finally, there is some research to indicate that children, especially those who live within spaces where IEK is present, may be more able to accurately identify toxic plants than non-toxic ones (Prokop & Fančovičová, 2019).

Beyond species names, knowledge of location, diet, behaviour, and interactions of species knowledge is noted as often limited especially at younger ages, with middle school to high school children holding and using more substantial behavioural and habitat (location) knowledge for animals (Tunnicliffe & Reiss, 1999). Younger children often have unorganized habitat knowledge, sometimes correctly locating species but other times locating all species to a particular environment, and usually missing location for plant species (Strommen, 1995). Food sources for animal species tended to be less well known except when discussing deeply favourite animals for some children (Myers Jr et al., 2004). More complex topics such as species behaviour and interactions, which relate to ecosystem functions and species' ecological needs, are observed as limited for elementary through middle school children (Myers Jr et al., 2004).

Species category, in terms of either native or endemic or introduced or invasive, is a relevant and important topic of knowledge for all areas of conservation (Shapiro et al., 2017) but especially for island communities with high rates of endemism (Panisi et al., 2022). Despite the importance of knowledge of these categories, studies show a general lack of knowledge especially around introduced and invasive species, even in vulnerable island ecosystems, of children and adults (Rigoberto et al., 2021; Sosa et al., 2021; Stazione, 2025).

Further to species category, species status, such as endangered or extinct, is an important type of LEK for the preservation of biodiversity (Ciążela & Gogacz, 2024), but is infrequently noted in the literature, especially with children, with many studies looking at correct identification of endangered species, and not at correct classification of species as endangered (de Azevedo et al., 2012; Gomes et al., 2019). One study looked at adult students and their ability to correctly classify local native or endemic species, which showed more awareness of exotic endangered species, and generally showed superficial and mid-range levels of endangered species (Ciążela & Gogacz, 2024). Only one study assessed children's abilities to correctly classify species as endangered, resulting in again high frequency of knowing exotic vs local endangered species, and low accuracy and high confusion when applying the term endangered to animals (Gavrilakis et al., 2024).

LEK also includes knowledge beyond flora and fauna, such as geographical, geological, and climatic knowledge of a local environment. Geography knowledge is frequently included in school curricula and is seen as an essential way to understand the lived world (Winter, 2012). Place or location knowledge is uncontested as an important feature of geographical knowledge and is often included in curricula through teaching mapping skills (Reynolds & Vinterek, 2016). Spatial knowledge, or spatial cognition (Gersmehl & Gersmehl, 2007), a requirement for locational knowledge, is also an essential element in understanding cognitive and social constructs that act on and with that knowledge (Piaget, 1929; Reynolds & Vinterek, 2016). Geographers in particular highlight the lack of spatial cognition content in geography and general classrooms, and the importance of ""spatial thinking at geographical scales"—thinking about locations, characteristics of places, and relationships among places" (Gersmehl & Gersmehl, 2007, p. 181). Research also reminds that there is "a strong experiential element involved in locational knowledge of children" (Reynolds & Vinterek, 2016, p. 69), and that, as a reference point, as of first grade, children "do not develop a full awareness of the concepts of physical geography they encounter through their experience" (Sheridan, 1968, p. 83). However, as children gain direct experience in locations, their conceptualization and understanding of that physical geography increases (Cin, 1999).

Gersmehl and Gersmehl (2007) determined “eight distinct modes of spatial thinking” (p. 183) about place that include: comparison (noticing connections between familiar and unfamiliar locations), aura (contextual features and sensory elements related to a place), region (noting similarities between connected places), hierarchy (nested understanding of smaller to larger bounded geographic features), transition (noticing change from one place to another), analogy (noticing how disparate spaces may have similar features), pattern (noticing small to large geographical patterns), and association (associating patterns to specific locations). Particularly for children, larger-scale modes of thinking such as region and hierarchy pose challenges, especially when children have a limited experiential bank of knowledge about place (Sebastián et al., 2024). Gersmehl and Gersmehl (2007) note that hierarchy, in particular, is a skill that children can develop early on, the “efficiency of that process however, appears to be hindered in very young children by the tendency for spatial working memory to become overloaded with too much unorganized information” (p. 186) and thus teachers should provide clear guidance on distinguishing between elements. Sebastián et al. (2024) found that children who have “lower mobility than adults” (p. 18) tend to know physically smaller areas, thus demonstrating LEK on very nearby space, while adults and perhaps children with greater mobility in cities would be able to conceptualize and map larger scale geographies.

In terms of geological knowledge, literature suggests that general earth sciences knowledge and education is poor in most global regions, including geological knowledge (Dolphin & Benoit, 2016). Studies also note that geological phenomena are often difficult for people, adults and children alike

(Cardoso et al., 2018), to conceptualize because they are abstract in nature (Blake, 2005) and because they "act on such minute or large temporal and spatial scales that humans are not able to perceive them directly" (Conrad & Libarkin, 2022, p. 263). Notably, studies typically find frequent misconceptions particularly around island formation and relationship between islands and the sea floor (Vasconcelos & Paz, 2023). Geological knowledge is noted as important for children and adults as it "allows the promotion of a more holistic view of the Earth system and its intertwined processes and dynamics, which are also related to the achievement of planetary sustainability" (Vasconcelos & Paz, 2023, p. 1).

Ecological knowledge, both bodies of Indigenously held and developed knowledge and more recent local knowledges, are deeply valuable to observe in the context of conservation work and when observing environmental literacy within a bounded population. For the case of Galápagos, while IEK about Galápagos does not apply, IEK does have a place in research and in community functions, as there are residents who are Indigenous ethnically, having moved from other locations often in Ecuador, to the islands. There has not yet been research on IEK and Indigenous philosophies around environmental sustainability applied specifically to Galápagos, beyond the adoption of Sumak Kawsay or 'buen vivir' nationally in Ecuador and thus regionally in Galápagos. While LEK is the term most applicable for Galápagos communities, looking to IEK for models of knowledge development and ideal states of knowledge banks, is still helpful, as Berkes reminds that in IEK systems, there is a "component of local observational knowledge of species and other environmental phenomena, a component of practice in the way people carry out their resource use activities, and further, a component of belief regarding how people fit into or relate to ecosystems" (Berkes et al., 2000, p. 1252). Looking at Galápagos through a lens of local community and human evolution, it would be helpful to keep IEK in mind as a framework by which to measure LEK.

Finally, children's knowledge of climate and weather, while less studied, does show some misconceptions throughout childhood about weather and more scientific understandings of weather vs climate (Henriques, 2002). Other studies note misconceptions not only for children, but in the general adult populace, especially in regard to the connection between weather and climate (Goebbert et al., 2012) and particularly in regard to weather and climate change (Lang, 2014). There is often an element of perceived weather changes vs actual recorded weather changes, noting an overreliance on subjective experiences with weather and climate vs recorded data (Goebbert et al., 2012).

2.4.1.2 Sources and Locations of LEK

So far, I have indirectly discussed sources of LEK for children, such as peers, family members, and school. Here I cover more detail about some of these sources in addition to organisations and add organisations and local sites. A combination of sources is cited as the most effective way of provisioning LEK (Amin et al., 2019; Pretelli et al., 2022; Takyi et al., 2023; Tunnicliffe & Reiss, 1999).

The family and the home have been noted as a foundational early childhood and ongoing source and location for learning about the environment, through exploratory experiences, observation of family members, and direct instruction from family (Kola-Olusanya, 2005). Often, studies note the benefits of child to adult environmental knowledge, values, and beliefs transfer (when mediated by sufficient and effective child to adult communication and adult willingness to listen to children), which assume lower volumes of these components in the familial adults in the study (Evans et al., 1996; Istead

& Shapiro, 2014; Legault & Pelletier, 2000; Straub & Leahy, 2017), thus indicating that not all families will have bodies of LEK to share with children (Halmatov & Ekin, 2017). However, there are many studies which look at adult families who do hold LEK and which highlight the clear and effective transmission of IEK or LEK from adult family members to children, focusing on Indigenous families (Adom, 2022; Calvet-Mir et al., 2016; Gallois et al., 2017). Often, older generations, such as grandparents, are noted as holding more IEK than younger generations (Okui et al., 2021), however, Souto and Ticktin (2012) note that while length of time in a place (at least two generations) predicted more knowledge of useful local plants, age (often aligned with length of time in a place), predicted more natural history knowledge. As adults who work in environmentally-related jobs are seen to hold significant bodies of LEK, such as jobs in fishing, farming, or conservation (Ardoin & Heimlich, 2013; Berkström et al., 2019; Garavito-Bermúdez, 2020; Iniesta-Arandia et al., 2015; Pontón-Cevallos et al., 2022), and asserting that when adults hold LEK and communicate with children, they are effective transmitters of knowledge, I propose that environmentally related jobs of family members present an unresearched but potentially potent source of LEK for children related to those family members.

Schools are a frequently noted source and location for LEK but the formalized inclusion of EE themes in the curricula are often missed (Eames et al., 2008; Stanisic, 2016; Sukma et al., 2020). Challenges for teaching LEK, usually through environmental education programs or encouragement, includes a high frequency of didactic or monologic teaching methods for this content, which are notably ineffective for EE (Stanisic, 2016). When experiential learning does occur in schools, it may be through field trips and use of school gardens if available (Erdoğan et al., 2008). Ultimately, there is a noted tend in lack of experiential and outdoor education within schools, despite calls for its inclusion for effective

LEK and EE (Georgopoulos et al., 2011; James & Williams, 2017). Another noted limitation in curricula, is a predominance of animal content over plant content, potentially contributing to children's plant blindness (Amprazis & Papadopoulou, 2018; Schussler et al., 2010). Additionally, environmental content is often relegated to science classes (Stanisic, 2016; Sukma et al., 2020). Overall, it is still rare to have environmental or ecological concepts infused throughout the curriculum, although some New Zealand schools, and indeed the Galápagos school system, have attempted this (Eames et al., 2008).

Sites, such as local parks, organisations like National Parks, are often listed as locations and sources for LEK and EE (Jun, 2019; Lugg & and Slattery, 2003; Soykan et al., 2018; Yusof, 1999). Often, these sites are noted for their access to 'free choice learning' which allows children to spontaneously engage with site features and even staff in an unplanned and non-adult-directed way (Kola-Olusanya, 2005). A noted challenge with parks and national parks is accessibility, both because of distance from where families live, and cost of entry, both of which cause locals to often not engage with or infrequently visit such parks (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013). Non-national-park nature sites, such as local Green spaces, can also offer both sources and locations for children's experiential environmental learning and connection to nature (Gambino et al., 2009; Hayes Hursh et al., 2024; Kola-Olusanya, 2005), although similar access issues arise, this time noting lack of green or nature-based sites in urban locations vs rural, thus producing inequitable access to nature sites for urban and also low income children (Mohamad Muslim et al., 2017; Rigolon & Flohr, 2014). In addition to green spaces, 'blue spaces', such as beaches and coastal environments, are highlighted as rich locations for environmental learning and child exploration, and are especially available to coastal and island communities (Speldewinde, 2024)

Children's play in nature, often in these types of sites, is noted as deeply important for environmental learning, cognitive and social development, and felt agency (Gundersen et al., 2016). Time in nature particularly offers children freedom of learning and exploration, as nature "offers a diversity of opportunities for play and activity, where every child has their own opportunity to explore, shape and change" (Gundersen et al., 2016, p. 117). However, there has been a recent increase in adult supervision of children's nature exploration, which disrupts the benefits of solo and peer-centric exploration (Gundersen et al., 2016; Louv, 2005; Skår & and Krogh, 2009), and that "when adults take a more hands-off approach instead of organizing and planning specific activities, then more spontaneous, unstructured and self-directed children's play can generate a more emotional, sensuous and embodied engagement with nature" (Gundersen et al., 2016, p. 117).

Related to exploration and time in nature, especially sans adult control, peers are a valuable source of LEK and species knowledge for children (Cruz García, 2006; Rogoff, 1981; Setalaphruk & Price, 2007). Additionally, peers are a noted effective source for sustainability knowledge, environmental values (de Vreede et al., 2014), and not only help other children learn, but through teaching, concretize and improve their own LEK (Bester et al., 2017). Literature notes that one avenue for peer-to-peer learning is informal and peer-led exploration, similar to the solo child exploration noted above (Cruz García, 2006; Rogoff, 1981; Setalaphruk & Price, 2007). Additionally, corrections are an effective way for peers to learn from each other, (Johnson, 2017; Morris, 2005; O'Donnell & Topping, 1998; Rachmawati et al., 2018), with one example being, "children are using correction as a resource to do the important work of honing one another's knowledge and competence" (Johnson, 2017, p. 20).

Acknowledgements, 'continuers' such as 'yeah' or 'uh huh' or confirmations of what other children have shared and know are less well documented but noted by Ogden (2000).

2.4.2 Dispositions: Environmental Attitudes and Emotions

In addition to knowledge, environmental dispositions are one of the four main components of common definitions of EL. These dispositions encompass a range of affective functions, but most frequently in the literature, environmental attitudes are used as a variable when measuring EL or when discussing dispositions in relation to environmental knowledge or behaviour, as echoed by Fang et al. (2022). I will first briefly outline useful definitions of attitudes and values, and the often-associated term, beliefs, and then describe the use of these terms within environmental contexts, and contexts with children specifically. I will also briefly discuss how emotion relates to these terms and the presence of research on emotions in relation to environmental education and literacy and how eco-emotions are impacted by or impact ecological knowledge and behaviour.

In the field of psychology, the term attitudes is described as a "general evaluative tendency" (Marsh & Wallace, 2005, p. 384). In other words, attitudes are the evaluations of objects, or likes and dislikes of objects or themes (Sjöberg, 1982). Beliefs are thought to follow from attitudes, and there is an "attitude-belief congruence" in that an individual will revise their beliefs to make them match built attitudes about a specific object of theme (Marsh & Wallace, 2005, p. 384). Values are seen as underlying attitudes are concepts held as right or true by the individual that influence the development of attitudes which in turn influence beliefs (Ajzen, 2012). Further to the relationships between values, attitudes, and beliefs, it is accepted that values and attitudes influence behaviour and can predict types of behaviours that align with those values and attitudes (Ajzen, 2012). Because of this, looking at environmental values and attitudes can help to connect the dots between environmental dispositions and environmental behaviour (Gifford & Sussman, 2012).

Within an environmental or ecological context, attitudes, values, and behaviour have similar relationships to the ones outlined above; however, research within the field of environmental psychology points out the need for specific models of measurement for the relationships between attitudes and behaviours especially as there are often more situational influences or constraints on pro-environmental behaviour choices in additional to moral influences (Corraliza & Berenguer, 2000; Gifford & Sussman, 2012; Kaiser et al., 1999). Environmental attitudes can include both attitudes towards or about the environment, and attitudes about environmental behaviours (Kaiser et al., 1999). Shmitz and da Rocha (2018) helpfully further deconstructed the relationship between environmental attitudes and behaviours by outlining the initial attitude which leads to an intention to act in harmony with that attitude, and that intention is what precisely leads to a pro-environmental behaviour.

Environmental values are often seen as the foundations set by either individuals or communities that then impact individual attitudes. Values can be detrimental to the environment because of the behaviours and actions that follow from them. For example, societal values such as "individualism, materialism, limited government, progress, and growth" are often directly linked to environmental problems (Gigliotti, 1992, p. 15). Individual values, often linked to morals or ethics, are also determinants of environmental attitudes. Other authors recognized challenges to developing environmental attitudes because attitudes, in their framework, stem from a worldview which is often anthropocentric, held by individuals (Catton & Dunlap, 1978; Hadler et al., 2022).

Catton and Dunlap (1978) named this common anthropocentric worldview, present across disciplines, as the Human Exceptionalism Paradigm (HEP), which, as discussed in the section on anthropocentrism, positions humans as separate and above nature. They noted that this paradigm, while seemingly omnipresent in research and Western or non-Indigenous cultures, is incongruous with ecological functions and makes it difficult for researchers and policymakers, even individuals themselves, to reconcile attitudes and behaviours with ecological constraints and degradation (Catton & Dunlap, 1978; Hadler et al., 2021). Because of this, they proposed a New Ecological Paradigm (NEP), which "emphasizes the inseparable connection of humans with nature and the limits of the physical and biological world" (Hadler et al., 2022, p. 16). The development of and adoption of the NEP by researchers allowed for an environmentally focused foundation from which to measure or determine human environmental values as measuring environmental values from an anthropocentric platform is incompatible. The NEP, and the associated NEP Scale, developed by Dunlap and Van Liere (1978), has been subsequently used to investigate and measure environmental attitudes from the position of assessing worldviews in numerous studies across disciplines (Amburgey & Thoman, 2012; Dunlap et al., 2000; Gansser & Reich, 2023; McDonald & Patterson, 2007; Wibowo et al., 2023).

Children's environmental attitudes, especially in relation to resulting behaviour, have been the subject of many studies in an attempt to improve environmental education programs, investigate when attitudes and pro-environmental behaviours are developed in childhood, and affect sustainable futures by targeting and understanding our youngest humans (Otto et al., 2019; Schmitz & da Rocha, 2018). The NEP scale, originally un-explicitly designed for use with adults, has been adapted for use with older elementary aged children (10–12-year-olds) in order to research children's environmental attitudes (Corraliza et al., 2013; Manoli et al., 2007; Rosa et al., 2022). Some have recognized that the NEP scale may pose challenges when using it with children from differing cultural and national backgrounds (Kopnina, 2011). However, others have used the survey cross-culturally, including a translation an administration of the scale in Spanish for use with children in Spain, which found those children' s worldviews to be ecocentric and that rural children exhibited higher levels of ecocentrism than urban children (Corraliza et al., 2013). Other research has highlighted the increase in environmental attitudes in middle childhood that correspond to elements of moral development and societal awareness. Liu & Green (2024), for example, note cognitive and moral development stages that fuel environmental awareness, ethics, and attitudes, even highlighting biocentrism flourishing in childhood:

> The focus here is specifically on children in middle childhood, roughly from six to twelve years of age, a period critical to children's development with regard to environmental awareness and forming ethical and moral attitudes towards nature and the environment. At this age, children tend to exhibit inquiring behaviour regarding local nature and start to develop a greater level of autonomy, critical-thinking, problem-solving, as well as an appreciative mind towards nature, or as Kahn and Kellert (2002) suggest, a sprout of biocentric reasoning (p. 2).

Collado and Corraliza (2015) echo this in their work looking at children's frequency of contact with or experiences in nature and the impact of those experiences on PEBs. They found that higher frequency of contact with and experience in nature was the fodder for children's adoption of PEBs through the mediation of increased environmental attitudes.

In some environmental research with humans, attitude is treated as a unidimensional concept, distinct from knowledge, especially within the definitions of EL, or such as how Gifford and Sussman (2012) describe environmental attitude here: “concern for the environment or caring about environmental issues” (p. 65). Contrastingly, some researchers deconstruct attitude into smaller components, which are often listed as: affect, knowledge, and intention (Grob, 1995; Kaiser et al., 1999), or as having “the affective (corresponds to emotional involvement, i.e., concern), the cognitive (environmental knowledge), and the conative (behavioral intention) dimensions” (Hadler et al., 2022, p. 16). The inclusion of emotion in the multidimensional definitions of attitude allow for a further exploration of how emotion relates to broader components of EL such as knowledge and behaviour, and I will explore emotion specifically below.

Emotion is present and plays a role in learning but has been often side-lined or treated simply as a catalyst for rationality and knowledge. Dewey (1933), for example, starts by describing reflection as an essential element of learning that comes after experience to construct new knowledge, noting that “[t]he function of reflection is to bring about a new situation in which the difficulty is resolved, the confusion cleared away, the trouble smoothed out, and the question it puts is answered” (p. 100). Within reflection, Dewey clarifies that “[e]motion is the moving and cementing force. It selects what is congruous and dyes what it selected with its color, thereby giving qualitative unity to material externally disparate and dissimilar” ((1938, p. 42). Kolb (1984) had a similar theory of emotion as an inclusion within the learning process, placing it again within the act of reflection following a concrete experience of learning, and noted that learning “involves the integrated functioning of the total organism—thinking, feeling, perceiving, and behaving” (p. 31). However, both theories treat emotion as a rudimentary steppingstone to rational thought, which "reiterates the traditions both of separating emotion from reason and of privileging the rational over the emotional" (Felten et al., 2006, p. 40).

The separation of rational thought or knowledge from emotion, is mirrored by a similarly Western concept of the mind (which thinks) as separate and entirely distinct from the body (which experiences) (Michelson, 1998). This is exemplified in Western thought, though not first theorised (we look to Plato for this), by Descartes who attempted to literally separate mind from body and thus be "[s]aved from emotion by the clear light of reason, able to separate moral judgements from personal desires and loyalties, and undisturbed by the implacable demands of the body" (Michelson, 1998, p. 218). This predominantly Western separation of thinking and feeling, akin to the false dichotomy of human vs nature discussed previously, has since been challenged and an insistence for both the interdependent nature of reason and feeling, or emotion, has gained support, with Felten et al. (2006) noting that "pure reason cannot be divorced from emotion" (p. 41).

The separation is directly contradicted by 20th and 21st century theories of learning which highlight experience, which is embodied, as essential to learning, and which include emotion, even if it is only as a catalyst. As Michelson (1998) notes, this early Western view of mind vs body "denies the connectedness of knowledge to the body and thus loses sight of knowledge as a product of corporeally and emotionally grounded human life" - thus packaging experience and emotion as dually essential elements of knowledge and learning (p. 217). The treatment of emotions as simply a catalyst has also been challenged, elevating emotions to hold a much more substantial role in the learning process. Graesser (2020) even went so far as to posit that an "emotion revolution is now evolving in the 21st century and is strengthening its tentacles to research in learning, cognition, education, social interaction, engineering, and computer science" and that "emotions reign supreme in connecting experiences in a complex world of formal, informal, social and personal learning" (p. 1), highlighting the interdependence between emotion and knowledge within learning.

From this foundational understanding of emotions as central to learning, we look to their specific role within environmental education, learning, and knowledge, and more specifically, how emotion and its partner term, passion, acts within the space of child environmental learning. Like attitude, emotion is recognized as a central tenant within environmental learning and the process of developing and choosing PEBs. Reis and Roth (2009) note that emotion is not just a by-product of effective EE but is essential to effectively achieving EE and that emotion should be included within EE pedagogy. Some studies use emotion awareness and expression as measures of environmental attitude, and studies have noted both strong and multitudinous emotions related to environmental questions asked of participants (Pooley & O'Connor, 2000). Others highlight a key correlation between types of attitudes and sources of learning about environmental issues, such as Millar & Millar (1996), who note that the attitudes constructed through direct experience with the environment are more distinctly emotion-based and are more frequently linked with actual PEBs, while attitudes from indirect experience (perhaps learning from curriculum or not within the environment), are cognitive and less frequently linked to PEBs. Clayton and Ogunbode (2023) also note that emotion is relational and has a "communicative function and is part of shared experience" (p. 275). In this way, individuals, when sharing their emotions about an environmental topic, communicate the significance of that topic and have influence on the audience of that communication (Clayton & Ogunbode, 2023). Greta Thunberg, a youth and climate activist, gave a clear example of emotions as communication about significance when addressing the wealthy and primarily adult audience of Davos in 2021 about climate change: "I want you to feel the fear that I feel every day and then I want you to act" (as quoted by Neckel and Hasenfratz, (2021, p. 259)).

Carmi et al. (2015) further highlight emotion as the central term within the space of environmental learning to behaviour, removing the term attitude altogether in their model. The model included knowledge as the initial variable with 'environmental emotions' as the central and essential mediating variable which then led to PEB (2015). Schultz (2002) used the concept "inclusion with nature" to describe the environmental emotion (singular) which Carmi et al. (2015) further detailed to includes three parts:

> a cognitive component that describes how connected she or he is; an affective component describing how caring she or he is for the environment; and a behavioral component that describes how committed she or he feels for conserving the environment (p. 187)

Environmental emotion, then, is linked or grows within a conduit of connection to nature, and fuels care and commitment. Studies with children, such as one with secondary school students in Spain by Robina-Ramírez et al. (2020), confirm the essential nature of emotions on the ultimate goal of increasing youth PEBs.

Multiple studies with youth highlight passion, or specifically, environmental passion (EP) as a strongly mediating and essential type of environmental emotion. Passion "refers to the strong inclination that individuals demonstrate towards activities which they both enjoy and perceive as significant" (Wang & Li, 2024, p. 1) and EP is furthermore energetic, positive, and directional in that it drives one towards environmental behaviour and protection (Junot et al., 2017; Wang & Li, 2024). Studies have shown that adolescent EP has positive impacts not only on those adolescents' own PEB but also on parental PEB, indicating that it is a powerful mediator of behaviour change beyond the individual, or child, experiencing and holding that passion (Wang & Li, 2024). Others confirm the deeply impactful momentum of EP towards environmental behaviours and beliefs for elementary aged children in Indonesia when passion in EE programs was allowed to flourish (Hidayati et al., 2017). Others note that passion, along with curiosity, are not only important to include in all levels of education about the environment but are more important to include at the forefront of elementary programs (Bostad & Hessen, 2019).

In addition to passion, another emotion-based term with roots in deep ecology has been used in literature with children: ecological empathy. Proposed by Lambert (2024), ecological empathy is defined as "a cognitive and affective ability, which allows for internal coherence across bodily separation in humans and their environment" (p. 11), and which has two subcomponents: "contextual understanding of more-than-human interdependencies and more-than-human awareness and earth system perspective-taking" (p. 1). The connection between emotion and empathy is a generative one: developing greater emotion understanding in childhood assists with the development of empathy as a felt concept (Y. Li & Yu, 2015). Ecological empathy as a concept, mirrors work on empathy for components of or whole environments such as Lithoxoidou et al.'s (2017) work with pre-schoolers that demonstrated children' s ability to develop environmentally-centric empathy, which corresponded to 'emotional activation' between first and second interviews in the intervention performed. Others note the importance of focusing on encouraging and giving space for children's curiosity, fascination, and other positively driven emotions around the environment to help them develop environmental or ecological empathy (McKnight, 2010). This emphasis on positive and generative emotions, instead of on emotions that limit energy and engagement, such as fear, is especially important for environmental empathy and for mitigating adult-influenced ecophobia (a fear of the natural world), especially for younger children (McKnight, 2010).

While it isn't a central focus for this thesis multiple concepts within place studies connect with/in the terms discussed in this literature review. Place studies, as Ardoin (2014) notes, 'attempt to measure the complex, over-lapping conceptualizations of person–place relationships, such as place identity, place attachment, place dependence, and sense of place' (p. 427). Both sense of place, which includes 'psychological, sociocultural, biophysical, and political-economic dimensions' (Ardoin, 2014, p. 427) and place attachment, a 'multidimensional construct' that 'incorporates different aspects of people–place bonding and involves the interplay of emotions, knowledge, beliefs, and behaviours with regard to a place' (Junot et al., 2017, p. 50) are deeply relevant for Galápagos, where the closeness within the bounded ecoregion contribute to community engagement with sustainability measures and pro-environmental behaviours (Ardoin, 2014). Indeed, place has a place in the broader conversation around conservation in Galápagos, as '[w]hen place is interpreted beyond physical boundaries to include people's perceptions, relationships, histories, values, desires, emotions, and more, it provides a powerful opportunity to acknowledge and leverage socio-ecological integration and promote place-protective behaviors" (N. Ardoin et al., 2025, p. 144).

2.4.3 Pro-Environmental Behaviours and Actions

How human behaviour impacts the environment is a relatively contemporary academic concern, and the first formal studies on negative or positive impacts of such behaviour on the environment began in the 1960s, followed by the development of environmental psychology in the 1970s (D. Li et al., 2019). Research on environmental human behaviour then expanded through work in other fields, such as geography, environmental planning, resource management, political science, sociology, and anthropology (Borden, 1977). It wasn't until 1987 that a multidisciplinary research team investigated the factors that were most strongly associated with pro- or responsible environmental behaviours (Hines et al., 1987). Axelrod and Lehman (1993) defined pro-environmental or ecological behaviour as "actions which contribute towards environmental preservation and or conservation" (p. 153). Kollmuss and Agyeman (2002) define PEB as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world" (240).

Others echo this definition, such as the description by Larson et al. (2015), that PEB is "behaviors that minimize ecological harm and support natural resource conservation" (p. 112) and a study by Li et al. (2019), which defines it as "purposeful action that can reduce a negative impact on the environment" (p. 29). Ardoin et al. (2013) noted a need for more research on behaviour change theories within the field of EE, and the importance of attention to human impacts on the environment through the lens of behaviour. PEBs can include choices of transportation, patterns of consumption, and other operationalized behaviours (Li et al., 2019), referred to by Larson et al. (2015) as a "suite of actions" (p. 112). Action is also used in the equivalence that Krettenauer (2017) states between PEB and prosocial moral action because each "requires overcoming narrowly defined self-interest for the benefit of future generations" (p. 581). Finally, PEBs can be both the positive engagement with an action, or the avoidance of a harmful one, in order words PEBs are "acting in ways that are beneficial to nature and avoiding what is harmful" (Liu & Green, 2024, p. 1).

There is considerable research on PEB with adults, investigating how to increase PEB in workplaces and other capacities, and indeed much of the foundational work on defining and listing individual PEBs assumes, but does not often explicitly acknowledge, an adult actor as the subject of PEB research and lists (Coelho et al., 2017; Fritsche et al., 2018; Kollmuss & Agyeman, 2002; Larson et al., 2015; J. Liu & Green, 2024; Van Valkengoed et al., 2022; Wesselink et al., 2017). Research on PEB with children, then, is particularly relevant to seek out, as behaviours in adulthood can differ quite considerably from those accessible to or chosen by children. Connecting adults and children, studies note that adults are often the teachers of PEBs to children, from school, home, and other known adults (Jia & Yu, 2021; Liu & Green, 2024).

According to a systematic review of all literature looking at children's PEBs, the actions most frequently measured or listed were recycling, saving energy, and environmentally safe waste disposal (Liu & Green, 2024). This was echoed by (Collado & Evans, 2019) and in studies with adult PEBs, which often foreground recycling and saving resources as go-to actions (Lauren et al., 2016; Thomas & Sharp, 2013). Indeed, most school programs that highlighted sustainable behaviours or PEBs, focused on recycling, waste disposal, and energy saving as top actions taught to children (Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Salazar et al., 2024; So & Chow, 2019). These behaviours are noted as being "small and easy" and that "perhaps too much emphasis has been placed on recycling as a pro-environmental activity rather than tackling waste avoidance and other sustainable consumption issues" (Thomas & Sharp, 2013, p. 16). Relatedly, focus on and engagement with easy or small PEBs (Lauren et al., 2016) like recycling or energy saving may in fact deter individuals from reducing other harmful behaviours, using engagement with PEBs as an allowance to engage in unsustainable other behaviours (Thomas & Sharp, 2013). Alternately, individuals may assume they are 'doing their bit' by engaging with these highly encouraged and taught PEBs and not seek to engage with more complex or impactful PEBs (Lauren et al., 2016; Thomas & Sharp, 2013). Teaching such easy and superficial PEBs in schools and in other ways to children does them a disservice by omitting and redirecting their attention from more impactful actions. In addition to being easy and small, actions such as recycling, have been greatly contested in recent years due to their marketed environmental benefit but realistic low impact and even lack thereof (Fritz, 2024; Macbride, 2013; Sullivan, 2020). Further to this, some highlight simplistic and easy PEBs as 'shallow environmentalism', lacking depth and impact (Fritz, 2024).

Other than PEBs, children's awareness of human impact on the environment, including observations of things like pollution, are noted in the literature, though studies on this topic are infrequent (Aguilar-Gomez et al., 2025; Choi & Woo, 1999; Duran, 2021). More studies have been done around child and youth perceptions and awareness of marine pollution, noting considerable concern by children about the negative repercussions of marine pollution on wildlife and ecosystem health (Canosa et al., 2021; Praet et al., 2023).

Children are key drivers for environmental change through PEB and are recognized as essential actors in sustainability goals by the UN (*THE 17 GOALS | Sustainable Development*, n.d.).

Hosany et al. (2022) note that "children of the current generation attribute increasing importance to environmental sustainability" (p. 236) and that they themselves have the desire to and actual exhibition of increased PEB and also influence members of their family, particularly adults, to reflectively change their behaviour. In developmental psychology, it is established that children consider the "protection of the natural environment a moral obligation" (Krettenauer, 2017, p. 581), an assertion that Kahn Jr. (2006) also supports. Furthermore, within early childhood, there is a "window of opportunity" (J. Liu & Green, 2024, p. 1) to encourage this moral stance for the purpose of increased engagement with PEB (Krettenauer, 2017).

This window is early childhood up until late elementary school age, as PEB tends to decline in later adolescence, particularly in late elementary and into secondary school (Krettenauer, 2017). This was supported by a study of EL levels for high school students in one city in Ghana which found that younger students within the group displayed more PEBs than older students in the group (Takyi et al., 2023). Liu and Green (2024) claim that "understanding and promoting PEBs in children lays the foundation for a more sustainable future" (p. 1). They importantly point out that the reason that children are some of the most effective actors in the PEB space is because of the phenomenon of "environmental generational amnesia" in which new generations are born into further environmentally degraded spaces and see that state as the norm and thus don't see them as morally wrong (Liu & Green, 2024, p. 1). This phenomenon can be mitigated, though, by encouraging the parallel phenomenon of the distinct morality of young children that Krettenauer (2017) recognizes and defines as mentioned above.

Investigations of factors leading to children's PEB recognize internal factors (of the child themselves), but also recognize external influences on behaviour choices, often from community or specific adults like parents or teachers (Liu & Green, 2024). Investigations around children's internal factors leading to PEB have used the Theory of Planned Behaviour, which requires a combination of intentionality and self-efficacy (Ando et al., 2015; Cheng & Monroe, 2012). The Value-Belief-Norm theory has also been used to connect attributes like ecocentrism or biocentrism, altruism, ecological worldview, self-responsibility, and sense of obligation (Stern, 2000). Liu & Green's (2024) systematic review of PEB literature with children notes that attitude is the internal factor most frequently associated with PEB. For external factors, the Social Learning Theory (SLT) has been used to show that modelling by external individuals, such as parents or teachers or organizational staff, and children's observation and imitation of their modelled behaviour is essential for constructing or changing both behaviour and associated attitudes for children (Liu & Green, 2024; Bandura, 1982). External non-human factors, such as time in nature, have also been explored, with results showing that "frequency of nature exposure was directly and indirectly linked to children's PEB through their environmental attitudes" (Bandura, 1982; Collado & Corraliza, 2015; J. Liu & Green, 2024). More generally, EE as an external factor, when provisioned to children, was recognized as generally positive for PEB enhancement, though some studies found a weaker link between knowledge, attitudes, and behaviour than expected (Liu & Green, 2024).

PEB in general is connected to work around environmental stewardship, both terms highlighting the complexity of this component of EL. Environmental stewardship is described in the literature as "practicing what you preach" (Basile & White, 2000, p. 58) indicating a direct connection between behaviours or actions and beliefs and values. A framework proposed by Bennett et al. (2018) defined environmental stewardship as:

> local environmental stewardship as the actions taken by individuals, groups, or networks of actors, with various motivations and levels of capacity, to protect, care for or responsibly use the environment in pursuit of environmental and/or social outcomes in diverse social–ecological contexts (p. 597)

And more recently, a scoping review by McLeod et al. (2024) described it as "both the philosophy and the actions required to protect, restore, and sustainably use natural resources for the future benefit of the environment and society" (p. 1). These definitions place stewardship more in line with a term like EL or EE as one that encompasses multiple components including behaviour or actions. Stewardship as a concept reflects some of the combined attitudes, values, and behaviours that children in Galápagos exhibited in this study and will be explored further in the findings and discussion.

2.5 Human Environment Relations in Protected Natural Areas

The Galápagos is not only an isolated and significantly biodiverse space, with high levels of endemism due to isolated evolution, it is also a designated protected natural area (PNA), as both an Ecuadorian National Park and a UNESCO Natural World Heritage Site. While there are many island systems that do not have the often-Westernized conceptual branding of protected areas (Langton et al., 2014), the Galápagos are certainly not alone in their designation. To understand the context of Galápagos, it is worth exploring literature that looks at protected areas and the human-environment interactions within them, especially along the lines of the previously explored components of environmental literacy and environmental education, especially for children living in these areas. PNAs are seen both as "important means to cope with global biodiversity loss, continuity of fragile ecosystems, and future availability of limited natural resources" and as a "means to provide local communities with new opportunities of social, cultural, and environmental development" (De Dominicis et al., 2017, p. 171), serving both the area itself and people around it. The concept of a PNA invites and recalls discussion earlier in this thesis around Western conceptualizations of humans separate from nature which are not often echoed by non-Western or specifically Indigenous groups. Because Galápagos has already been branded and designated as a PNA, it is still useful to explore research related to this term, but the concept of a PNA is contested and requires reflection.

Research around protected areas and children often centre on programs aimed to increase local environmental awareness, and other components of environmental literacy, for the purpose of conservation of the protected area itself. In communities living peripherally to Masoala National Park in Madagascar, a much larger island state but one that also faces conservation challenges with endemic species, EE programs for residents including adults and children have focused on developing positive relations between park staff and locals (Ormsby, 2008). Additionally, a contextualized curriculum was developed for local schools that incorporated topics and themes reflective of the local protected areas, similar to the current curricular approach in Galápagos (Ormsby, 2008). In continental protected areas, such as the Brazilian Pantanal, a large wetlands area in south-central Brazil, research has been done on local children's perceptions and attitudes towards large, endangered fauna such as jaguars in order to determine best courses of action for community-based conservation (Porfirio et al., 2014).

Unlike Galápagos, where large native terrestrial mammals don't exist, and where native terrestrial fauna is not dangerous to humans, the conservation of local species in this study was a concern because of the presence and potential for negative perceptions of them by children (Porfirio et al., 2014). The study also highlighted the importance and success of working with local children as opposed to local adults, as "children can internalize environmental awareness much more successfully than adults, whose repertoire of habits and behaviours are more crystallized and difficult to reorient," (Porfirio et al., 2014, p. 247).

Other research around protected areas focus on how the protected areas themselves serve as sources of learning and environmental awareness, values, and behaviour change for children who visit them. A study in the Lazio region in Italy found increases in pro-environmental attitudes and behaviours for children learning about and visiting local PNAs to act as little guides through nature reserves (De Dominicis et al., 2017). This study clarifies the benefits not only directly to PNAs from local human populations, but also the positive cycles created through engagement with such PNAs that contribute to positive human-environment interactions. However, the study does not specify which PNAs were visited by children, thus missing key information about how close children lived to these PNAs and how that closeness or distance impacted development of positive place attachment and pro-environmental attitudes (De Dominicis et al., 2017). The case of Galápagos differs from this study in that children in Galápagos live within a region that is 97% national park, or PNA, vs children living in Italian cities who then visit isolated and bounded spaces that are PNAs.

Similar to the Galápagos is the case of Zakynthos Island in Greece, which is home to one of the two National Marine Parks in Greece (Martinis et al., 2018). A survey-based study with primary and secondary school children living on the island and other islands in the archipelago assessed levels of LEK and environmental concern and found that overall, children were highly interested in their local environments and indicated the importance of the PNA in the presence of LEK and environmental interest and awareness for children (Martinis et al., 2018). Similarly, a study with rural children living in the buffer zone (edge of) of a PNA in the Atlantic Rainforest in Brazil found that, compared with urban children not living in direct contact with a PNA, children had robust knowledge of their local environment due to daily interaction with the protected area and the both preserved and externally degraded environments around their homes (Pío-León et al., 2017). The researchers also noted explicitly that children's "constant interaction with natural environments establishes positive ties with nature" and increased their pro-environmental attitudes and awareness of environmental issues (Pío-León et al., 2017).

Other research explores existing levels of environmental awareness, attitudes, and behaviour for local adults living close to, in, or around PNAs. A study by Dimitrakopoulos et al. (2010) assessed levels of these EL components for Greek citizens living in three PNAs and found positive environmental attitudes specifically towards conservation within PNAs, and "relatively high levels of knowledge of environmental issues" related to the PNAs, but often were disconnected from and inactive when it came to actual environmental behaviours and management of the PNAs (p.1847). This finding was contradicted by a study by Zhang et al. (2020) with adults living next to a PNA in China which found that community participation in the management and conservation strategies of a PNA was highly influential in local adults developing pro-environmental behaviours. Additionally, they found that community participation increased and acted as a bridge between place attachment and pro-environmental behaviours (Zhang et al., 2020). Some research contradicted findings by Dimitrakopoulos et al. (2010) in regard to awareness and knowledge, highlighting that there was considerable variation in both awareness and knowledge of locals living near a PNA in India about the PNA (Olomí-Solà et al., 2012). This research called for sufficient publicity and awareness campaigns for locals around PNAs and highlighted that simply because people live near a PNA does not inherently imbue them with heightened LEK or environmental awareness (Olomí-Solà et al., 2012). Public involvement in PNA management and conservation work was also noted as essential for existence of PNAs, especially in lower-income and economically struggling communities who may resent the sequestration of natural resources (Fiallo & Jacobson, 1995). This was exemplified in a study with rural residents both within and next to Machalilla National Park in Ecuador (Fiallo & Jacobson, 1995). Alignment between park management and residents and locals is paramount not only for the non-violent existence of the PNA itself but for the ethical treatment and inclusion of residents in ways that allow for human sustainability alongside environmental sustainability. Fiallo and Jacobson (1995) note that this was not an isolated development and management charge, as "people inhabited 86% of 184 national parks surveyed in South America" (p. 241) in 1993, including both Indigenous and non-Indigenous communities.

Other studies still look at how PNAs can be designed for the benefit of not only conserving non-human ecosystems and environments, but also sustaining socio-ecological spaces that have and still include Indigenous peoples as a part of that environment. These studies implicitly recognize the Western separation of human from nature and explore how this concept can be modified to be compatible and mitigate harm to Indigenous populations. Descriptions of the Indigenous Protected

Areas (IPAs) in Australia exemplify this modification of Western-pushed land use policies to acknowledge and return voice and agency to previously ignored, removed, or exploited Indigenous populations (Langton et al., 2014). These IPAs are protected natural spaces that are directly managed by first nations, Indigenous, groups, thus legally placing the ability to direct land management and conservation in the hands of Indigenous groups with historical and cultural rights to the land and environments themselves (Langton et al., 2014). While the Galápagos does not have a population Indigenous to the islands, this approach can be used as a model of effective and ethical local community centric management and conservation.

3. Background and Context: Zooming in and Out

3.1 Galápagos: Islands Overview & Human History

To understand the need for scholarship on Environmental Education for children in the Galápagos, it is important to first understand the human history of the islands. Permanent human habitation of the islands is relatively recent. Unlike many other archipelagos, the Galápagos has never hosted a human population Indigenous to the islands, primarily because of the inhospitable (to humans) nature of the islands without modern tech. After brief stopovers by Spanish ships who 'discovered' the islands in the 1535 (Durham, 2021), and subsequent pirate and whaling pit stops through the centuries, the first inconsistently permanent settlement, in the form of a penal colony, and claim by Ecuador to the islands occurred in 1832 (Hickman, 1985). Three years later, Darwin, aboard the HMS Beagle, arrived in the Galápagos. A series of penal colonies failed due to prisoner uprisings, alongside ultimately unsuccessful wealthy Ecuadorian elites attempting to run small plantations using effective slave labour from continental debtors prisons, which often meant poor Mestizo and Indigenous individuals, through the 1800s and into the early 1900s (Hennessy, 2019). These failed socio-political experiments in colonization and expansion left few remaining inhabitants at the turn of the 20th century (Hickman, 1985). But in the early 1900s, human habitation, while still sparse, picked up again and extended across five of the main islands. Small influxes of European settlers began in the 1920s, from Germany, Belgium, Austria, and Norway and continued through the 30s (Oxford & Watkins, 2009; Hennessy, 2019). Ecuador also encouraged migration of again elite Mestizo Ecuadorians to the islands, often in response to these small pockets of European and North American immigrants (Hennessy, 2019). The non-linear and patchwork collections of immigrants through the 19th and 20th centuries built a diverse group of colonists along racial, ethnic, and class lines. As Hennessy (2019) notes, by the 1930s, the 500 or so residents of the islands included "elite Ecuadorians who attempted to establish extractive industries, penal laborers brought out to work on haciendas, government officials and police officers who managed island penal colonies, and European and North American expatriates who came seeing opportunity and new lives on tropical desert islands" (p. 90). This foundation of diversity was the Galapagos human community starting as it meant to go on, as continued waves of migration to the islands from various economic, national, racial, and ideological backgrounds continued through the end of the 20th century.

Per the first ever national census in Ecuador, conducted in 1950, the Galápagos had a total human population of 1,346 across four islands: Santa Cruz, San Cristóbal, Isabela, and Floreana (Camilo Ponce Enriquez et al., 1950). From 1950-2000, immigration to the islands from mainland

Ecuador increased significantly. The first wave of immigration, from 1950-1962, was prompted by a direct promotion for cooperatives on the islands by the Ecuadorian government. A second wave followed the creation of the Galápagos National Park, and the formation of the Charles Darwin Research Station, both in 1959 (*About Us*, 2024; *Parque Nacional Galápagos*, n.d.). The founding of these two iconic institutions were supported and heavily staffed by international organizations, bringing in more non-Ecuadorian and often wealthier white immigrants from North American and Europe (Hennessy, 2019).

Economic opportunities on the islands served as the primary reason for increased immigration throughout the latter half of the 20th century. The nascent sea cucumber and then fishing industry and increased agriculture on the islands drew immigrants from mainland Ecuador from the 1960s until the 1980s (Oxford & Watkins, 2009; Durham, 2021). Additionally, after the foundation of the National Park and Research Station, conservationists pitched tourism to the Ecuadorian government as an economic focus compatible with island ecology protection, thus drawing migrants to work in and support this new industry (Hennessy, 2019). This shift was a formal steak in the ground for conservation and led to considerable conflict between existing more extractive economies and those working in them and the goals of the National Park and the international conservation backers (Hennessy, 2019). Due to the increase in tourism, the Galápagos National Park established and implemented the 1974 Master Plan for the Protection and Use of the Galápagos National Park which required all tourist trips to be accompanied and guided by a trained and qualified National Park Guide (*Parque Nacional Galápagos*, n.d.). A turning point came in 1998 when the Special Law of Galapagos was passed federally in Ecuador, which included increased regulation on local industries such as fishing, in the form of required permits, and quotas on catches (Bassett, 2009). For residents in various industries, the special law caused disruption both positive and negative – while providing new and different employment for locals and relaxing regulation on tourist activities in order to promote it as the main economic function in the islands, it also purposefully hampered industries that were at odds with the internationally and federally-backed conservation goals for the islands, without considered or inclusive conversations with Galapagueños in those industries (Bassett, 2009; Hennessy, 2019). Effectively, the Special Law imposed a top-down economic and thus social shift on the islands, which, today, means that conservation-related jobs (including all National Park and other related agencies) are the most populous across the islands (Bassett, 2009).

The Special Law also included strict curtailment of migration for the purpose of limiting population growth and prioritizing island conservation and added "residency based right to property ownership", among many other regulatory points (Hennessy, 2019, p. 210). This had an immediate impact of creating a class-based hierarchy hinging on residential status, bucketing most of the existing community members into "Colonos" or colonists, many of whom "would call themselves galapagueños," which often is a "marker of class status" or noting an 'authentic' quality to their residential status, with many members now having generational ties to the islands and some of the original inhabitants from even the early 1800s (Hennessy, 2019, p. 210). Since the Special Law, the term 'colonos' has "distinguished those with long ties to the archipelago from recent migrants" (Hennessy, 2019, p. 210). Other groups, then, are legal migrants to the Galapagos who have moved over since 1998, or illegal migrants who have overstayed visas but remain on the islands. This legal fracturing has given formal contours to the cumulative groups of colonos who often now hold generational ties and perhaps firmer roots on the islands, and who have shaped or been shaped more frequently by the two centuries of residential politics on the islands. This social hierarchy plays out in Galapagos political and social spheres, and means that some adults would be economically outcast, or 'marginados' – recently migrated and on the margins of the often highly-regulated economies of the islands (D'Orso, 2002).

The number of people living in Galápagos has most recently grown to 25,244 as of the 2015 Ecuadorian national census (*Principales Resultados Censo de Población y Vivienda Galápagos 2015*, 2016). Within this group, 7,500 school aged children inhabit all three residential statuses, with many of the children in this study using the term Galapagueño/a to describe themselves if they were born on the islands. Others noted that they had moved over recently or years prior but were not born on the islands. Social status related to residency was not asked of participating students directly, and the impact of social status did not clearly come through in interviews or focus groups as it may have with adults. However, diversity, and hierarchy within diversity, persists on the islands, and what is clearly noted as a current and persistent reality for adults must then impact children's lives in many ways, in what jobs their adult family members can get, in the ability of their families to own property, and in the legacy and generational knowledge, experience, and ties to islands that their families have. Ultimately, the Galapagos human community is, and has never been, a homogeneous group, and issues of equity, status, voice in Galapagos politics and policies, and social treatment pervade interactions on the islands.

3.2 Education in Galápagos

3.2.1 General Context and History

To understand the current state of education for those children on the islands, this is a brief overview of the education system in Galápagos. As of 2021, there were 21 schools (Table 1), including both primary and secondary institutions per information provided by a direct contact within the Galápagos Conservancy. Additionally, as of 2021, there were over 7,500 school age children on the four main inhabited islands (Knab et al., 2021).

Table 1

List of all primary and secondary schools across inhabited Galápagos Islands

Island/Canton	School	Grades Taught	Number of Teachers
Santa Cruz Total schools:11	Centro Educativo Comunitario Intercultural Bilingue Runakunapak Yachay	PK-7	9
	Escuela de Educación Básica Galo Plaza Lasso	PK-10	33
	Unidad Educativa Nacional Galápagos	8-12	39
	Escuela de Educación Básica Caupolicán Marín	PK-7	13
	Unidad Educativa Miguel Ángel Cazares	8-12	33
	Escuela de Educación Básica Oswaldo Guayasamin	PK-7	20

	Unidad Educativa San Francisco de Asís	PK-12	49
	Unidad Educativa Tomás de Berlanga	PK-12	22
	Escuela de Educación Básica Delia Ibarra de Velasco	PK-7	5
	Escuela de Educación Básica Julio Humberto Puebla Castellano	2-7	2
	Unidad de Educación Especializada Galápagos	PK-7	5
	Unidad Educativa Loma Linda	PK-12	17
San Cristóbal Total schools: 6	Escuela de Educación Básica Carlos Darwin	PK-7	8
	Escuela de Educación Básica Alejandro Alvear	PK-10	32
	Unidad Educativa Ignacio Hernández	8-12	19
	Unidad de Educación Especializada Corazones Unidos	2-4	3
	Unidad Educativa Liceo Galápagos	PK-12	20
	Unidad Educativa San Cristóbal	PK-12	53
Isabela Total schools: 2	Unidad Educativa Inmaculada Stella Maris	PK-12	33

	Escuela de Educación Básica Jacinto Gordillo	PK-9	17
Floreana Total schools: 1	Escuela de Educación Básica Amazonas	PK-10	4

Per the Ecuadorian education system, these schools are split into five educational levels; Prebásica (4–5-year-olds), Primero (1st grade), Subnivel Elemental (2nd-4th grade), Subnivel Medio (5th-7th grade), Básica (8th-10th grade), and Bachillerato (10th-12th grade) (Knab et al., 2021). Historically, the Galápagos education system, which remains part of the national Ecuadorian education system under direction of the Ministry of Education, has been criticized for low levels of child and teacher performance, and for not incorporating the wealth of learning experiences that exist in the Galápagos (Knab et al., 2021; Román et al., 2015).

3.2.2 UNESCO and Galápagos Education

The islands were originally declared a UNESCO Natural World Heritage Site in 1978, an inscription that brought with it increased monitoring of the Galápagos environment and conservation efforts in addition to regulations and provisions for the human population of the islands ('2 COM VIII.38 - Decision, Review of Nominations to the World Heritage List', 1978). In 1998, in response to the concern by UNESCO that Galápagos should be entered onto the list of sites in danger (*Twenty-Second Session Report*, 1999), the Ecuadorian Government made-into-law, the Special Regime Law for the Conservation and Sustainable Development in the Province of the Galápagos, otherwise known as the Special Galápagos Law (*Ley Orgánica de Régimen Especial para la Provincia de Galápagos*, 1998). The law included commitments to strengthen conservation on the islands and in the recently-established marine reserve around the islands, eradicate introduced and invasive species, strengthen the Galápagos National Park, implement residence and immigration control in order to minimize further human impact on the islands, and, most notably for this paper, work to increase the "appreciation of Galápagos by local people and their participation in its conservation through environmental education," (*Twenty-Second Session Report*, 1999, p. 14). Per the text of the law itself, the education system in Galápagos would be reformed to create a curriculum and system that teaches to and about the Galápagos as a unique ecosystem (*Ley Orgánica de Régimen Especial para la Provincia de Galápagos*, 1998).

Nine years later, after successive monitoring trips by UNESCO, the islands were officially added to the List of World Heritage in Danger because of a lack of implementation of promised conservation measures and a decline in some indicators of conservation (*Report of the Reactive Monitoring Mission, Galápagos Islands (Ecuador), 8 - 13 April 2007*, 2007). The UNESCO mission observed that none of the 15 areas of concern in the Galápagos, including the state of the education system, had improved since their 2006 visit, and explicitly stated that:

> The education system has not been reformed as required under the Special Law for Galápagos, and as yet does not incorporate elements of environmental management and heritage preservation, and natural resources conservation development, further delaying the critical need to develop an insular culture focused on sustainable development (*Report of the Reactive Monitoring Mission, Galápagos Islands (Ecuador), 8 - 13 April 2007*, 2007, p. 10)

Corroborating the UNESCO findings, the Ecuadorian government released a Presidential Decree stating that the conservation of the islands and the island ecosystems were now at risk and included a new management plan by the Ministry of the Environment (*Report of the Reactive Monitoring Mission, Galápagos Islands (Ecuador), 8 - 13 April 2007*, 2007).

In the findings of a follow-up Reactive Monitoring Mission to Galápagos in 2010, UNESCO noted that, while education is a long-term project for the islands, still no significant progress had been made in its reform or improvement (Strahm & Patry, 2010). The topic of education was not mentioned at all in the most recent Reactive Monitoring Mission report by UNESCO and IUCN, leading us to believe that either significant progress has been made in the improvement of education on the islands, or it is no longer a prioritized topic for UNESCO (Lethier & Bueno, 2018).

3.2.3 Ecuador's National Education Plans

Nationally, Ecuador has a federally designed and mandated education system that the Galápagos Islands are a part of. Per a law enacted in 1994 in Ecuador, the country will establish a National Education Development Plan every 10 years and the plan covering 2006-2015 dedicated $80 million USD to all levels of education (*Plan Decenal de Educación Del Ecuador 2006-2015, Año 2 de Su Ejecución*, 2007). The plan covered eight main areas of focus and improvement: 1) achieve universal education for children 0-5 years of age; 2) achieve universal elementary through 10th grade education; 3) increase the child population in high school to at least 75%; 4) eradicate illiteracy and improve adult education; 5) improve infrastructure and resources/equipment for all educational institutions; 6) improve the quality and equity of education and implement a national system for evaluation of children, teachers, and schools; 7) increase the valuation of the teaching profession through teacher training, professional development, working conditions, and quality of life; 8) increase annual government expenditure on education to 6% of the GNP (*Plan Decenal de Educación Del Ecuador 2006-2015, Año 2 de Su Ejecución*, 2007).

This ambitious plan resulted in faster improvements in educational quality in Ecuador than in most Latin American countries. However, because Galápagos still struggled with practical challenges like slow internet, distance from the capital and thus delays in receiving physical materials, etc., schools, children, and teachers on the islands did not benefit from the plan as much as those in other Ecuadorian provinces (Knab et al., 2021).

3.2.4 Galápagos Teacher Training Program

In an effort to support local education leaders, teachers, students, and communities, a coordinated long-term program for teacher training began in 2014 (Román et al., 2015). The initial needs assessment was conducted in 2014, and findings were then used to design a teacher training program with particular emphasis on teaching around education for sustainability (Knab et al., 2021). The five-year teacher training program was carried out between 2016-2021 and the self-sustaining program continues to this day. The program, titled "Education for Sustainability in Galápagos," was spear-headed by three entities: the Galápagos Conservancy (a US non-profit organization), Fundación Scalesia Galápagos (an Ecuadorian NGO), and the Ecuadorian Ministry of Education (Knab et al., 2021). The proposal for the project's main components included ongoing professional development for all teachers, through workshops and professional learning programs, leadership training to build a team of teacher leaders in the hopes of developing self-sustaining professional development, and ongoing educational improvements (Knab et al., 2021).

The ongoing professional development manifested in two five-day-long teacher institutes per year that the Ministry of Education has set aside two weeks for during the schoolyear, which means that teachers do not have to take vacation time to attend training (Knab et al., 2021). Additionally, all professional development takes place in the Galápagos, a noted change from previous offerings in Quito or elsewhere on mainland Ecuador, making it much more accessible and affordable for teachers and school leaders.

3.2.5 Galápagos Contextualized Curriculum

While additional support for the teachers and children in the Galápagos school system continues to be a needed focus, much helped by the ongoing, now self-sustaining teacher training program, the Ministry of Education supported the research and development of a Galápagos-specific, or locally contextualized, curriculum with a focus on sustainability, which was implemented in 2021 (*CurriculoGalápagos – CurriculoGalápagos*, n.d.).

In addition a contextualized Galápagos centric curriculum being a stated right for Galápagos educational staff and students per the Special Law of Galápagos, some local organizations who have played an instrumental role in supporting formal and informal education sources on the islands also championed this development, recognizing the benefits of a contextualized curriculum for taking advantage of the local environment as a source of learning and as an essential element for sustainable development. The Galápagos Conservancy, a US based organization who contemporarily supported the development of the teacher training program, note on their website that:

> Until recently, formal education was a missing piece of the conservation puzzle in Galápagos. Despite educational reform efforts on mainland Ecuador, the physical and digital isolation of Galápagos perpetuated traditional forms of education that did not take full advantage of the Islands' amazing natural surroundings as a living classroom (*Educating Students for Sustainability*, n.d., para. 5).

While sustainability and localization of sustainable learning and concepts is indeed the stated core thread through the new curriculum, other themes have also been contextualized for the purpose of children learning not only about the local environment and their role in it, but also about local economy and culture, in this way providing a comprehensively localized curriculum (*Currículo Contextualizado para Galápagos*, n.d.). In a 2024 interview led by the Galápagos Conservation Trust, another non-profit that has done and continues to do work for local education, a local education workshop leader, Adi Benea noted the purpose and importance of the new curriculum:

> Adapting the national curriculum to the unique context of Galápagos and its needs has added meaning to the education work being done on the Islands. The units that make up the curriculum provide understanding for current and future generations regarding the role they play as members of the local communities in taking care of and protecting the Islands (*Understanding the Importance of Environmental Education in Galápagos*, 2024, para. 3)

The new curriculum was developed by the Ministry of Education, with research support from the Universidad de las Americas, a university based in Quito, and some independent advisors, after conducting local consultations with 126 individuals from "all sectors" (not specified in the document) on all four of the inhabited islands (Ministerio de Educación & Universidad de Las Américas, 2020). These consultations, conducted within a framework of participatory action research resulted in the development of 14 major themes around "key sustainability issues" to be addressed through formal education. These 14 themes were then grouped into three main 'axles or meta themes which are: 1) economy, 2) environment, and 3) society (Ministerio de Educación & Universidad de Las Américas, 2020). The axes, or meta themes, speak to the breadth of topics covered within Buen Vivir as they include local environmental, sociocultural, and economic realities. In this way, the curriculum is contextualized across all human systems of Galápagos to generally improve local knowledge across all subjects for school children, both in relation and in addition to the goal of learning about sustainability. The curriculum covers both primary and secondary schooling and curricular documents outline teaching standards by subject taught in relation to the three axes and the 14 themes.

The overarching framework of the curriculum follows from the three axes or meta themes. These axes, and the 14 themes grouped between them, are shown in Figure 1 below, translated from the curricular documents. Sub-themes below the grouped 14 themes highlight more detail that informs the general teaching topics (rightmost column) that are covered throughout the subjects and grade levels.

Figure 1

Contextualized Galápagos Curriculum axes and themes

AXES OF SUSTAINABILITY	ESSENTIAL TOPICS	SUB-TOPICS
Sustainable Island Economy	1. Food, sovereignty, and food security 2. Responsible consumption and production 3. Fair trade and sustainable finance 4. Work, cooperation and autonomy	• Healthy and responsible eating • Self-cultivation, permaculture, and food safety • Sustainable and responsible consumption • Sustainable and responsible agricultural and industrial production • Sustainable artisanal fishing • Ecotourism • Fair trade and sustainable economy • Civil society initiatives for sustainable productive activities • Self-sustainability and cooperative labor relations
Interdependence and harmonious coexistence in nature	5. Cosmos, biodiversity and territory 6. Climate crisis and global-local sociopolitical relations 7. Water, sanitation and renewable energy 8. Materials, solid waste management, compost and sustainable recycling 9. Population, mobility and transportation	• Terrestrial and marine biodiversity • Invasive species • Protected areas, zoning • Humans, non-living beings, matter, and energy • Global and island geography • Climate change, adaptation, and mitigation • Globalization • Water and sanitation • Renewable and ecological energies • Waste management (solid and liquid) and recycling • Sustainable transportation and mobility
Galapagos identity, diversity, sociocultural equity	10. Rights, gender equality and social justice 11. Interculturality, cultural diversity, inclusion and ancestral knowledge 12. Arts, body, expression, creativity and development 13. participation, autonomy and community organization 14. Access to and responsible use of information, quality, science and technology	• Identities • Equity, gender and social justice • Comprehensive sex education • Ancestral knowledge and dialogue of knowledge • Diversity and interculturality • Universal accessibility and social inclusion • Arts, creativity, and development • Freedom, body, and movement • Responsible access to and use of information • Development and use of proprietary technologies

Note: This graphic has been translated and reproduced from the Contextualización Curricular con Enfoque de Sostenibilidad para las Islas Galápagos (2020, p. 15). Original document note: information was co-constructed with local Galápagos actors in a participatory manner.

Each of the three main axes are broad, with scope to cover issues of sustainability across a wide variety of topics. It is key, here, to highlight and discuss the definition of sustainability and indeed of education with a focus on or education for sustainability. As readers can observe in the figure above, sustainability topics include many aspects of human-centric activity, knowledge, and behaviours, ranging from addressing sustainable approaches in culture, including awareness of interdependence with local and global environments, sustainability of local economies including food production, waste management systems, other systems of production, and health. Terms that do not appear in the figure above and indeed in the definition of sustainability that the curriculum documents cite, include local ecological knowledge, environmental awareness, pro-environmental behaviours, or more specific topics such as species knowledge, ecosystem knowledge, geology, among others (Ministerio de Educación & Universidad de Las Américas, 2020). The second axis, 'Interdependence and harmonious coexistence in nature', does, in its phrasing, use the term 'in' instead of 'with' which linguistically places humans as part of the broader environment and not separate from it, which is a notable choice as it may encourage more environmentally aware thinking. However, within the topics and sub-topics of that axis, the only mention of environmental learning about local ecology, which arguably for Galápagos is not inherently human-centric are topic 5. Cosmos, biodiversity, and territory, and two (of 11) corresponding sub-topics, 'terrestrial and marine biodiversity' and 'global and island geography' (though the latter could include human geography in addition to topography, climate and other non-human-centric themes). Here we look to the definition of sustainability used within the curriculum itself (translated from Spanish):

> Sustainability is a central 21st-century movement focused on the interrelationship between the environment, human cultures, and healthy economic systems for current and future generations, at the local, regional, national, and global levels. Under this premise, a sustainable community would ideally be able to maintain a balance between social, environmental, and economic pillars without overusing resources and without disrupting the local ecosystem. The need for transformative change toward the development of sustainable communities in all spheres, including education, is urgent. (Ministerio de Educación & Universidad de Las Américas, 2020, p. 8)

In this definition, the need for human populations to use sustainable (meaning consistently maintainable as a basic definition of the term) practices for the purpose of sustaining human cultures and economies without overusing, overburdening, and destroying the environment indicates an anthropocentric worldview. Contrastingly, the opening sentence of the section on justification for the development of the curriculum focuses entirely on the non-human biodiversity, uniqueness, and importance of the Galápagos ecosystems, stating (translated from Spanish):

> The Galápagos Islands are the classic paradigm of conservation achievements and management challenges and opportunities. Unlike other oceanic archipelagos, the Galápagos Islands maintain 95% of their intact biodiversity (Watkins and Cruz, 2007), including a high level of

> endemism (e.g., 108 vertebrate species, 234 plant species, and a still unknown number of invertebrate and non-vascular plant species). The Galápagos Islands present an ideal conglomeration of organisms unique in the world (e.g., marine iguanas, vampire finches, giant tortoises) sheltered in settings of unparalleled beauty that have made them, since time immemorial, a hotspot for natural science research (Ministerio de Educación & Universidad de Las Américas, 2020, p. 8)

This ecocentric focus persists in the paragraph following the one above and notes more specifically native and endemic species and how the species themselves, and the Galápagos ecosystems are what have garnered the islands status as a UNESCO Natural World Heritage Site. But the focus on ecology is dropped just after these opening lines in a shift to anthropocentric language discussing sustainability.

The Galápagos curriculum introduction does seem to use some of the terms associated with 'old' sustainability (described in the previous section) but contradicts that ethos with a predominant focus on anthropocentric reasons for sustainability such as protecting Galápagos ecosystems for the sake of preserving existing ecotourism and broader economic systems. The discussion of the lack of acknowledgement of contention of the term sustainability in international and local programs, including the Galápagos Curriculum, is not to demean the work of the curriculum, but to clarify the framing and use of the term within a curricular context. In the Galápagos curriculum introduction, the authors state exactly this, noting (translated from Spanish):

> The contextualization of curricula with a sustainability focus for the Galápagos Islands is centred on the premise of an education focused not only on sustainability issues, but also on

> the promotion of principles and skills that foster sustainable ways of life. (Ministerio de Educación & Universidad de Las Américas, 2020, pp. 8–9).

Here, curriculum authors provide, though briefly, a reason for the anthropocentrism of the curriculum, stating that "Research has identified the need to seek strategies that link work with community work to create effective curricula aligned with the needs of societies" (Ministerio de Educación & Universidad de Las Américas, 2020, p. 9). Unfortunately, the authors do not actually cite any research here, but there does seem to be some academic literature on the topic. Most of this reasserts previously made statements by various UN conventions, using modern definitions of anthropocentric sustainability as reasons for anthropocentric sustainability. Schaubroek et al. claim that an anthropocentric sustainability is necessary because "as humans it is impossible to look beyond a human viewpoint and desire for sustainability" (2015, para. 1).

The term sustainable development, as its most basic, presents a "bad oxymoron" (Daly, 1990, p. 1) as development, tightly linked with the terms 'modernization', 'Westernization', and 'growth' in Western-pushed systems of power inherently does not align with sustaining the environment (Adelman, 2018). As Adelman (2018) further points out, dominant economic systems, including both capitalism and socialism, do not prioritize ecological sustainability. It also does not actually guarantee preservation of environments and ecosystems, or even biodiversity, because "[m]ass extinction could conceivably come to pass without jeopardizing the survival of the human species; and because people might be materially sustained by a technologically biota made to yield services and products required for human life" (Crist, 2003, p. 65). These contradictions can lead to insidious confusion and misguided use of the term. As Wals and Jickling (2002) point out, "When comparing the sustaining of ecological processes with the sustaining of consumerism we immediately see inconsistencies and incompatibilities of values, yet many people, conditioned to think that sustainability is inherently good, will promote both at the same time" (p. 223).

When looking at the Galápagos Contextualized Curriculum, it is not immediately apparent that anthropocentrism is the guiding light, as addressing sustainability issues within local economies and cultural practices is essential to ensuring environmental sustainability. Put another way, if the goal is environmental sustainability, we must examine and design environmentally sustainable economic activities and cultural practices. However, as I will explore further in the fourth findings chapter in this thesis, the content delivered along the topics and sub-topics of the curriculum to children in Galápagos seem to sometimes take the tack of reasoning for the need for environmental preservation in order to sustain local economies. The Galápagos curriculum is not entirely unique in this approach - as Malone (2016) highlights, broad recent education and environmental curricula and programs often are rooted in similarly anthropocentric beliefs which in turn perpetuate the Western separation of human from nature. This confusion with or perversion of environmental linguistics towards wholly anthropocentric beliefs is not helped by a curriculum which does not explain what ethic it is coming from, leaving that decision and interpretation open to instructors and other adults with access to the curriculum.

4. Methodology

4.1 Introduction

The impetus for this study is a continued interest in the environmental experiences of children living in the Galápagos islands and within a UNESCO Natural World Heritage Site. As supported by the results of the scoping study, detailed in previous sections, there is a noticeable gap in research on the education system in the Galápagos, and more specifically, a gap in research on EE for children. In this study, I hope to begin to fill that gap through the analysis of data collected with 5th grade children in Galápagos schools. I collected all data in Spanish, the primary language spoken in the Galápagos. In this chapter, I will discuss the theoretical framework, including the epistemological and theoretical lenses through which I worked, my positionality, the chosen methodology, and the methods; the research design; instrument design; data collection; and data analysis.

4.1.1 Researcher Positionality and Identities

It is essential for me to acknowledge and analyse my positional subjectivity as an 'outside' researcher who collected data not only in a country that I am not a citizen or resident of, but also in an education system that I have not participated in. I approach this work through an interpretivist lens, so it was important to be aware of my subjectivity through preparation, data collection, analysis, and interpretation of findings. This was particularly important as an outside researcher (i.e., not a member of the community of participants I worked with), especially as the research I conducted included a source language different from my own. I also approached this work through the framework of Childism (Wall, 2022), which will be further described in following sections. This meant attempting continual interrogation of my adult lens to equitably understand and centre children.

Assuming representation of individuals, a community, and system that I was not a part of without first positioning myself as an outside researcher and exploring ways in which my position undoubtedly affected the research design and outcomes would be irresponsible and would both mislead the readers and misrepresent the subjects. In this research, I, as a Western researcher, worked with young children in a country that I am not a resident of or native to, so it was important to conduct fieldwork and subsequent analysis from a power-sensitive perspective. While I do speak Spanish and have previously conducted research within schools on the Galápagos, I am not a native speaker or a resident of Galápagos and as such, am an outsider looking in. This approach is described through the following section on theory.

I held and exhibited multiple identities while collecting data. These identities include: an adult, a white Western American female; a researcher from the University of Oxford; someone who spoke Spanish; and someone who is familiar with the Galápagos. Many of these have their own rarity in the Galápagos. Upon meeting district office officials, teachers, and school directors, and at the beginning of each first session with a class that I visited in Galápagos, I introduced myself with the following information: "My name is Amelia Farber, and I'm a student (I added: "much like yourselves" when talking to children), from the University of Oxford in England and I am here conducting research for my doctorate on environmental education and how children learn about the Galápagos environment".

The identity I most frequently needed to remind myself of throughout the doctoral process, was my position as an adult. The pervasiveness of adult-centric worldviews, assumptions, and systems will be discussed further in following sections and has been discussed throughout the literature review. Even so, consciously removing my figurative adult glasses to both refuse to remove agency from children and to more equitably engage with children required daily practice. Despite having been a member of this specific community earlier in my life, the current lack of membership was most apparent as a positionality that required constant care and attention.

Less than three percent of the Galápagos population is white, and thus my identity as a white person entering Galápagos classrooms is rare (*Principales Resultados Censo de Población y Vivienda Galápagos 2015*, 2016). Contrastingly, most international tourists to the islands are white, so, while some children may have come in contact or interacted with someone who is also a white Western female, it was a novelty to engage with one in their classroom. Additionally, my identity as an American was exciting to many children. I did not lead with this information, but many children asked where I was from, to which I would respond that I used to live in California. Upon learning that I was American, and from California, many children would excitedly ask if I spoke English and occasionally a child would ask me to say something in English.

There was a distinct power dynamic between me as an adult researcher and children. While most interactions with children were positive, there are undoubtedly children with different views on race and the historical or national narratives that accompany whiteness. I believe that, overall, my identity as a white, American woman was met with positivity and curiosity from many children, which unintentionally may have helped to cause excitement from children to want to participate in the research. It should be noted that encouraging children to participate in any of the three data collection methods is not appropriate and I did not verbally or in any way suggest that children had to or should participate.

My identity as a researcher from the University of Oxford did not have a perceivable impact on children. I say this because when I introduced myself as an Oxford child, I got no audible or visible reaction from children. The impact that the Oxford name might have on a study done in the UK was certainly not present in Galápagos classrooms. After seeing little reaction to the Oxford name, I modified my statement to include "in England" to which some children noted that England was far away, but still even the country name did not measurably affect how children reacted. The absence of reaction to both England and Oxford University may have mitigated any potential effects of that knowledge on data collection that may have been present if engaging with adults. All of this is said from an adult centric lens, and I cannot assume that children were unaware of the names I mentioned, when in fact they may just not have found them interesting or assigned importance to them.

Both my familiarity with and ability to speak Spanish with children and engage with teachers and other adults in schools and on the islands was essential to appropriately conducting research and creating an environment in which children could feel linguistically confident and thus hopefully willing to engage with data collection methods. I let children know that they could ask any questions if they were at all confused or didn't understand anything during data collection, and I frequently walked through classrooms during survey administration, answering dozens of questions that children felt comfortable and eager to ask in Spanish. Using Spanish as the research language was also important so that I could understand what children said or what children misunderstood so that I could explain questions or instructions in new or different ways.

Additionally, my own comfort in Galápagos, with this being the third time visiting the islands and second time conducting research and engaging with the communities, allowed me to approach classrooms with knowledge about how schools function in Galápagos and who I needed to gain permission from and keep in the loop during all research activities. Finally, my knowledge of Galápagos towns, restaurants, policies, and other community-centric topics meant that I could engage in meaningful conversations with teachers, school directors, and district officials in a way that formed friendships and sparked new ideas around educational research. My previous experiences in Galápagos were also important because they give me credence as a researcher, especially when engaging with school leaders who are busy and do not have the time, nor should they engage, with researchers who conduct research ignorantly or with no knowledge of Galápagos or its human systems. It was also deeply important that I caught up with old Galápagos friends and academic contacts before conducting this research to best bring myself up to speed with how things have changed or persisted in Galápagos communities so that I was an aware and knowledgeable participant in my own research and in the communities who were facilitating my research.

4.2 Theoretical Framework

4.2.1 Epistemology and Framework

To obtain a holistic understanding of how Galápagos children construct ecological local knowledge through environmental learning, I approached this research within an interpretivist epistemology, as I believe that meaning is formed by and iterated on by individuals within a social context and that knowledge and a specific reality is accessed through interaction with social constructs and an individual's broader environment. More specifically, the children I worked with each had their own lived realities, "shaped by the individuals' historical or social perspective" through which they held and formed knowledge, and it would be impossible to understand each of their realities without "looking at it through their experience" (*Understanding Pragmatic Research*, n.d.). Additionally, through the lens of interpretivism, I, as a researcher, am undoubtedly a part of the research itself, influencing the information that children choose to share with me and the opinions that they have about the research. This means that there is a direct link between me as a researcher and the research participants and, while the children are the ones 'providing' data to be analysed, any resulting data will be shaped by my presence and interaction with the children, thus producing research that would be distinct if a different researcher interacted with the same children.

Within the greater lens of interpretivism, I designed this study within a constructivist theoretical perspective to best fit the stated goals of the research as a whole and the research questions. This perspective allows us to understand that children within this research, and indeed me as a researcher, are learners who "construct knowledge rather than just passively take in information" and that as we "experience the world and reflect upon those experiences, [we] build [our] own representations and incorporate new information into [our] pre-existing knowledge" (*Constructivism*, n.d., para. 1). This perspective is stated directly in the title of this research, which in turn reflects the goal of the research questions as I believe that child participants construct local ecological knowledge through processes of reflection on experience and subjective understanding.

4.2.3 Theory: Centring the Marginalized

This study is situated within the field of environmental education, but draws on literature in environmental psychology, equity, Indigenous philosophies, and childhood studies. The deepest undercurrent through this research is that of awareness and recognition of marginality and a seeking to equitably construct and work through this research for the sake of acknowledging inherent agency and power of groups and entities that are marginalized that are often mis-heard, stripped from, or made invisible. Acknowledging marginalized groups in this study is essential as part of an ethical research design, but also to effectively engage with both the research context in Galápagos in a world housing the human-caused environmental polycrisis, with Indigenous groups present, and with children. Indeed, recognition of marginality and of assumed truths from lenses far too often unquestioned, unseen, and thus unremoved (such as Western-centric, anthropocentric, or adult-centric lenses) is ethically paramount for researchers and humans to address.

In this research, I engaged with multiple marginalized groups and entities: children, the environment, Indigenous philosophies and peoples, and small local island communities. Children are an oppressed group which now have stated rights per the UN, but have historically been, and continue to be in many domains, silenced, misunderstood, and stripped of agency (Wall, 2022). Indigenous peoples are globally oppressed and marginalized and their centuries, sometimes millennia, of environmental knowledge and philosophy is essential to reference and frame this research, despite a lack of people Indigenous to the Galápagos (*Indigenous Peoples Rights Are Human Rights.*, n.d.). The global more-than-human environment, the ecosphere, including flora, fauna, and non-living ecosystem components, have, through the course of Western-dominated history, been marginalized and exploited to the point of the environmental polycrisis, which returns to harm humans as part of global ecosystems (Britnell et al., 2023). Small human communities, especially those living within and near protected natural environments, are frequently marginalized in spaces of conservation and recognition of stewardship of their local environments or are treated as separate from and removed from their local environment (Dahal et al., 2014; Spierenburg et al., 2006).

Marginality is complex, so in recognizing the groups mentioned above, I do not mean to paint any single piece or actor as monochrome. Within every marginalized group mentioned, there are spaces and individuals who also may inhabit identities of privilege. However, the nexus of topics covered in this study focuses on identities that are indeed marginalized. Because this research works with and within marginalized groups and spaces, I apply a network of theories meant to keep my eyes, and the eyes of readers, wide open to recognition of marginality and that seeking of justice in various forms. These theories include: the UN Rights of the Child and Childism; Indigenous standpoint theory; and a combination of ecocentrism, Sumak Kawsay, deep ecology, and post-anthropocentric theories. Overall, the theories on which I have built this research with the participants and place, and with which I seek to understand that research, all overlap in their decentring of dominant or normative powers and practices, and the centring of marginalized voices and entities.

Firstly, I aim to ensure, through this research, a constant auto-evaluation of my own adultism to continually centre and listen to the valid and whole voices of children. The theories and work that I use to situate this research are the tenets of the United Nations Convention of the Rights of the Child (UNCRC) and an evolution from childhood studies called Childism. The UNCRC was an adult-led gathering and agreement which was formalized in 1989, through which the adult-centric and child-marginalized assumptions and exploitations of children were addressed and changed (*Convention on the Rights of the Child*, n.d.). The resulting agreement, signed by many member states, essentially provides a legal framework that asserts that:

> children are not just objects who belong to their parents and for whom decisions are made, or adults in training. Rather, they are human beings and individuals with their own rights. The Convention says childhood is separate from adulthood, and lasts until 18; it is a special, protected time, in which children must be allowed to grow, learn, play, develop and flourish with dignity (*Convention on the Rights of the Child*, n.d., Section 2)

The agreement thus holds adults accountable for preserving and respecting human rights of children and recognizes children as their own unique entities. The agreement also provided foundational documentation that allowed and encouraged children's participation in research on or about them (Sudarsan et al., 2022). This international framework mirrored the development of evolved understandings of childhood within sociology through the 1980s and 1990s (Quennerstedt &

Quennerstedt, 2014; Wall, 2022). This newer field of childhood studies was a "reaction against prevailing views of the child in developmental psychology and traditional socialisation theory" (Quennerstedt & Quennerstedt, 2014, p. 118).

An important highlight of both the UNCRC and literature on childhood studies, focuses on the recognition that children are not simply 'adults in training' or incomplete individuals (*Convention on the Rights of the Child*, n.d.; Quennerstedt & Quennerstedt, 2014). Adults, then "ought to approach children not as social 'becomings' but as social 'beings,' not as passive recipients of adult socialization but as active and diverse social participants in their own right" (Wall, 2022, p. 258). I agree with this stance, though have mediated it in line with Quennerstedt and Quennerstedt's (2014) discussion in their work on children's rights in education, which asserts that researchers in education especially should have caution around the dichotomy of being vs becoming. The idea behind a shift from looking at children as 'becoming' [adults] vs 'being' [full humans] was meant to shift away from the associations that 'becoming' carried with it, often including incompetence and incompleteness and which can be used to justify adult dominance over children and a lack of child agency (Quennerstedt & Quennerstedt, 2014; Wall, 2022). The recognition of children as 'beings' or persons, then, serves to support child agency (Quennerstedt & Quennerstedt, 2014). However, as this research is grounded in the educational space, which is "a setting where becoming is central [...] the study of the rights of children in education must acknowledge that children are 'becomings' as much as 'beings' (Quennerstedt & Quennerstedt, 2014, p. 123). In essence, the insistence that becoming and being are mutually exclusive does both children and adults a disservice by forcing an assumptive either-or paradigm. This research, then, fully recognizes children as whole beings capable of constructing their own views and knowledge, while also recognizing that all beings are forever in the process of becoming.

Beyond this foundational view of children, I use Childism, a term recognized and explored by Wall (2022), as a theoretical lens through which to work with children. Wall (2022) situates Childism within other isms such as feminism, decolonialism, or environmentalism, as a similar lens and tool for critically engaging with marginalized and oppressed entities for the purpose of study and activism. Wall (2022) asserts that this conceptualization of Childism is a "needed critical lens for deconstructing adultism across research and societies and reconstructing more age-inclusive scholarly and social imaginations" (p. 257). Using this lens of Childism serves as an active way to reflect and deconstruct my own and other adultism for the purpose of listening to children in ways that do not strip them of rightful agency and voice. As Wall (2022) notes:

> In these and other ways, childism makes the crucial claim to critique adultism in any manifestation so as to restructure fundamental social norms. Children remain central, but now as subjectivities and not just objects, lenses and not just specimens, prisms and not just waves of light, Archimedean levers for moving the world. (p. 262).

In addition to centring children, I have also included elements of Indigenous standpoint theory to mitigate marginalization and invalidation of Indigenous philosophies that are critical guides for research with humans and within environments. I recognize the historic and still contemporary dominance of Western individuals and thought within the academy, among other human spaces, and the inherently restrictive nature of an academic approach which is constructed within a Western institution, which continues to allow little to no space for differences in approach to thinking, philosophizing, and conceptualizing the world (Foley, 2003). In this way, I hold true the idea that the Western academic tradition is deeply limited in scope and its refusal to recognize humanity and competence of thought of non-Western people both dehumanizes Indigenous and non-Western groups, but also perpetuates the construction of incomplete and globally uninformed research. Throughout this research, I actively work to seek out and engage with Indigenous and non-Western theories and thought, including the framework of Sumak Kawsay as an approach to human and environment relations, explored below and in previous sections. I recognize and note that this study does not engage with Indigenous participants about their indigeneity, nor is it done by an Indigenous researcher, so this study does not critically interrogate or dismantle Western research paradigms, methodologies, or methods as well or as much as it could and should. This is something I discuss further in the limitations.

The environment, a term used in this research to mean the ecosphere that both encompasses and includes humanity, is another marginalized entity due to dominant and prevailingly Western ideologies of human superiority over nature (Alberro, 2020; Keating & Merenda, 2013; Kopnina, 2019). This classically Western tradition of separation from and superiority over nature, which can be conceptualized as anthropocentrism (Kopnina, 2019), also fuels other separations and superiorities asserted by humans of the West and others over non-Western and Indigenous humans. Indeed, "scholars warn of the predominance of Western and colonial understandings of human relationships with other species that undermine the magnitude of violence both nonhuman species and Indigenous peoples have been experiencing" (Kalfagianni et al., 2024, p. 1151). Thus, this research rejects the anthropocentric worldview, which "that privileges the aim of improving human welfare over other aspirations" (Kopnina, 2019, p. 1). In this way, as discussed in section 2.2.3, we understand anthropocentrism to be contradictory to needed social, environmental, and ecological justice, and an alternate term "'industrocentrism,' or a focus on industrial neoliberalism, that subordinates both people and nature to the economic system" (Kopnina, 2019, p. 2) is more revealing of anthropocentrism's self-destructive flaws as a worldview.

Instead, this research is grounded in and draws on understandings of humanity, justice, and ecological welfare that include ecocentrism, Sumak Kawsay, deep ecology, and post-anthropocentric theories. Ecocentrism is discussed further in section 2.2.3, and Sumak Kawsay, the Indigenous Kichwa worldview, in section 2.2.4, and I now highlight the terms deep ecology and post-anthropocentrism as additive theories with which to situate this research. Deep ecology is a theory conceptualized by Naess (1973) which counters the shallow ecology movement which, in essence, mimics tenets of anthropocentrism and humanism (Kopnina, 2019) in their superficial "Fight against pollution and resource depletion. Central objective: the health and affluence of people in the developed countries" (Naess, 1973, p. 95). Deep ecology then, approaches ecocentrism through the lens of ecology, and proposes a complex, but not complicated, philosophy. The first tenet of deep ecology states that the "traditionally anthropocentric notions of a separate and superior humanity 'over yonder' are largely dismantled in favour of a holistic 'human-in-environment' worldview that emphasises the equal and inherent value of all life" (Alberro, 2020, p. 672). Other tenets emphasize the complexity of human-designed and ecological systems and that ecological sustainability, and the valuing of whole ecosystems must be forefront, but this does not preclude the necessity of dismantling and actively working to change destructive socio-political systems which harm the ecosphere and perpetuate inequities within humanity (Naess, 1973). In this way, deep ecology has a kinship with both ecocentrism and Sumak Kawsay.

Similarly, post-anthropocentric theories explicitly mirror elements of ecocentrism, in that they seek to move beyond and break from the asserted superiority of humans both over other humans and over the ecosphere (Keating & Merenda, 2013). Within post-anthropocentric thought, a novel approach emerges through the work of Chicana queer-feminist Gloria Anzaldúa, and Keating and Merenda (2013), who seek to highlight Anzaldúa's work as a proposed post-anthropocentric framework. As Keating and Merenda explain, "Anzaldúa develops a post-anthropocentric subjectivity and onto-epistemology which neither erase nor elevate the human but instead radically blur the boundaries between conventional (Cartesian) definitions of human and nonhuman life" (2013, p. 76). Her theory approaches post-anthropocentrism through the concept of 'conocimiento' (the Spanish word meaning, knowledge, or consciousness), which she imagines and shapes as a fluid awareness of and stepping back from in order to view and dissolve Western and anthropocentric dualisms and fallacies with regard to the ecosphere, including the human (Keating & Merenda, 2013).

In addition to the above theoretical framework, theories that situate and contextualise the learning that I investigate and discuss with children in this study have been discussed previously in section 2.3.2. As a reminder to readers, these theories include experiential learning theory, observational learning, and the socially mediated transmission and construction of learning exemplified by many Indigenous communities, particularly in the cultivating and curation of IEK.

4.3 Methodology

For methodology, I look to the proposition that mixed methods can in fact be its own distinct methodology (Greene, 2006, 2008). The emergent guidance for and validation of mixed methods approaches continues to grow (Castro et al., 2010; Greene, 2006, 2008; Hanson et al., 2005; Tashakkori & Teddlie, 2010) exemplifying that mixed methods as a research approach can be a holistic way of understanding social phenomena, because by definition it includes multiple ways of seeing and understanding experiences inherent in different ways of collecting them from participants. Greene highlights that social science researchers and practitioners

> Sought to use various methods because the practical demands of the contexts in which they worked called for both generality and particularity. And they called for defensible patterns of recurring regularity as well as insight into variation and difference. And they called for results that conveyed magnitude and dimensionality as well as results that portrayed contextual stories about lived experiences. (2008, p. 7)

These needs reflect those in my own research and are predominantly why I chose various mixed methods for data collection. Within this methodology are ways of understanding and illuminating the general and the personal, including strategies to capture broad sweeping stories of a place or people and individual anecdotes and stories. Both qualitative and quantitative swaths of data can be seen as equally valuable through this methodology as they complement the other and serve to describe a whole, or "meaningfully make interpretive sense of localized phenomena" (Greene, 2008, p. 7). Effective approaches to research using mixed methods as a framework and methodology include distinct ways of sequencing and integrating the multiple methods and data types. Creswell (2010) describes these, and I highlight the concurrent approach as one that best fits the aims of this study. This study uses the concurrent triangulation approach of which the purpose is to "use both qualitative and quantitative data to more accurately define relationships among variables of interest," (Castro et al., 2010, p. 1). For this approach, no priority or increased weight was given to either quantitative or qualitative methods and data.

4.4 Methods

Methods used within this mixed methods study were a survey, semi-structured interviews, focus groups, and observational field notes as my methods. These choices are supported by the literature: when reviewing studies that aim to measure or explore EE and Environmental Learning both qualitative and quantitative methods are commonly used. For example, a study by Ballard et al. (2017) in the San Francisco Bay Area employed semi-structured interviews with children to explore their environmental science learning through participation in science programs. Other studies, intent on exploring LEK and impacts of that knowledge, also utilized semi-structured interviews (Berkström et al., 2019). Additionally, other studies that focused on measuring levels of environmental behaviours, ethics, or ecological knowledge, utilized surveys as their primary method to produce quantifiable results (Bergman, 2016; Cho & Lee, 2017; Luan et al., 2020; Mullenbach & Green, 2018). The considerations for type of each method chosen, and a foundation of literature covering each of the three participant-involved data collections methods will be discussed further in the instrument design section of this chapter.

4.5 Research Design

I conducted fieldwork on two of the four inhabited Galápagos islands: Isla Santa Cruz and Isla San Cristóbal. Initially, I intended to conduct fieldwork on three of the four inhabited islands; however, due to a contemporarily recent boating accident to the third island, Isla Isabela, I revised the plan and resolved to cover the two most populous islands. The two remaining islands, Isabela and Floreana, have significantly smaller human populations than the chosen two islands, which, while not relevant for the qualitative data collection, would have been less additive to the quantitative survey. The decision to only work on two islands was due to a balance of resource restrictions, including time and funding, and potential impact on all data collection methods. The map below in Figure 2 illustrates the physical location of the islands in relation to mainland Ecuador and serves to orient the reader as to how the islands are arranged and where the towns on each of the four inhabited islands are.

Figure 2

Map of the Galápagos Islands

Note: https://en.wikipedia.org/wiki/File:Galapagos_Islands_topographic_map-fr.png#filelinks

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I collected data using mixed methods during fieldwork, including: 1) a survey for children, 2) semi-structured walking interviews with children through outdoor spaces in their school, 3) child focus groups guided by topics like those in interviews, and 4) observational field notes. Each of the four data sources were used to answer each research question respectively partially. Jick (1979) notes that "organizational re- searchers can improve the accuracy of their judgments by collecting different kinds of data bearing on the same phenomenon" (p. 602) thus triangulating by using multiple methods that approach the same questions. For example, using the written survey and interviews to ask the same questions of children for the purpose of generating different types and scopes of data which, together, confirm a more reliable finding than a single method producing that result.

Fieldwork was conducted from October 5th to December 5th, 2022. I lived in Puerto Ayora on Santa Cruz Island and conducted one four-day trip to Puerto Baquerizo Moreno on San Cristóbal Island to conduct data collection with children living there. I chose Santa Cruz as my home base as it is the most populous island, and thus has the most schools and time needed for data collection. I gathered data with children in 5th grade classrooms in 12 schools across the two islands. The twelve schools were selected because they have 5th grade classes and because my goal was to obtain data from as many eligible schools on the islands as possible to have a representative sample of the islands' children for the survey.

I selected 5th grade (nine- to 10-year-old children in Galápagos) because I am interested in determining if, and if so, how, EE and LEK is shaped in the initial years of formal schooling, as, if they are formed in early years of schooling, it would result in more total years of children' growth of EE and LEK through the rest of formal schooling. To be able to have in-depth conversations with children about these topics, it was important to select an age group that was not at the beginning of elementary education to minimize chances of children not being able to elaborate on their experiences, engage in conversations about environmental subjects, or not be able to read or understand survey questions.

Additionally, research shows that this mid-elementary age tends to correspond with an increase in social awareness and moral development, which lends itself well to discussing topics such as environmental concerns (Krettenauer, 2017; Pretelli et al., 2022). As Krettenauer (2017) states, this age is a "period of increased moral sensitivity owing to more abstract thinking skills, greater perspective-taking abilities, and greater knowledge about societal issues" (p. 581). This is complemented in a study by Pretelli et al. (2022) of ecological knowledge acquisition from ages 5-26 in youth in Tanzania which found that "Knowledge acquisition appears in our data to be fastest during middle childhood, between 7 and 12 years" (p. 11).

4.6 Method Approach and Instrument Design

4.6.1 Survey – Approach and Instrument

4.6.1.1 Framework and Approach

A survey was the most effective way of gathering high volumes of general data with children. Because I was able to design an instrument that could be administered with entire classes at a time, coverage of all available and participating schools was possible, as opposed to the additional methods of interviews and focus groups, which, due to time and resource constraints. Additionally, a survey including quantitative LEK questions was helpful to answer the research question: what is the state of LEK of children living in the Galápagos Islands? Surveys designed to determine children' levels of Ecological Knowledge have been successfully used by EE researchers, such as Srbinovski's (2019) Knowledge of Ecology Test or the US-based Middle School Environmental Literacy survey (McBeth &

Volk, 2009). While there is, now, a Galápagos-specific curriculum that includes modules on Galápagos ecology, it had not been fully implemented at the time of data collection, so I did not design questions based on that curriculum.

Some questions were designed specifically to augment the qualitative data collected, using short answers that could be qualitatively coded. While survey data was helpful in presenting comparable images of children' LEK and how they learn about their environment, it did not allow children to provide expanded answers or engage in further discourse about their LEK. This is described as one of the main limitations of surveys by Cohen et al. (2017) as the structure of a survey may result in "possible unsophistication and limited and superficial scope of the data that are collected, and by the likely limited flexibility of response" (p. 471). For this reason, interviews and focus groups were used to expand data collection.

Because research questions for this study are predominately exploratory and descriptive, the survey itself used a descriptive design. As Jann and Hinz (2016) explain, "The primary goal of studies based on descriptive designs is to give an account of the state of social reality at a specific point in time or its development over time" (p. 110). This design was ideal for gathering data that helps to paint a picture about what children learn, their perceived sources for knowledge, and state of LEK. Additionally, the survey was designed to be cross-sectional, meaning that participants would only be surveyed at one point in time, allowing the data to give us a snapshot of participants' state of LEK and other responses (Jann & Hinz, 2016). This is helpful because schools in the Galápagos have not participated or administered a survey that seeks to describe these child attributes or knowledge about the environment, so a baseline or reference point may serve as the springboard for future research.

Relatedly, the survey was designed to be a cohort study, meaning that the survey would only be administered to a single group of participants with a shared attribute (Jann & Hinz, 2016) - in this case, children who were in grade 5. It was especially important to control for the variables of age and grade because children are exposed to specific content per school curricula and programs and thus determining the most accurate level of LEK and sources of LEK should be based on a single cohort. To preserve some of the benefits of in-person surveys (de Leeuw & Berzelak, 2016), I chose to administer surveys to one class of children face to face. This allowed me to not only explain survey instructions and briefly establish some relationship with participants, but also allowed me the chance to respond to real time questions, observe any confusion from children and act quickly to clear it up, and ensured that I was present to mitigate other survey challenges.

When designing the survey, it was important to have a response-centred approach, or, as Smyth (2016) describes, making sure to "consider how the respondent will experience the questions, what they need to be able to answer accurately, and what might go wrong for them" (p. 218). My previous experience conducting research in Galápagos schools assisted in this approach. Additionally, I used the guidance set out by Smyth (2016) to ensure design elements such as "question wording, visual design, and question order" (p. 218) were top of mind while creating the instrument. Smyth (2016) also notes that "a primary goal [of the survey design] has to be to make each step of the response process as easy as possible so that respondents can provide accurate answers with minimal burden" (p. 220). One key consideration was the length of the survey. Based on my previous research in Galápagos with thirteen-year-old children in 2014, I determined that longer surveys were not well suited to gathering accurate, complete data from children, nor are they creating equitable and comfortable spaces for children to engage with research, or, as Cohen et al. (2017) states, was an "intrusion into the life of the respondent" (p. 471). Therefore, I attempted to simplify the types of questions used, and limited it to 25 questions.

To contribute to ease of responding, I also drew from previous experience and chose to print individual paper surveys for each child, as opposed to printing a reusable set of classroom surveys and copying a single-page answer sheet for children to fill in. While I had used the latter approach in previous research in Galápagos to save on both printing costs and limit paper resources, teachers and children informed me that separate answer sheets, which had been familiar to me in a US school context, were unfamiliar, and in fact never used in Galápagos schools. The use of them resulted in considerable confusion, frustration, and discomfort for children, which negatively impacted them and the data.

4.6.1.2 Question Content

While multiple choice was the best fit for some questions, it was clear that others required space for children to provide possible answers that I as the researcher, who isn't a young child living in Galápagos, couldn't think of, or for when I wanted to see what children could retrieve from memory. In addition to designing questions best-fit to answer research questions, it was also paramount to ensure children understood the questions I was trying to ask (Smyth, 2016), so age-appropriate vocabulary, structure, and content was used. Additionally, to ensure clarity of some questions, instructions and examples were given. Both instructions and examples were kept to a minimum to mitigate any influence that they had on participant responses (Smyth, 2016). This will be further explored in the Pilot section.

Working with younger children, it was especially important to me to develop a survey instrument that was positive to engage with. One element of this was requiring surveys to be anonymous. Because I didn't ask for children' names or any clearly identifiable information, coupled with a verbal and written reminder that this was a survey and not a test or any sort of exam for a grade, I hoped to encourage children to answer simply based on their knowledge and not make up answers or be tempted to collaborate with other children. Additionally, I used a title that was designed to put children at ease that this was a survey and not a quiz. The title for the pilot survey was "Tus Pensamientos sobre tu Ambiente" (Your thoughts about your environment), emphasizing that this was about their ideas and knowledge, not a test of either of those.

Another way of designing an engaging survey that encouraged children to respond was to design a survey narrative that guided children logically from one section to the next. Questions were grouped by theme and content into four sections in the survey which were titled: 1) Questions to get to know you better; 2) How and where do you learn about the Galápagos environment?; 3) Questions about the ecology of the Galápagos; and 4) How do you feel about the Galápagos Environment? All groups had a mix of multiple choice and short to long answer questions. In questions 18 and 20 (group 3), each of the eight sub-questions asked children to name a different photo of an endemic or native Galápagos animal or plant. Species were chosen to represent a selection of the most iconic species in Galápagos. This requirement resulted in animals that inhabit the marine, coastal, arid, transition, and scalesia ecosystem zones on the islands, which therefore includes species that are present in both port towns and highland villages, covering, at least a part of, the lived spaces of all students surveyed. While this was a more challenging section it had a highly visual design, providing images of species to identify, which I hoped would keep children engaged. The animal species chosen for the photo identification questions were blue footed booby, sea lion, finch, marine iguana, hammerhead shark, giant tortoise, flightless cormorant, and land iguana. The plant species chosen for the photo identification questions were: opuntia cactus, scalesia, Galápagos tomato, mangroves, palo santo tree, yellow cordia or muyuyo, Darwin's cotton, and manzanillo or poison apple. To choose these, I consulted Galápagos field guides to confirm that species were native or endemic. I also drew from my experience visiting and conducting research in both Galápagos towns and Galápagos highland villages (distinct ecological surroundings), to determine which animal and plant species are visible in those spaces either by their actual presence, or by their likeness on statues, souvenirs, signs, and in murals.

There were five questions in group four, all asking children to reflect and give their emotional or attitudinal view of how they feel about the Galápagos environment. These questions, while not directly answering the research questions, provided context that assisted in evaluating the importance of learning about the environment to children, and relatedly, the awareness they have about learning about their environment. These were multiple choice, scale questions with five available answers ranging from "Completely agree" to "Completely Disagree". I chose to provide five possible answers for these questions per the recommendation by Smyth (2016) for reliability and validity.

4.6.1.3 Review and Validity

To ensure validity of ecology questions, I used the Middle School Environmental Literacy Survey (MSELS) developed by McBeth and Volk (2009) as a guide, as it includes questions on Ecological Knowledge, Environmental Learning, and environmental behaviours and attitudes. Specifically, I modelled questions asking about ecological concepts and environmental attitudes or beliefs. I used similar sentence structure, vocabulary (translated) and question type. While I do speak Spanish and all data collection was conducted in Spanish, I developed the survey first in English, as it is my primary language, and then had the instrument translated into Ecuadorian Spanish by a professional to ensure that wording was accurate and appropriate. Both prior to and following translation of the instrument, I conducted review sessions with various individuals who have worked, lived, or spent years focusing on Galápagos research and local communities, to further hone each question.

4.6.1.4 Survey Pilot

Because I had developed a survey instrument from scratch, it was integral that it be tested prior to full data collection with all schools. While it would have been ideal to conduct the pilot survey with multiple classrooms and through multiple iterations to further hone the instrument, it was key to balance the need for a substantial final sample size. This meant that I had to minimize the impact of the pilot on the final participant group, and thus chose to only administer the pilot survey with one classroom of children. To ensure that all available schools could still participate in the final data collection, I chose to administer the pilot with one class at a school where there were multiple classes of 5th grade children. With significant support from local non-profit leader, Daniel Proaño of FUNCAVID, I contacted the director of one of the schools on Santa Cruz Island that had multiple 5th grade classes and arranged a first visit to discuss if the school was willing to host the survey pilot in one of those classes.

Overall, the administration of the pilot proved more useful than anticipated as in-person observations of how children reacted to the survey, how many children had questions on particular questions, and noting the wording that resonated with children when I helped them with those questions made subsequent survey modifications more streamlined and informed. During the survey, I floated around the classroom, pausing next to children who looked a bit lost or unsure and asking them if I could help with anything (this often led to the child asking a question that they may have been nervous to ask of their own accord). I noted that, while the teacher was very helpful, her desire to help children with the survey responses was something I needed to mitigate, as any assistance coming up with the "right" response would result in unusable data.

Children were engaged and seemed eager and excited to participate in the survey. It was important, even within the pilot, to create what I hoped would be a good experience for children, as the research is not primarily about gathering data, but about having a net positive impact on participants and the community with which I wanted to work. All in all, children seemed especially excited to engage with someone not from the Galápagos.

4.6.1.5 Survey Modifications

The most common observations during the survey pilot included: difficulty with the complexity of written questions and level of vocabulary throughout the survey; confusion with how to answer demographic questions; confusion about how much to write in free-response text answers; and difficulty recognizing species in the photographic species identification section.

There was some confusion from children on questions five, which asked, respectively, which islands children had visited before. A handful of children were unsure about question 10, which asked in which classes they learned about the environment. When they were given examples of classes, many of them then realized they needed to write down the names of each class. From this, I added more examples of class names to help children understand what to put in the free-response line. Many children had questions on question 12, which asked who and what were other people and programs from which they learned about the environment. When I verbally explained this question to children, I added examples of each (parents, grandparents, friends, the National Park etc) and the examples seemed to help. Many children had questions on question 14, which asked what would happen if the Opuntia Cactus disappeared from the islands, but even when I offered alternate verbal explanations, children still struggled, and I determined that the challenge was with the actual ecological concept, which was helpful LEK data.

The most questions arose in the species identification sections. While most children were able to name all or most of the animal species, there were still frequent challenges with children copying others, walking over, and asking the teacher what the name of each species was, or whispering or telling their friends the answers. It took significant verbal reminders and physically moving through the class stopping children from sharing or copying work to get through the two sections with minimal data quality issues. From this I added highlighted reminders in the text of the survey to not share or copy answers for these sections, and that leaving questions blank was just as valuable as providing a name.

Additionally, in the plant identification section it became clear that a few of the photos posed a challenge. I chose to find new images that were visually clearer so that children might have a better chance at recognizing these species. In the case of the photo of the scalesia, which is an endemic species related to common daisies elsewhere, there are many different variations across the islands. The photo I had originally included was one of the tallest scalesia that grows into tree-like forests in the highlands. While I could have changed this photo to one of a coastal species of scalesia, I chose to keep the original species (highland, tree-like scalesia) but find a clearer photo that showed the full tree versus just the crowns as I believed that many children would still be able to identify it. Similarly, I replaced the palo santo tree photo with one that was clearer. Finally, I removed the passionfruit flower and Galápagos coffee plant photos and swapped them for different species, as neither of the original species were endemic. While both species are native, they could easily be mistaken for non-native species, and thus did not accurately or effectively measure children' LEK. I instead chose photos of muyuyo and Darwin's cotton, both endemic flowering shrubs.

After making the above modifications, I requested review from four individuals already involved in the research: Daniel Proaño; Richard Knab, Professor Diego Román, and Alejandra Mejia. Considerably helpful were the suggestions from Proaño who gave a bird's eye view edit to the structure and sequence of the survey and survey questions, noting that some questions seemed to be in a random order and would make more sense grouped with similar questions. This, combined with edits from Knab, Román, and Mejia produced a final survey that created a more comprehensible and digestible story and sequential flow that I believe helped children to work through the survey during data collection in classrooms. Both Knab and Román suggested changing all instances of the word "ambiente" to "medioambiente." However, both Proaño and Mejia felt that ambiente was the more locally used term and would be the best understood by the age group of children, so we kept all instances of ambiente. All modifications to the pilot can be found in Appendix E.

While it would have been ideal to pilot the survey instrument multiple times with different classes over the course of months of detailed review and modifications, doing so would in effect jeopardize the total number of participants in final data collection.

4.6.2 Go-Along Interviews – Approach and Guide

As stated in the survey overview, while interviews and focus groups were more limited in this study due to resource and time constraints, they did provide valuable and more in-depth insights due to their focused and qualitative nature. I chose to design a semi-structured interview. This design allowed for data to be produced that was complementary to that in the written child survey as it gave space for elaboration and improvisation following ideas, memories, and thoughts that children volunteered during interviews. The flexibility that semi-structured interviews offered was especially fitting, as I was keen to allow new questions to surface in each interview and influence successive interviews with other children - thus expanding the scope of data beyond the survey's more rigid format.

I created a thirteen-question interview guide which I could stick to if children were less verbose and could use more prompting, or I could use as a starting point and see if other topics arose in conversation with the child. While short, the interview guide included questions that aimed to provide data for all four research questions, like the survey. All interview guide questions are included below for reference (prior to translation):

Interview Questions in English:

1. Were you born in Galápagos, or did you move here? (if you moved here, how old were you when you moved?)
2. How would you describe the environment of Galápagos where you live?
3. How do you learn about your environment?

4. How did you learn about your environment when you were little?
5. What is a memory from your childhood about learning about your environment?
6. Did someone teach you things about your environment as you were growing up?
7. Who teaches you things about your environment now?
8. How comfortable are you naming animals or plants in Galápagos?
    a. Where and how did you learn these things?
9. What other avenues do you have for learning or getting information about Galápagos?
10. Can you describe how you feel about Galápagos as your environment?
11. Is it important for you to learn about the environment of Galápagos? If yes, why?
12. Does your school put emphasis on learning about the Galápagos as your environment?
13. Is conservation of the Galápagos environment important to you? If yes, why?
    a. Does your family agree?
    b. Do your friends agree?

While I could have done interviews with children sitting in a classroom, the method of go-along interviews, during which the interviewee and interviewer move through a space, seemed especially appropriate for a study asking children about their constructed knowledge of a natural environment (one which exists outside of a classroom). These movement-based go-along (which could include walking or assisted movement) interviews were inspired by other researchers in the social sciences who have used the go-along interview as a rich ethnographic tool that allows the researcher to gain insight into "in situ" experiences of the interviewee (Kusenbach, 2003, p. 455). As Carpiano (2009) describes, "the "go-along" interview method is a variation on qualitative interviewing techniques that has great utility (either alone or in conjunction with other methods) for exploring—and subsequently improving understanding of peoples' experiences of their local residential context" (p. 263). Additionally, Evans and Jones (2011) note that "it is argued that walking interviews generate richer data, because interviewees are prompted by meanings and connections to the surrounding environment and are less likely to try and give the 'right' answer" (p. 849).

I conducted go-along interviews with one child volunteer per classroom, and for each interview, I prefaced our discussion by introducing myself to the child again and letting them know that I had some questions to ask them but that we'd walk around the school grounds wherever they wanted to go while talking. Each go-along interview, given the nature of the flexibility of the method and the allowance for each child to lead the direction of travel, was unique in its path and environmental backdrop. Some children walked around or through school garden areas, while in other schools where more non-built outdoor space was prevalent, led a path through grassy fields (in the highland schools) or through vegetation-lined pathways between school buildings. Others, even in port schools where sometimes the outdoor spaces were more built up, led walks around main buildings, and still pointed to or referenced vegetation planted or growing around them. None of the children needed assistive devices for movement and so all go-alongs were done by both the child and me walking through the school grounds. Sometimes children would pause and talk while standing or pause to point out a plant or location they incorporated into their narrative.

The flexibility of the go-along also allowed for a variance in social engagement, as neither the child nor I was sitting across a table from the other which may cause more focus on social norms such as posture, eye contact, physical movement/fidgeting, etc. Additionally, conversing while moving provided an active filler for silence, when perhaps children may feel obliged to speak or not be silent during a literal face to face sit down interview. Moving through a space allowed both interviewer and interviewee a break from some of the expected social norms of engagement which I believe allowed the interview itself to be focused more on the knowledge being shared by children. As there was no set path, there was also no set timeframe, which allowed for customization of each interview based on how quickly or how much a child wanted to share information, and meant that at any point, the walk could circle back to the classroom and wrap up for interviewee comfort.

Moving as a method of knowing, knowledge collection, construction, or sharing, among other purposes, is not a novel discovery of Western researchers but draws on culturally situated uses of movement, particularly those within Indigenous communities (Blades, 2021). In the academic space, researchers note the increase in walking-related research (Lorimer, 2010; Pink et al., 2010) as "a strategy for exploring new understandings of lived through experiences" (Iared & Torres de Oliveira, 2017, p. 100). Much of the literature cited in this section uses the term walking; however, for the sake of this study, I have chosen to use the term 'go-along interviews' to ensure that accessibility is not sidelined, meaning that the term can incorporate an interview that moves through outdoor space either by walking, if participants are able, or by using assistive movement devices (Stafford, 2017). Further to the use of go-along interviews as an accessible and useful way of allowing adults or children to move through spaces comfortably, some research highlights the benefits of go-along interviews as opposed to sit-down or sedentary interviews because they can mitigate intrinsic barriers and power dynamics between researchers and participants, and also because they may offer a more comfortable and thus inclusive method for neurodivergent participants or participants with varying mental health challenges (Kinney, 2021; Marcotte et al., 2022).

Specifically as a conduit for exploring and sharing data about a local environment, Evans and Jones (2011) further note that "walking with interviewees generates more place-specific data than sedentary interviews" and that they are "more spatially focussed, engaging to a greater extent with features in the area under study than with the autobiographical narrative of interviewees" (p. 856) both notes supporting the usefulness of go-along interviews to converse and share knowledge about local environments. The use of the local environment for the sharing of participant thoughts and knowledge on that topic, aligns with beliefs about construction of knowledge through experience. Ingold's (2001) work on knowledge and knowing which further supports the use of walking through space to share and know knowledges about that space, is summarized as "what we learn from the world comes from our experience of existing and being in the world which he calls Education of Attention whereby we observe, identify and create on the basis of our incorporated living experience" (Iared & Torres de Oliveira, 2017, p. 100).

As this study was designed to investigate how children learn and what they know about their local Galápagos environment, the go-along interviews were an apt variation of the traditional interview to capture more information about, and in, a part of the children' local environment. The literature supports this, noting that go-along interviews are particularly suited to various types of research, including "environmental perception" (Kusenbach, 2003, p. 456). Being within the outdoor Galápagos environment, even if still within the school grounds, not only allowed me to incorporate real-time questions about what is in that visible, tangible environment, it also allowed the child to lead the physical path of the interview through natural spaces at school that they enjoyed. These benefits provided additional content that helped to answer research questions. For example, children could point out visual examples of plants that they knew the name of, of trash on the ground to highlight their comment about pollution or allow a child to show me a space in which they learn about the environment outside of the classroom.

Most research using or discussing benefits and appropriateness of go-along interviews centres, often un-explicitly, on adult participants (Blades, 2021), often using the word 'people' (Evans & Jones, 2011; Waitt et al., 2009) in place of properly acknowledging the life stage of research subjects. While some studies do use and focus on the application and structure of go-along interviews with children, other texts minimally include children in ways that do not sufficiently address the uniqueness of the child life stage, cognitive development, or centring child voices (Springgay & Truman, 2018, 2019). Research that does centre children and explores go-along related methodologies have developed parallel terms such as child-led tours or child-led place tours, which give space for researchers to go-along with children in various contexts (Green, 2012; Hart, 1979; McFadden et al., 2023). This originally accidental method (Hart, 1979) continues to be championed by childhood researchers in partial fulfilment of child rights and for work that seeks to prioritize child voices instead of marginalizing them (Green, 2012). Specifically, to investigate and listen to children's thoughts on their environment, child-led tours have been used to learn about children's perceptions of their outdoor environments in a way that allows them to shape and fill space and time in the most comfortable communication way (Merewether, 2015).

Child-led tours are often included within studies using the mosaic approach, which is a methodology designed to listen to and centre children and includes walking with, creating with, talking with, and reviewing materials with young children, further adding weight to the importance of accepting children as 'experts in their own lives' (Clark, 2017; Clark & Moss, 2011). The term 'child-led tours' is helpful in adding context to the appropriateness of walking with and letting children lead as a research method, though has typically been used with younger children in early childhood, often pre-school ages. Because of this and to transition to working with upper-elementary children, I have chosen to use the term walking interviews, with the contextual caveat that these interviews were child-led and the purpose of them was to continually centre children as the knowers and sharers of environmentally related knowledge.

While there are many studies that use such child-centric go-along methods, none seem to use these methods to explicitly explore children's knowledge of the environment, especially reactive knowledge referencing environmental features or spontaneously found flora and fauna as real-time examples of sharing LEK with researchers. Some studies get close to this topic, such as using go-along interviews with children in parks to discuss park features (Veitch et al., 2020), or going along with and being curious with children about physical interactions with weather and climate (Rooney, 2019). While there is a noticeable lack of research using the go-along interview for the purpose of research learning from children about what they know about a local environment, and how they learn about that environment, the landscape of other child-centric research gives ample foundation for my choice in using go-along interviews in this study.

Evans and Jones (2011) note that because my walking interviews were designed so that the interviewee led the path for the interview through the space, I would need to assume that the interviewee was familiar with the space and able to move easily through that space. All children were familiar, based on time as a child in the school, with the immediate school grounds. All randomly selected child volunteers for interviews were also mobile and able to move throughout the outdoor spaces in schools, and, while one of the children was newer to the school, this did not hinder a sufficient familiarity with the space to conduct the interview.

4.6.3 Focus Groups – Approach and Guide

While interviews allowed me to engage 1-1 with individual children, there was a risk that children would not feel entirely comfortable sharing the amount of information that would be beneficial in an interview setting with a person they did not know. Partially for this reason, focus groups seemed to provide a more comfortable, peer-led discussion space in which children might be willing to engage and comfortable doing so. For this reason, focus groups were the final data collection method in each class, following interviews. In this way, I was also able to use any notes from interviews, such as particular subjects or new questions, to feed the focus group discussion. Additionally, if I noticed a trend in lack of response or type of response to certain survey questions in that class, I could tweak questions and discussions within the focus groups to address those. Like interviews, focus groups gave me, and the other child participants in the focus group "a way of listening to people and learning from them" (Morgan, 1998, p. 9) but they also allowed participants to expand on the narrative of individual interviews, as focus groups, by design, involve multiple participants and thus a space for discourse as opposed to the isolated thoughts of a single interviewee. In other words, focus groups are "a means to set up a negotiation of meanings through intra- and inter-personal debates" (Crang & Cook, 1995, p. 56) and "[permit] possibilities of hearing the multiple and collective voices of the 'Others'"

(Liamputtong, 2011, p. 2). Another benefit of including focus groups in my data collection methods was that focus groups may also “suit people who cannot articulate their thoughts easily and provide collective power to marginalized people” (Liamputtong, 2011, p. 3). Other researchers in the environmental ethics and education space have implemented focus groups to generate community discussions on environmental behaviours in the Bay Area (Biggar & Ardoin, 2017).

The focus groups in this study were semi-structured in that I did draft and bring a physical focus group guide to each focus group and prompted children with these questions and topics, but I also left space open for children to talk to each other to generate conversation and share knowledge about the prompts. Questions on the guide are listed below:

Focus Group Guide Questions in English:

1. What is the environment here in Galápagos? How would you describe the environment where you live?
2. How do you learn about your environment or who teaches you about it?
3. Do you have a positive or exciting memory about the environment or nature here in Galápagos?
4. Do you like to learn about the animals and plants of Galápagos? If yes, why? If not, why not?
5. Can you describe how you feel about Galápagos as your environment?

Because focus groups allow for collaborative conversation and idea sharing, I believe that they provided distinct insights into shared experiences or knowledge of children, as this was the only data collection method that did not focus on the individual as an isolated source of data and instead on the individual as a member of a community source of data.

I conducted focus groups outside, mimicking part of the approach to the go-along interviews, however, focus groups were conducted seated to allow all children to actively engage and be heard. The groups were also conducted on school grounds with eight children per surveyed class, per the design recommendation by Liamputtong (2011). Focus groups with vulnerable people, in this case, children, can be challenging so it was important to ensure child comfort and social safety in each small group. One of the main limitations of focus groups, as described by Liamputtong (2011), is the potential loss of control by the moderator. This was particularly relevant for the focus groups that I conducted. Conversation often veered away from the prompts or overall research questions, so I employed loose but active management of each focus group, encouraging children to return to the question or topic by repeating it or asking it in a different way. This management was balanced with the allowance for children to still feel like leaders of their own discussion. Another risk which occurred was children more comfortable talking publicly or in loud environments, would dominate focus group discussions. To minimize or re-direct this occurrence, I also employed management of participation and encouragement for sharing the spotlight or talking space to ensure all children felt that they could participate easily.

4.7 Data Collection

4.7.1 Participants and Recruitment

As described in the Research Design section, I collected data with grade 5 children on Santa Cruz and San Cristóbal islands. There are twelve schools, eight on Santa Cruz and four on San Cristóbal, that have grade 5 classes of children, and all these schools were willing to participate. The number of total children enrolled in 5th grade and who participated in the survey are noted below in Table 2. The difference between children enrolled vs surveyed is attributed to either absence on the day of the survey or lack of parental permission to participate. Some schools were primary schools (básica) while others were combined primary and secondary schools (básica y colegio). Finally, most of the schools on each island were in the port towns but a few schools were in the highland villages. The significance of distinguishing between port and highland schools will be explored further in the first findings chapter.

Table 2

List of participating schools

School Code	**Number of Grade 5 Classes**	**Class Codes**	**Number of Grade 5 children**	**Number of children Surveyed**	**Level of Schooling Provided**	**Island**	**Highland vs Port School**
GA1	2	GA1A, GA1B	66	58	Básica	Santa Cruz	Port

GA2	1	GA2A	30	22	Básica	Santa Cruz	Highland
GA3	1	GA3A	9	5	Básica	Santa Cruz	Highland
GA4	1	GA4A	11	11	Básica	Santa Cruz	Port
GA5	1	GA5A	17	13	Básica	Santa Cruz	Port
GA6	3	GA6A, GA6B, GA6C	85	71	Básica y Colegio	Santa Cruz	Port
GA7	3	GA7A, GA7B, GA7C (GA7C was pilot class, not included in final survey)	79	31	Básica	Santa Cruz	Port
GA8	1	GA8A	12	9	Básica y Colegio	Santa Cruz	Highland
GB1	1	GB1A	27	23	Básica y Colegio	San Cristóbal	Port
GB2	1	GB2A	7	5	Básica	San Cristóbal	Highland
GB3	3	GB3A, GB3B, GB3C	57	51	Básica	San Cristóbal	Port
GB4	2	GB4A, GB4B	40	38	Básica y Colegio	San Cristóbal	Port
		Totals:	440	337			

Note: Schools are distinguished by anonymized codes; table includes Grade 5 student population, levels taught, island, and location information.

Gaining access to participants required engagement with gatekeepers (Seidman, 2019, p. 43), which I planned for through the development and use of parent permission forms. However, as access to parents could only be obtained through the dissemination of these forms through schools, I first worked with 1) school district staff, 2) school directors, and 3) teachers. To appropriately request permission from these gatekeepers, I consulted with local and international contacts, notably Richard Knab and Daniel Proaño. Because this was a study designed and run by a researcher and university external to the Galápagos, it was also essential to ensure that the research design and all data collection methods were approved by the school district and that the head of the district agreed with the premise and purpose of the study.

In preparation for fieldwork, I consulted with individual academics and organization members who each provided valuable reminders and insight into required travel documents, any changes to the visa process, connections to contacts for finding short-term rentals for lodging, and Galápagos news that helped to contextualize the study and allow me to best prepare for data collection. While I brought my own background knowledge and experience of Galápagos to this study, it was essential to prepare to return to a former research site by gathering as much up-to-date information, so that I was an appropriately qualified and knowledgeable researcher to conduct an informed study and minimize misunderstandings or ignorance I had as an outsider.

4.7.1.2 District and Ministry Approval

The next point of permission, past a project visa approval, was the Galápagos school district office. With district approval, I would have the allowance to enter any schools and coordinate with the head teacher and teachers to schedule data collection. Proaño and Knab were both generous with their support and time and made introductions for me to the new head of the district office, the Directora de Educación, who was in turn incredibly supportive and willing to provide the permission.

Any research conducted in schools should not take time away from the primary goals and work that any school staff are involved in, including use of classroom time and resources. Patience and the knowledge that this study, while hopefully useful and beneficial to schools, should not be the top priority for education officials in the islands, was essential. When the Directora was able to share her time for the letter, I provided her with all informational and data collection documents that I had prepared, including a signed letter from my supervisors, a letter of support from Galápagos Conservancy and FUNCAVID, all drafts of the survey, interview, and focus group instruments, drafts of parent permission forms, and child assent forms. With this information she was able to draft and secure an official approval letter for my research with the stamp of the Ecuadorian Ministry of Education. The letter included a list of schools in which I hoped to conduct data collection, so that school directors would be aware that I would be visiting. In addition to providing me with this letter, the Directora contacted the directors of all schools on the list, informing them via email that the study had district and ministry approval.

4.7.1.4 School Participation and Permission

Once district and ministry approval were given and communicated to all school directors, I relied on the continued support from Proaño to contact school directors to schedule initial visits and arrange the survey pilot. This involved Proaño sending each director a WhatsApp message, letting them know that he was supporting the study that they had been informed about via the district office's email and attached letter, and that I would also be in touch with them to arrange visits. Proaño then passed on directors' contact information, with their consent, to me. As WhatsApp is the most common messaging channel in Galápagos, I communicated with directors on the app. I introduced myself, explaining what my data collection would entail and again attached the approval letter from the district to ensure that they knew that it was the study they had been emailed about. Overall, directors were very responsive and generous with their time. It was important to meet with each director of each school in person to establish rapport, ensure that they were fully aware of who I was as a researcher and what I would be doing in their classrooms, and to ensure that I could respect their time and the time of their teachers and children by letting the directors guide the schedule for data collection.

During these initial visits, I spent anywhere from five to 20 minutes talking with directors about my research, my PhD program, their observations of environmental learning for children or their thoughts on the importance of conservation or environmental knowledge as residents of Galápagos. Ethically, it was key to involve directors and other Galápagos education stakeholders as much as possible to inform the real-time development of my data collection, and to inform the broader scope of my research and its potential for usability and impact. During these meetings, I was also able to give directors the correct number of parent permission forms and talk with them about permission form protocol. Working with the directors, we determined that children and parents should be given at least two full school days to read, sign, and return the forms before the scheduled data collection with each class.

Parent permission forms were opt-out forms, meaning that parents were not required to return them unless they did not want their child to participate. This method was recommended to me during the 2014 fieldwork in Galápagos and proved to be the most efficient as it did not require parents to spend time sending back paperwork if they wanted their child to participate. This explanation was discussed with school directors during initial meetings and relayed to teachers by the director. In most schools, the above process was smooth, and most parents did not return forms, which signalled their consent for their child to participate in data collection. While the opt out style of form was approved as part of the CUREC for this study, and while it was understood by school directors, it may cause more confusion for teachers, parents, and children if it is not the typical type of parent permission form used by schools for other activities.

Overall, classes typically had 2-5 children whose parents opted them out of participation, and some classes had zero opt outs. If there were parent opt outs, it was important to explain to children that they hadn't done anything wrong and assure them that not participating wouldn't impact their grade. Some children whose parents did not consent were visibly disappointed that they couldn't join their classmates in doing the survey and other activities. Some of these children raised their hands when volunteering for the interview and focus group, but the teacher and I had to remind them that they couldn't participate. Mitigating children feeling that they were being purposefully excluded was important as them feeling this way could have negative impacts on their interactions with classmates from lacking a shared experience or feeling that they were not a valued member of the class.

4.7.2 Data Collection

4.7.2.1 Overview and Schedule

Data collection began on November 1st, 2022. All school visits were scheduled predominantly on WhatsApp as described previously. WhatsApp was also essential for coordinating with directors on the second island because I lived on the first island during fieldwork and only visited the second island for a tightly scheduled data collection trip. This trip allowed for four school days of data collection to accommodate four schools.

I have broken down data collection activities into five categories, explained in the "Schedule Key" (Table 3) below: initial meetings with directors, the one-time survey pilot, administration of the survey, conducting the interview, and conducting the focus group. Because of busy school schedules the initial meetings with directors and the subsequent classroom visits for data collection were staggered. All activities are detailed in Table 4 below.

Table 3

Schedule key: types of data collection activities

Schedule Key	
(yellow)	Meet with Director
(red)	Survey Pilot
(green)	Survey

	Interview
	Focus Groups
GA1A	*Class* code. GA = Santa Cruz schools; GB = San Cristobal schools

Table 4

Schedule of data collection activities per school and class

DATE	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GB1	GB2	GB3	GB4
Oct 27												
Oct 28							GA7C					
Nov 1	GA1A											
Nov 2		GA2A	GA3A									
		GA2A	GA3A									
Nov 7	GA1B					GA6A, B,C						
	GA1B											
Nov 8							GA7A, B					
Nov 9	GA1A											

	GA1A, B											
Nov 11		GA2A	GA3A				GA7A, B					
							GA7A, B					
Nov 14					GA5A							
Nov 15					GA5A							
					GA5A							
Nov 16						GA6A, B,C						
						GA6A, B,C						
Nov 18				GA4A								
				GA4B								
				GA4C								
Nov 23								GA7A				
								GA7A				
								GA7A				
Nov 28												

Nov 29										GB2A		GB4A
										GB2A		GB4A
										GB2A		GB4A
Nov 30											GB3A, B,C	
Dec 1									GB1A		GB3A, B,C	GB4B
									GB1A		GB3A, B,C	GB4B
									GB1A			GB4B

Note: Class codes are included to note activities carried out with individual classes within a school

Based on observations of timings during the pilot, I determined that I would need two sessions with each classroom of 5th graders: one session to administer the survey and one to conduct the interview and focus group. Most class periods in Galápagos schools are 40 minutes long, so directors scheduled the two visits based on the start times of two class periods. Depending on what activities were going on in the school and the class periods that I would be joining for data collection, these two sessions per classroom were rarely consecutive.

It was important to defer to teachers and directors for how to balance the priorities of the school staff who, rightly so, dictated when it was appropriate to continue data collection and when it was appropriate to reschedule for later times or days. For example, when first scheduling data collection visits, noted that it was important to not schedule these visits during English class time, as English classes are highly valued and less frequent and thus should not be used for alternate activities. Additionally, when coordinating directly with a teacher at one highland school, we rescheduled three times as things came up for the school that were essential to prioritize, such as a school evaluation visit, a week of presentations and exams, and a backlog of class projects after a holiday.

Another challenge that arose in the field was the frequent need to make copies of surveys and forms. Based on previous research I had done in the islands, I planned to only bring with me a small number of the parent consent forms and the survey and assent forms for the pilot class. All other printed materials had to be sourced locally on the islands. Sourcing was not an issue as there are many print shops around the port towns on both islands, but it did require me to ask directors for the numbers of children during initial visits to print correct numbers of forms and surveys.

As a thank you to these directors for facilitating data collection I gave each of them a thank you card during the final school visit and ensured that we had each other's contact information.

4.7.2.2 Survey Data Collection

The survey visit was my first contact with each class, which meant it was also when I introduced myself to children and they first got to know me as a researcher. Visually, it seemed that most children were excited to have someone who wasn't a teacher or school staff member in their class. Upon arriving in a classroom, I spoke with the teacher first, introducing myself to them and letting them talk with their class and do what they needed to do before they handed it over to me. I then introduced myself to children, explaining that we were going to do a survey ("una encuesta") and that it wasn't a test, or for a grade, and that it was only about what they know about Galápagos.

Initially, directors and I had scheduled the survey to take an entire class period, which ranged from 40-50 minutes depending on the school. This assumption was based on the length of time the pilot survey had taken. While this sometimes was accurate, the amount of time differed per class. Sometimes teachers would be actively involved in classroom management during the survey and offer to help answer questions with me. Other times, teachers would leave the classroom.

One challenge associated with time was explaining the assent forms to children to help them understand what they were and how to complete them. Based on child reactions in nearly every class, I do not believe similar types of forms, asking children directly for their assent to participate, as opposed to parental consent, are common in school settings. To facilitate a smooth assent form process for children, I made sure to hold up and explain what it was and what to do with it in front of the whole class so that everyone could hear me. Often, teachers would do the same.

Another challenge with conducting a survey as a solo researcher was managing the many small instances of predominantly benign help that children wanted to provide to their friends. Perhaps because I had emphasized that the survey was not a test, children may have believed that they didn't need to worry about copying each other, and that helping friends was okay. This required kind reminders to children that we couldn't help them with the answers, but that it was okay if they didn't know the answer and to just leave it blank. This also required me to remind teachers of the same thing so that they didn't unintentionally invalidate child data. In one class, the teacher let me know before handing out surveys that one of the children at the front of the class struggled with literacy, specifically reading, and that I may need to help him with his survey. I wanted this child to feel included as he was eager to take the survey, but I couldn't sit with him throughout the class as I had to answer other children' questions. We worked out a system in which I would quietly read a question to him, and he would immediately have a detailed verbal answer that I encouraged him to write down and while he wrote his answer, I would move to other children to answer questions and then float back. In this instance, I realized that one of the major drawbacks of a child-conducted written survey is a reliance on fluency in reading and writing skills versus verbal. Thankfully, this child was able to participate and completed the survey with extensive written answers, but I realized that perhaps participating in a focus group or interview would have allowed him more freedom and time to provide additional anecdotes and thoughts.

In one of the final survey classes on the first island, and one of the smaller classes in general, the teacher informed me that three children at the back of the class, all sat at a table together, were working on their reading and writing proficiency. This posed a significant ethical issue, as I did not want to create a damaging experience for these three children by excluding them but also knew that their surveys may not produce valid data as I couldn't be sure that they understood the questions. I chose to sit with these three children during the entire survey and quietly read aloud questions to all three at once and then help all three write down their answers. This meant that their data was invalid as I was influencing their answers, how much they wrote, and necessarily, each of the three would verbalize their answer which the other two would hear often copy. Because of this, I wrote down the codes of these three surveys and did not include them in data entry, but felt it was important to allow children to be included in doing the survey to ensure that children felt heard and not excluded. This choice may have lowered the quality of data collected from the other children in class, because I wasn't able to move around the class to answer their questions.

4.7.2.3 Interview Data Collection

I chose to do interviews and focus groups post-surveys because it allowed me to make note of questions that could be explored more in a qualitative and verbal setting or to formulate new questions for interviews and focus groups that built off observations during surveys. Additionally, because interviews and focus groups are more direct contact methods for data collection it was helpful to have already met and worked with children during surveys prior to returning for interview and focus group days. This familiarity seemed to help children feel comfortable volunteering for and participating in these final two data collection methods. I conducted visits for interviews and focus groups much like the survey days, first saying hello to the teacher and checking to be sure the time we had scheduled still worked for them and the class. I then reminded children that we would be doing an interview and focus group that day and how many volunteers could participate in each.

Because I wanted to have an unbiased selection of children both for interviews and focus groups, it was essential that participants for these two methods to be randomly chosen. To do this, I brought small blank pieces of paper into each class on which children could write their name if they wanted to volunteer. I would then collect all pieces of paper, shuffle them on a table or in a box or bucket provided by the teacher, and blindly select the interview child, return their name to the pile, then blindly select eight child names for the focus group. Often, teachers would offer ideas for faster or easier ways of picking a child to interview or for focus groups such as calling off a name from the register sheet, or the teacher suggesting the name of a child they thought would be particularly gregarious and well-suited to be interviewed. In these instances, I thanked teachers for their willingness to help but explained that I had to keep participant selection procedure consistent from class to class so had to do it as described above.

Like the survey, these data collection methods were entirely optional to children, and I made sure to stress at the beginning of the class that children did not need to participate but that if they wanted to, they could write their name on the piece of paper. Once I chose the pieces of paper and announced the names, I also did a final verbal check with the selected children to ask again if they wanted to participate. It was encouraging how many children were excited (verbally, physically running to the front of the class etc.) to participate in these methods. When I first announced that we'd be doing an interview and focus group, many children in each class would shout "me!" in English or Spanish, and when a name was selected, there was often an audible lament from other children in class.

Once a child was selected for the interview and they confirmed that they wanted to do it, I let the teacher know how long we'd be gone and where we'd be walking through the school generally, so that another adult knew where the child would be. I then gave the child the mic and recorder and explained that their voice would be recorded and that they could hold on to the mic while we walked. This seemed particularly exciting to many children who sometimes joked around with the mic before we started the interview.

I planned for interviews to take approximately 10 minutes, to allow enough time for children to answer questions and for us to explore additional topics, but also so that children weren't asked to spend more time than may be comfortable talking 1-1 with someone while being recorded. This time varied per child, depending on how vocal a child was that day and if additional questions were explored. Most of the 18 interviews were slightly shorter than 10 minutes, with an average of 07:58.

It was very important, as part of child safeguarding, to ensure that children felt comfortable during the interview. To do this, I that we could walk around the outdoor areas of the school and allowed them to lead the way unless they didn't have a preference in which case I would point to the garden or another outdoor space and ask if they wanted to walk around there. Additionally, it involved me starting the conversation casually, asking them questions like the first survey questions which were straightforward, and which could be answered with yes or no as children got used to the interview process. Examples of variations in how talkative children were include one child who was very comfortable talking during the interview who joked that his favourite Galápagos animal was the megalodon, laughing and noting that it was a "chiste" (*"joke"*). Similarly, some children felt very passionately about protecting animals in Galápagos or cleaning up trash and used the interview questions as a springboard for telling longer stories about their local environmental experiences.

Another variation in interviews was the path and environmental setting. This produced different discourses because in some schools there was very little vegetation and sometimes no native or endemic Galápagos vegetation to ask children about or for children to incorporate in their responses, while in other schools' vegetation and Galápagos plant species were plentiful. In each interview, though, children always found a way to incorporate some aspect of the space into their answers or anecdotes. For example, one child, walking around the school garden area which was surrounded by lava rock and few trees noted that they didn't have many native Galápagos species around the school grounds - exemplifying her LEK through awareness of species absence.

4.7.2.4 Focus Group Data Collection

Focus groups, like interviews, were conducted after the survey to include potential expanded question topics from surveys. Much of the preparation and selection process for focus group participants was included in the subsection above on interviews, as the processes were done jointly and were the same for both. As a final note on selection process, the eight child names that I randomly selected from the small pieces of paper from volunteering children were selected from the entire possible group. Meaning, once the interviewee was selected randomly, the interviewee's name was returned to the bag, bucket, or table, and reshuffled into the remaining papers. There was one instance in which a teacher noted that one of the randomly selected children for a focus group had challenges with literacy and learning and asked if I wanted to remove that child and sub in another. I thanked her for the information, as it allowed me to know how better to engage with the child but confirmed that the child was still welcome to be a part of the group as there was no required level or ability of engagement to be a contributing member. The choice to not bar children from participating was a safeguarding measure to ensure that data collection did not create an exclusionary environment for any child which could negatively impact that child.

Strategy for where focus groups were conducted evolved throughout fieldwork based on challenges with audio recording, behaviour management, and interaction with other children in the school. For example, during the first focus group, children and I walked to a central outdoor area of the school. However, this area was difficult to sit in for eight children and myself, and so we moved to a space near a tree. We faced additional challenges as other classes were out to recess during this time so there was considerable background noise. For subsequent focus groups, I worked with children to find locations that were not too close to designated recess zones like the cancha (outdoor covered gym for sports).

One distinction between planning for focus groups versus interviews was setting expectations for the length of time for the activity. I presumed that focus groups would take slightly longer to conduct than interviews as I would be facilitating discussion between eight children, instead of one, for a similar number of guiding questions and potential expansion on survey topics. This led me to assume an average of 15 minutes for each focus group, which is what I communicated to directors and teachers. This length varied per focus group depending on how vocal children were, how many children wanted to contribute thoughts or stories to each question asked, and how many tangential comments were made, however, the average focus groups was 15:01.

Because children were selected randomly, as they were for interviews, there was variation in child personalities, comfort in speaking in a group setting, and even volume of voices. I observed and actively monitored each of these variations to guide the focus group discussion in a way that would allow all children to feel comfortable speaking or engaging (by head nods or other visual confirmations of engagement) at some point during the discussion. Occasionally, this meant physically shifting the mic from where I placed it on the ground in the centre of the circle closer to children who spoke more quietly to pick up what they were saying. However, I did not want to actively silence louder or more frequent voices, and did not want to impose discussion structure, such as requiring children to raise their hands and speak one at a time, as this could mute or change the content said. For the question “what are your favourite Galápagos animals” I frequently observed many or all the children in the circle physically bouncing with excitement, raising their hands, and verbally exclaiming their excitement to share or starting to list off their favourite animals at once. Allowing this natural reaction from children was both helpful for encouraging voluntary engagement throughout the discussion, but also became a point of analysis to note which topics children were collectively excited about.

There were a few instances in which quieter children, because of the immediate reaction from other children, physically pulled back and seemed like they did not want to engage. Once the initial reaction from other children subsided, I would ask quieter children if they would like to share their thoughts on the question, offering them a calmer space in which to engage. Sometimes children did engage once this space was offered, and other times, children shook their heads and said they didn't have anything to say. Participation by verbal engagement was not demanded of each child, as part of the safeguarding strategy and to not force production of data. As will be further highlighted in findings chapters, children in each class seemed to be overwhelmingly excited to talk about their learning about and knowledge of the Galápagos environment.

4.8 Data Analysis

4.8.1 Transcription

As mentioned at the beginning of this section, all methods of data collection were conducted in Spanish which is the local language. The resulting data from fieldwork, then, included survey data in Spanish and audio files of both interviews and focus groups in Spanish. For the audio files, the first phase of data preparation was transcription into written documents. Because I had collected the data, and thus conducted the interviews and transcripts and had the memory of each of them, and because I have previously transcribed other Spanish audio files, I manually transcribed each audio file. I used verbatim transcription to preserve and listen to children's voices closely, without imposing any adultism on audio files. This approach is supported by multilingual research teams such as Smith et al. (2008).

To complete the transcriptions, I used a transcription pedal, along with the accompanying transcription software, DSS Player Version 7 Plus. I began by transcribing the interview files one by one, working chronologically. During transcription, if there were any terms or phrases that I could not decipher, I made note of the time stamp in the transcription document and moved on. Once all interviews were transcribed, I then returned to the first file and conducted a second-round of listening and corrections. Oftentimes, I found that, having had a break from listening to an audio file, it was then easier to understand children' responses, approaching it with "fresh ears".

Because all the interviews took place outside, there were often moments of audio disruption or lack of clarity due to wind or other ambient sounds. Additionally, because the interviews were conducted while walking, placement of the mic sometimes resulted in quieter or muffled audio. Because every child was different, some less vocal, some more so, some with unique ways of phrasing or speed of talking, it was sometimes challenging to determine what children said.

Even after the second round of listening and correcting transcriptions, there were some files with time stamped question marks on words or phrases. I am not a native Spanish speaker, and thus to achieve a further level of completeness, I decided to ask a native speaker to conduct checks. Alejandra Mejia was given access to anonymized audio files and transcriptions, and she listened through each audio file while following along in the transcription. Through this process, she resolved all time stamped question marks and added her corrections or additions within the transcription documents. To preserve more data within transcriptions, I also added notes distinct from the verbatim transcript, noting if a child paused, sounded unsure, if many children answered at once, if there was noticeable emotion etc.

During the process of transcription, I began initial data analysis by keeping a running document of notes, observations, and potential findings based on what I was listening to. This was an essential step in data analysis as final written transcriptions were exact replicas of speech and did not include sentiment or emotive notes. I also logged the frequency of topics that I noticed while listening to all interviews, which then helped me to form an initial plan for possible codes when conducting qualitative analysis.

For focus group audio files, I transcribed one audio file at a time to completion, starting with the chronologically first focus group. Because focus groups were conducted with eight children, and because I wanted to allow children to talk freely and create their own discussions after I asked questions, they frequently resulted in many overlapping voices answering questions at once. These multi-voice moments were of interest through data analysis as it often showed that children had knowledge to readily share, or showed excitement and eagerness to answer, but it also meant that transcription of these moments were more challenging than the single-child voice in interviews. For some overlapping voices, when children were saying filler words or non-content words, I noted in the transcription that many children (a number if I could determine this) were talking at once and transcribe the content words that I was hearing. Predominantly, child voices were unrecognizable through the audio files and thus I focused on distinguishing between real-time differences in voices.

4.8.2 Translation

Because the final thesis is in English, all data cited in this final thesis were translated into English. Because all instruments were originally designed in English, the first point of translation, from the target language (English) to the source language (Spanish) occurred prior to data collection. This process was detailed in Instrument Design. According to Santos et al. (2015) there are five points at which translation could occur: prior to data collection, at data collection, during data preparation, during data analysis, or at dissemination of findings. Based on my previous research which involved translating data at the point of final write up, and because of a concern for losing meaning and not preserving participant voices, as is reflected by multilingual research teams such as Smith et al. (2008), the verbatim transcripts were kept in Spanish and not translated at the point of analysis. This is also supported by the proposal of Temple et al. (2006) that translating qualitative data prior to analysis transforms data into secondary data, thus obfuscating participant voices through linguistic reconstruction of their voice. Like Smith et al.'s (2008) approach, I produced the resulting thematic analysis codes and themes using a mixture of Spanish (local language) and English, with the final results reported in English. Translation of direct quotes from children occurred at the point of writing and editing this final thesis document, thus preserving children's direct voices until the actual point of research communication.

4.8.3 Qualitative Analysis

Analysis of all data began during collection, while taking field notes as they were immediate reflections on collected data. These detailed observations were also kept on hand as I began to look over the completed transcripts of interviews. Additionally, prior to conducting coding of transcriptions, I took additional notes on patterns observed, interesting ideas that I thought of, and even notable quotes that were impactful and effective in communicating findings from individual children, while transcribing audio files. In this way, the entire process of analysis spanned the life of the data, from production through to write up, and is ongoing every time I engage with a data source. Each of these instances of interacting with the data allow me to see that data in a new way and develop more nuanced ways of thinking about or interpreting it.

Analysis continued by looking at the quantitative data from specific survey questions and the qualitative data in interview transcripts. This choice was made as it allowed me to answer a selected research question in full, pulling from multiple data sources. As Cohen et al. reminds, qualitative data must be interpreted, and, as the interpreter (the researcher conducting analysis), I must be aware of how and why I am interpreting data in certain ways. I believe that allowing interpretation and analysis to evolve and layer over time is both a joy of social science research and a responsible way to approach any data source so that the "many possible analyses and interpretations" (Cohen et al., 2017, p. 644) are included in findings, mitigating the bias that a single processing of a data source could produce.

This process aligns with the instructional guide for qualitative data thematic analysis outlined by Braun and Clarke (2012). This method of analysis emphasizes that meaning is developed and cultivated across all data. Braun and Clarke (2012) summarize thematic analysis as:

> TA is a method for systematically identifying, organising, and offering insight into, patterns of meaning (themes) across a dataset. Through focusing on meaning across a dataset, TA allows the researcher to see and make sense of collective or shared meanings and experiences. (p. 2)

The six phases of thematic analysis that Braun and Clarke (2012) are described below.

Phase one involved immersing myself in the data to become intimately familiar with it as a set and as individual sources, making me best positioned to then conduct effective and appropriate analysis. My approach to analysing the qualitative data was to listen through audio files and read through transcripts to re-familiarize myself with the content of each child's narrative, until I felt comfortable moving between data sources and remembering which child talked about which topic, signalling that I was immersed and ready to move into coding. I made informal notes on possible codes and themes I envisioned coming out of more formal NVivo-based analysis. This list included a priori codes (such as Environmental Learning, LEK, etc), which is a common approach per Cohen et al. (2017).

Phase two was developing initial codes. Braun and Clarke (2012) describe these initial codes as the bricks of your analysis house. It was important to approach the data with the goal of discovering what the data stated vs searching for ideas that I expected to be. I conducted analysis on all interview transcripts first, before moving into analysis of focus group transcripts. I conducted line-by-line coding of one transcript at a time, thus creating codes that were directly responsive to the data. To be consistent in how I thought through real-time emergent codes and to mitigate any mid-transcript differences, I finished coding each transcript in one go and completed initial coding of all transcripts in a week. Braun and Clarke (2012) consider this phase complete when you have "enough codes to capture both the diversity, and the patterns, within the data, and codes should appear across more than one data item," (p. 7). Of the initial codes, most were applied only once, which, as Braun and Clarke (2012) note, requires further condensation, via deletion of inapplicable codes, or combination of similar codes, so that codes represent multiple data items and references. To do this it was necessary to sort codes into smaller groups so that I could visually grasp the codes and find ones that could be combined or deleted effectively. I sorted codes into buckets of similarities. I then condensed codes further within each of the buckets by sifting through codes to find similarities and ways of combining single codes into more interpretive or broader topics.

Phase three involved developing themes from those codes, effectively synthesizing initial observations or responses. This phase is entitled "searching" because developing themes from codes must be an active process. I used the buckets that I created for code sorting as the structure for developing my themes. Initial names for these buckets were summative simply to help me do data cleaning through condensation of codes, but I then further developed those names to reflect major themes that captured parts of research question answers. While not all these major themes answer the research questions for this study, they still capture findings that could be explored in future reports. Within themes that directly answered research questions, I began searching for subthemes, further filtering codes into thematic groups that would inform the structure of each findings chapter.

I then shifted into phase 4: reviewing potential themes. As Braun and Clarke (2012) note, the researcher engages in a quality check of their work. It is important to ensure that themes accurately reflect the actual data content, and if they do not, then modifying the theme to better fit the data, reassigning different codes to the theme, or eliminating the theme altogether is necessary. I especially spent time reviewing the subthemes within each of the main themes, ensuring that the data coded to them was captured effectively or if codes needed to be shifted under different subthemes.

Braun and Clarke note that final versions of themes will have distinct and carefully chosen names and clear, concise definitions that capture the breadth and depth of each specific theme. The researcher should be able to state what is “unique and specific about each theme” and ensure that each theme has “clear focus, scope, and purpose” (p. 9). This fifth phase also included determining which of the main themes would be used for writing the findings of this work. Once I made that selection, I developed more appropriate names for each major theme and subtheme and wrote definitions for each. These themes and subthemes are explored in the findings chapters as the completion of the final phase 6: writing the report.

4.8.3.1 Analysis of text-answer survey questions

In addition to interview and focus group transcripts, there were qualitative data within the survey instrument, pulling from short answer questions. For these questions, I used a modified qualitative analysis described below. For example, for survey question 16, “what would happen if the Opuntia cactus disappeared from the islands?”, children could write in answers. Analysis of the answers was not to generate themes, as above, but to reflect and assess answers to determine levels and types of accuracy. To do this, I developed nine codes which I then applied to the answers, listed in Table 5 below. All codes are described following the table.

Table 5

Codes for answers to survey question 16

Code description	Rate of responses

1. Correct identification of direct ecological repercussions	98 children
2. Correct observation of indirect ecological repercussions	14 children
3. Partially correct observation of ecological repercussions	39 children
4. Technically correct interpretation of question	19 children
5. Observation about emotional or human response	9 children
6. Observation about economy or tourism	7 children
7. 'Don't know'	121 children
8. Incorrect answer	30 children

Note: Number of students who answered each way out of the total 337 children surveyed

The first code, *Correct identification of direct ecological repercussions*, applies to any answer that identified the direct impacts that the removal of one species would have on other species, for example, students would note something like "the tortoises wouldn't have any food" or "the land iguana wouldn't have food" or "there would be a smaller population of cactus finches" or "animals would be left without food." In the case of the last answer example, the student identified the correct repercussions, but did not identify the names of local species that would be impacted. For all answers given, I determined if the application of a secondary code, "Local Ecological Knowledge" could be applied. For answers like "animals would be left without food" which did not explicitly include LEK and instead only included Ecological Knowledge which could be generalized, I did not apply this secondary code. I don't believe that the lack of inclusion of Galápagos species names accurately reflects a lack of LEK, as many of the respondents did very well on the species identification section of the survey, but it is interesting to see whether students felt the need to explain using local species vs general language.

The second code, *Correct observation of indirect ecological repercussions*, covers answers that may capture other accurate processes or events that might occur if a species disappears, but which are all indirect and not related to the food web angle of the question. For example, some students noted that if the Opuntia disappeared, "the water would be dirty" which references their learning about how cactus pads can serve as natural filtration for water. Other students noted that if the cactus disappeared, that "we would be losing our biodiversity," or that if Opuntia cacti were gone, then "the only cactus that would remain would be the candelabra cacti" referencing one of the other local cactus species on their island.

The third code, *partially correct observation of ecological repercussions*, covers answers that partially capture the correct direct ecological repercussions, but which may represent an incomplete understanding of the whole picture. For example, a student answered, "the animals wouldn't be able to eat" - which captures the correct assumption that there would be a lack of food for animals in the Galápagos food web but fails to clarify that this would only directly impact the animals that eat the cactus (not all animals in Galápagos would be directly impacted). Or a student noted that "there wouldn't be homes for the finches and iguanas" which isn't entirely false, but also isn't entirely true, as without Opuntia, there indeed would not be homes for cactus finches (other finches who nest elsewhere would not be directly impacted), and they know something would happen to land iguanas, but they mistakenly lump that impact in with homes, whereas land iguanas would be impacted because they would lose their food source. Still another noted that "finches wouldn't have food" which is partially correct, but not all species of finches eat the "tuna" or cactus fruits. These types of answers are exciting to see because children are constructing and recalling knowledge real time and while they may not do so with 100% accuracy, it is important to see the development of this knowledge.

The fourth code, *technically correct interpretation of question*, covers answers that re-explain the question using different words, thus providing something that is technically accurate, but which doesn't recognize what the question was asking. For example, many children noted that if the cactus disappeared, then "there would not be cactus in Galápagos," "we would not have any cactus," or "that species of cactus wouldn't exist." This is true, and perhaps reflects a potential misstep in the wording of the question, if children thought I was asking them what the event would be (i.e., what is another word for disappearing). A reflection here might be that I should have asked the question as: "What would happen if the Opuntia cactus went extinct?" This could be supported by the fact that some children displayed general ecological knowledge by correctly using the concept of extinction in their answer here, noting that if the Opuntia disappeared, "their species would go extinct." Knowing that children already understood the concept of extinction would have possibly changed the way that I worded the actual question which may have then correctly led children towards the food web answers.

The fifth code, *Observation about emotional or human response*, encompasses a group of answers from a handful of children that explained how they would feel or the emotive or value-based outcome of the Opuntia disappearing from the islands. Five children noted that they would be either sad or worried if the cacti disappeared, such as this child who said, "I would be very sad to see a plant go extinct." Other children noted that Galápagos "wouldn't be a beautiful place" if the cactus disappeared, or that "it would be the worst because it is native to Galápagos." While most of these responses, aside from the one that includes knowledge that the Opuntia is native to Galápagos, do not exhibit LEK, it is interesting to note that they do contain insight into children's Environmental Attitudes which may also influence Pro-Environmental Behaviours.

4.8.4 Quantitative Analysis

Many survey questions were short answer, which I have included in qualitative data analysis, but questions that relied on multiple choice answers and the ecological knowledge species identification questions, which asked children to simply write the name of the species below a photo of that species, were all treated as quantitative. There were three main types of multiple-choice questions: those about LEK which contain one correct answer and three incorrect answers, those that use a scale (i.e., asking about how important learning about their environment is to them), and those determining rank of possible answers (i.e., asking about which environmental learning sources children use most).

The first step in data analysis for the survey was conducting data cleaning. All survey data was entered into the tool KoboToolbox, designed for researchers to build out their survey instruments within the platform for streamlined data entry. The platform also included fail-safes that I created for each question so that when I conducted data entry, the online survey version would catch any miss-entry or missed questions. This helped to mitigate the risk of unusable data due to data entry errors. During the data cleaning process, I read through survey questions and responses repeatedly, giving me ample time to reflect and think through ideas for directions for analysis. I kept a running notes document open while conducting data cleaning to capture these ideas. This included noticing possible relationships between question responses in addition to noting overall trends especially when reviewing the species name questions.

The data collected were both descriptive and correlational, meaning respectively that results help to "create a snapshot of the current state of affairs" and to "assess the relationships between and among two or more variables" (Stangor & Walinga, 2019, para. 1). Multiple choice questions on the survey that explicitly asked children if and how much they engaged with certain potential providers and sources of environmental learning were particularly of interest at this stage to describe the "state of affairs" prior to delving into more nuanced qualitative findings. For these questions, I aggregated responses and measured proportions of child perceptions graphically.

I made the decision to disqualify all data from questions 22-25 of the survey. During survey administration, these questions garnered considerable confusion from children and despite explanations given verbally, the structure of the questions themselves, with the scalar answers, often led to children saying they didn't understand and thus wouldn't respond to them or quickly circling the same answer for each of the four questions. Because of the high rate of unreliable data for these questions, they were omitted from data analysis.

4.8.4.1 Analysis of Questions 18 and 20

For survey questions 18 and 20 and their respective sub-questions which asked children to identify, by naming, a selection of iconic photos of Galápagos native or endemic animal and plant species, I created a coding system to assess and rank answers. This system was: 0 represented a response of no answer (i.e., left blank, which children were told to do if they did not feel that they knew the answer); 1 represented an incorrect name; 2 represented a partially correct name; and 3 represented a correct name. Determination of what was incorrect, partially correct, or correct was based on my own knowledge of Spanish names used for keystone Galápagos plants and animals, verified by referencing names cited by the Charles Darwin Foundation (CDF) Galápagos Species Database (*dataZone*, n.d.) and other non-profit sites.

Spelling and grammar were not determining factors in correctness of naming a species if I could reasonably determine what the child was intending to write. An example of an incorrect name is a child writing in "manzanillo" for the photo of a forest of scalesia trees (different tree species), or a child writing in "marine iguana" for the photo of the yellow land iguana. For some species, multiple correct names were accepted as correct, while other species had one reasonably correct name. The names accepted as correct for both animals and plants are below in Tables 6 and 7. Partially correct names were determined on a species-by-species basis, and for some species, there were no reasonably partially correct options. For example, for the Opuntia cactus, the answer of just cactus was accepted as partially correct because there are multiple distinct native and endemic cactus species on the islands; or for the blue footed booby, the answer of piquero (booby) was accepted as partially correct because there are three species of booby or piquero in Galápagos. Contrastingly, the name hammerhead shark, or tiburón martillo, was accepted as correct, despite there being more than one species globally of hammerhead shark, because there is only one species present in the Galápagos marine reserve, and because the CDF Species Database notes that tiburón martillo is the name for this species in Spanish. In this way, LEK was measured using a relative, or local, scale versus a general or global one.

Table 6

All names accepted as correct for the eight animal species in survey question 18

English	Spanish
Blue footed booby	Piquero patas azules
Sea lion	Lobo marino, León marino
Finch	Pinzón, pinzón de Darwin
Marine iguana	Iguana marina
Hammerhead shark or scalloped hammerhead shark	Tiburón martillo
Giant tortoise	Tortuga, tortuga gigante, tortuga terrestre, galapago/s
Flightless cormorant	Cormorán no volador
Land iguana, yellow land iguana	Iguana terrestre, iguana amarilla, iguana dorada

Table 7

All names accepted as correct for the eight plant species in survey question 20

English	Spanish

Opuntia cactus	Cactus opuntia, tuna
Scalesia	Scalesia/escalesia
Galápagos tomato	Tomatillo, tomate de Galápagos
Mangroves	Mangles, mangle, manglar, manglares
Palo santo tree	Palo santo
Yellow cordia or Muyuyo	Muyuyo, uva, flor de overo
Darwin's cotton	Algodón de Darwin, algodoncillo
Poison apple or manzanillo	Manzanillo, árbol de la muerte

Once this initial phase of analysis was complete, I then began looking across variables to explore children's species knowledge more fully. To test for difference in accuracy rates for all participating children of naming animal species vs plant species, I applied a two-proportion zed test. The null hypothesis was that there was no significant difference between the two rates ($H_0 : p_1 = p_2$) and the alternative hypothesis stated that there was a difference ($H_A : p_1 \neq p_2$). The test produced a z-score of 36.39 ($p = 0$) at a significance level of $\alpha=0.05$. As $p < \alpha$ and with such a large z-score, it was clear that the null hypothesis should be rejected and that there was an extremely significant difference between the two scores, favouring a high rate of correct answers for animals and a significantly lower rate of correct answers for plants.

I also applied a two-proportion zed test to determine if there was a difference between rates of both correct answers for animal species and then for plants between highland and port school children. The null hypothesis was that there was no difference ($H_0 : p_1 = p_2$) and the alternative hypothesis stated that there was a difference ($H_A : p_1 \neq p_2$). The test produced a z-score of 1.295 ($p = 0.197$) at a significance level of α=0.05. As $p > \alpha$ the null hypothesis was accepted that there was no significant difference. However, when I then looked at overall correct answer rates for plant species comparing highland and port school children, the opposite result occurred. Again, the null hypothesis was that there was no difference ($H_0 : p_1 = p_2$) and the alternative hypothesis stated that there was a difference ($H_A : p_1 \neq p_2$). The test produced a z-score of -4.50 ($p = 0$) at a significance level of α=0.05. As $p < \alpha$ the null hypothesis was rejected.

Additionally, I conducted two-proportion zed-tests to determine if any significance existed between highland children and port children in their rates of accurately naming individual plant and animal species. These tests indicated that there was no significant difference between accuracy rates of correct naming between highland and port children for five of the eight plant species: the opuntia cactus, Galápagos tomato, mangroves, muyuyo, and manzanillo. This was determined by again conducting two-proportion zed-tests with the null hypothesis that there was no difference ($H_0 : p_1 = p_2$) and an alternative hypothesis stated that there was a difference ($H_A : p_1 \neq p_2$). Tests for each of these species produced a z-score less than |1.96| ($p > .05$) at a significance level of α=0.05, which led to the null hypothesis being accepted, that there was no difference between accuracy rates.

Three plant species had significant differences in accuracy of naming between highland and port children. The first was the scalesia plant which produced a z-score of -6.63 ($p = 0$) at a significance level of α=0.05. As $p < \alpha$ the null hypothesis was rejected, and with a large negative z-score, it was clear that the highland school children named scalesia correctly at a higher rate than port school children. This is supported by the fact that 43.9% of highland children named scalesia correctly, whereas only 7.8% of port children did the same. For the palo santo tree, the same test produced a z-score of -3.64 ($p = 0$) at a significance level of $\alpha=0.05$. As $p < \alpha$ the null hypothesis was rejected, indicating that highland school children named palo santo correctly at a higher rate (39%) than port school children (15.5%). For Darwin's cotton, or algodoncillo, using the same hypotheses as above, the two-proportion zed-test produced a z-score of 2.25 ($p = 0.02$) at a significance level of $\alpha=0.05$. As $p < \alpha$ the null hypothesis was rejected, indicating that port children named algodoncillo correctly at a higher rate (11.1%) than highland school children (0%).

Two proportion zed-tests were again used for each animal species to determine if there were significant differences in naming accuracy between highland and port children. For seven species, there was no significant difference. This was determined by again conducting a two-proportion zed-test with the null hypothesis that there was no difference ($H0 : p1 = p2$) and an alternative hypothesis stated that there was a difference ($HA : p1 \neq p2$). Tests for each of these species produced a z-score less than $|1.96|$ ($p > .05$) at a significance level of $\alpha=0.05$, which led to the null hypothesis being accepted, that there was no difference between accuracy rates. The single species that did show a significant difference was the marine iguana. With the same hypotheses as above, the two-proportion zed-test produced a z-score of 2.23 ($p = 0.03$) at a significance level of $\alpha=0.05$. As $p < \alpha$ the null hypothesis was rejected, indicating that port children named the marine iguana correctly at a higher rate (86.5%) than highland school children (73.2%).

I also tested whether the trend of lower accuracy when naming plant species persisted within groups of highland children vs port children. Two tests were conducted, again using two-proportion zed-tests with the below results. For highland children, again, the null hypothesis was that there was no difference in rates of correct answers between questions on plants and animals ($H0 : p1 = p2$) and the alternative hypothesis stated that there was a difference ($HA : p1 \neq p2$). The test produced a z-score of 9.47 ($p = 0$) at a significance level of $\alpha=0.05$. As $p < \alpha$ the null hypothesis was rejected, indicating that they got higher rates of correct answers for animals (64.9%) vs plants (28%). The same test, with the same null and alternative hypotheses, was applied within the port school sample. The test produced a z-score of 35.33 ($p = 0$) at a significance level of $\alpha=0.05$. As $p < \alpha$ the null hypothesis was rejected, indicating that the port school children also got significantly higher rates of correct answers for animal species (68.5%) vs plants (17.7%).

4.9 Chapter Conclusion

This chapter discussed all parts of the methodological journey of this study: the theoretical framework and theories used to ground and contextualize the study; my researcher positionality and the ways that I ensured continual awareness of and mitigation of negative impact of that positionality; the methodology (mixed methods) used, and the individual methods of data collection chosen (survey, go-along interviews, focus groups, and fieldnotes); the research design and plan; the creation and testing of data collection instruments; the pilot of the survey; the data collection process including participant recruitment, gatekeepers, and challenges; and data analysis. This considerable detail throughout this chapter was purposeful to uphold research and researcher integrity, transparently discuss the realities and choices made throughout the research process and ensure that the remaining chapters in this thesis are credible and well-grounded.

Preface to the Findings Chapters

Each one of the four data sources in this study (survey, interviews, focus groups, and observational field notes) produced complementary findings to the rest. This difference in resulting data was one of the reasons I chose to conduct a mixed methods study. With four sources for data all providing evidence and answers for pieces of this study's four research questions, I was able to weave a narrative from and about children' stated experiences and knowledge that is more comprehensive than would be possible with a single data collection method. I use direct child quotes and reference emergent trends and patterns from each of the four sources throughout the four subsequent findings chapters.

To refresh readers, each of the findings chapters will address one of the four research questions that guided this study:

1. What is the state of Local Ecological Knowledge of children living in the Galápagos Islands?
2. How do children describe the sources from which they learn about their Galápagos environment?
3. Where do children perceive that they learn about the environment?
4. What content do children describe learning about their Galápagos environment?

While readers at this point have received an overview of the social sphere in Galápagos, before discussing findings for any of the above questions, I believe it is important for readers to be fluent in the geological, climatic, and resulting ecological realities in different geographic zones on the islands. This contextual information will help readers to follow child narratives and understand the findings as I do, especially at it will contextualize and give weight to the actual stories and types of LEK children mention. This information has been included in Appendix H if readers don't yet have this knowledge.

5. Young Experts

5.1 Chapter Introduction

In this findings chapter, I explore the first research question: What is the state of Local Ecological Knowledge of children living in the Galápagos Islands? By state of, I am interested in the complexity, amount, and detail of LEK that students have. Data from all collection methods supports the claim that children in Galápagos have robust LEK and they are readily able to accurately understand questions about this LEK and provide detailed responses, highlighting complex knowledge. The LEK that children have and shared can be categorized into three subsections: 1) knowledge about local species including species names, status, category, behaviour, location, and interactions; 2) knowledge of local climate, geography, and geology; and 3) knowledge of human impact on local ecology. Each of these areas of knowledge will be unpacked in subsections of this chapter.

As discussed previously, ecological knowledge is seen as one of the components of Environmental Literacy, and an outcome of successful Environmental Education. As the NAAEE describes, there are many bodies of knowledge that are included in the development of Environmental Literacy. All four data sources in this study supported the discovery of the breadth and depth of LEK for local Galápagos children, but also illuminated the presence of the related bodies of knowledge that NAAEE recognizes as important building blocks in environmental education work.

5.2 Knowledge of local species

Of the four knowledge areas, knowledge about local species was the most frequently and consistently exhibited by children through all forms of data collection and thus represents the largest volume of held LEK by child participants. The content of this knowledge area can be further detailed as: 1) knowledge of species names; 2) knowledge of species status (endangered, extinct, etc.) or category (introduced, invasive, endemic, or native), and 3) knowledge of species location, diet, behaviour, and interaction. Species names was the most voluminous category of knowledge, though was heavily skewed towards animals, a finding which is consistent in literature with children and adults (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018), although unique to Galápagos, where there are fewer native or endemic mammal species, especially terrestrial mammals (*Biodiversity*, n.d.; *Galápagos Wildlife - Mammals*, n.d.), the skew within animal knowledge did not significantly favour mammals over birds, reptiles, or amphibians, as it does in the literature (Díez et al., 2018; Huxham et al., 2006). This skew persisted in the other two species knowledge sub-areas. Across all three species knowledge sub-areas, positive emotion and passion was frequently noted. The presence and importance of emotion connected to bodies of knowledge, as noted in the literature (Graesser, 2020; Michelson, 1998; Reis & Roth, 2009) will be reiterated in the discussion.

Species names was one of the foremost types of knowledge that I chose to measure LEK, a decision supported by the literature, as some even note that it is an effective proxy for more complex species knowledge (Härtel et al., 2023). Knowledge of species names, however, do not represent a reliably comprehensive measure of an individual's entire LEK. Upon reflection, I raise the question of whether names are the most representative measure for LEK, as an individual can possess LEK that does not include species names but would still be considered substantial. Names, as well, being of single species and not knowledge of ecosystem interactions, change, behaviour, species location, trophic levels etc. may represent rudimentary LEK vs a grasp of more complex and comprehensive LEK. Additionally, some children did exhibit substantial LEK in the form of observational data on species in terms of food sources, behaviour, appearance, location, geography, etc. with a simultaneous lack of species name knowledge.

Names also may be complicated or hard to remember, as one child interviewee from GA5A noted. While walking through their school yard, the child pointed to a tree within the school and said "that's an endemic tree of Galápagos" to which I responded, "which one, that one? What is that?" and the child responded "…its name is really difficult. I don't remember." While not being able to recall the name, the child had already exhibited other LEK, in terms of recognition of a local species and its correct categorization as endemic. This, and other examples, are reasons for using additional data beyond the survey questions that asked children to name local species, to try to understand the scope of a child's LEK from multiple perspectives and through multiple modes of engagement. I caution against studies that rely solely on one measurement or one form of engagement with participants when attempting to measure a complex construct like LEK, as children did share substantial and robust species knowledge beyond species names

5.2.1 Species names

Species names were an expected sub-area of knowledge because of targeted questions in the survey, interviews, and focus groups, asking children if they could identify photos of local species, and asking questions about favourite Galápagos animals, and examples of endemic, native, or introduced local species. But children also shared an abundance of species names conversationally in interviews and focus groups, often accompanied by strong and positive emotions. Children often exhibited pride and excitement when listing and naming Galápagos species, and did so with considerable speed, indicating confidence and frequent use of this knowledge. Recall of this knowledge was predominantly accurate, with low rates of mis-speciation or lack of knowledge of accurate names. Within species names, children displayed higher volume and accuracy of animal names vs plants, which mirrors findings in the literature (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018). Additionally, highland children displayed slightly greater accuracy when naming plants than did port children, mirrored in some literature between rural and urban children (Corraliza et al., 2013).

In this section, I highlight findings about children's knowledge of animal species names, compare their knowledge of animals vs plants, share findings about their knowledge of individual plant names, and finally, note differences in species knowledge between highland school children and port school children. Species names knowledge was collected through the survey, interviews, and focus groups. The level of accuracy in both flora and fauna species names was pointedly explored through survey questions 18 and 20, which asked children to identify species from colour photos of iconic

Galápagos animals and plants. Species knowledge was also supported by the interviews and focus groups.

5.2.1.1 Animal Names

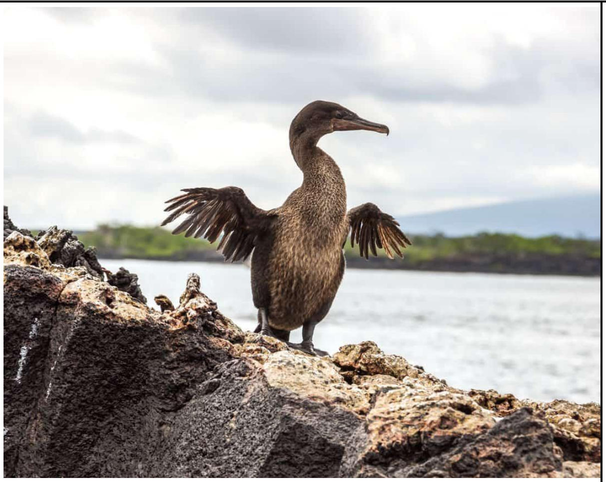
Children displayed high accuracy of animal names, especially for animals that were experientially accessible to them through their frequent wildlife interactions around towns and highlands. Animal name knowledge was pointedly explored in survey question 18 and its eight sub-questions. As discussed in the earlier quantitative analysis section, children's written-in answers to survey questions 18 and 20 (asking them to identify animal and plant species) were coded as correct, partially correct, incorrect, or not answered. As a refresher, the eight animal photos from the survey are included below in Table 8, with names listed.

Table 8

Sub-questions from survey question 18 with listed species names

 18.a Blue footed booby/Piquero de patas azules	

	18.b Sea lion/lobo marino
 18.c Finch/pinzón	 18.d Marine iguana/iguana marina
 18.e Hammerhead shark/Tiburon martillo	 18.f Giant tortoise/Tortuga gigante/tortuga terrestre



18.g Flightless cormorant/cormorán no volador

18.h Land iguana/iguana Terrestre/iguana amarilla

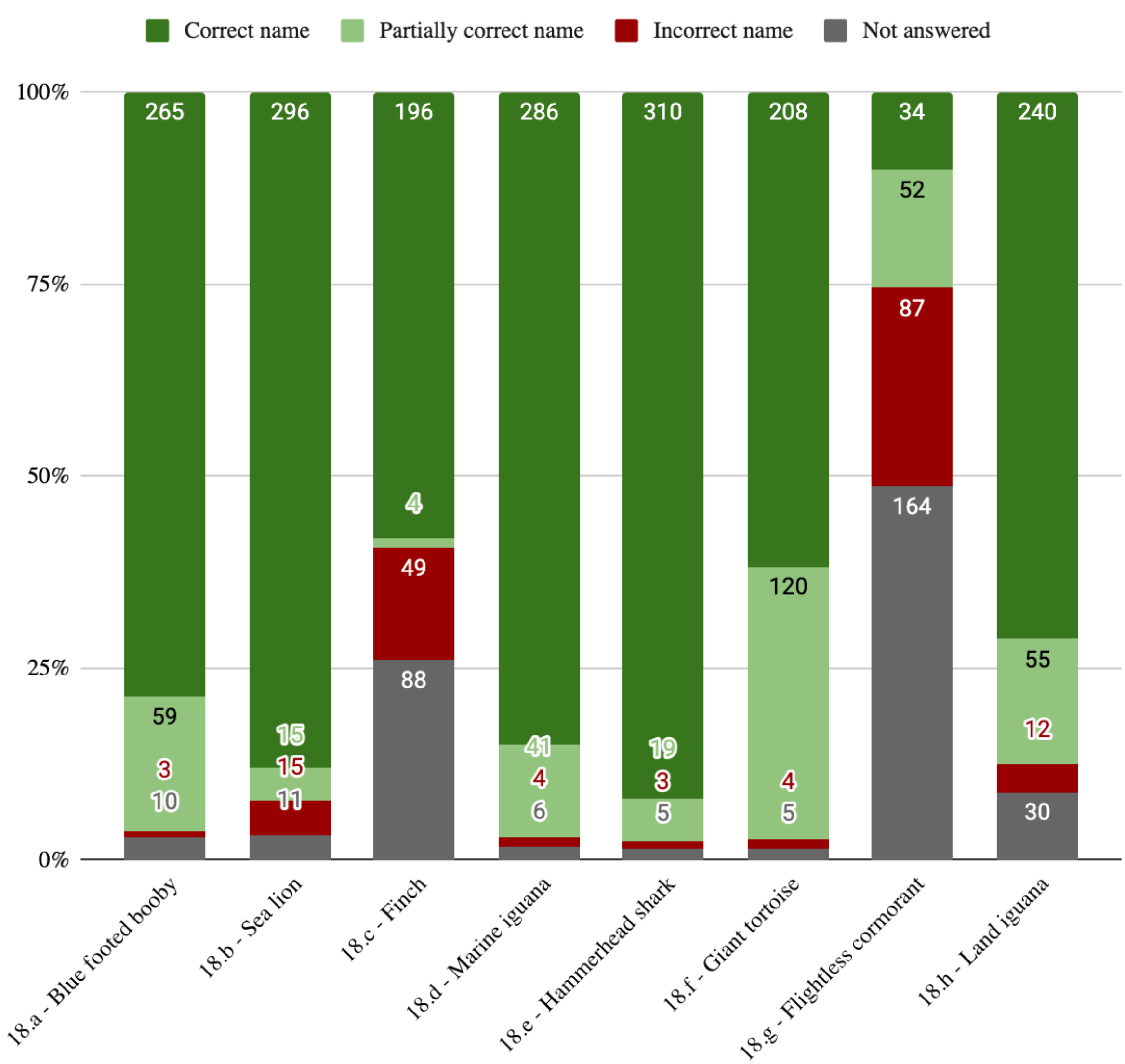
In Figure 3 below there are notable trends in accuracy of results to the above questions. Combining both correct and partially correct responses, the most accurately and frequently known animal species names of the eight chosen, in descending order, were: hammerhead shark, giant tortoise, marine iguana, blue footed booby, sea lion, and land iguana. The finch and flightless cormorant were the least frequently identified species. Some of the reasons for noticing the trends outlined below lie in my knowledge of Spanish and the Galápagos context. For example, the high rate of partially correct answers for giant tortoise can be explained by the fact that when referencing them in Spanish, locals very often will simply call them tortugas, and, while tortuga can also is the name for turtle in Spanish, the context is usually very clear and distinguishing between tortuga marina (sea turtle) and tortuga terrestre/gigante (giant/land tortoise) is unnecessary. In this way, the frequent use of just the name tortuga by children to identify the giant tortoise does not necessarily reflect a lack of knowledge of the full and correct species name. Similarly, the partially correct answers for blue footed booby were most frequently the word piquero, which is the family of species of the boobies in Galápagos (of which there are three, including the blue footed boobies). The small chunk of incorrect answers for the sea lion photo were predominantly due to a common confusion (in both English and Spanish) between the names for sea lion (lobo marino) vs seal (foca) (*Is It a Seal or a Sea Lion?*, 2024). The Galápagos sea lion is significantly more common in general on the islands, and so the animals that children see are most frequently going to be sea lions (*Galápagos Fur Seal*, n.d.), but the frequency of perceived identification of seal vs sea lion indicates a gap in clarifying knowledge of differences between the two pinnipeds.

Additionally, the photo of the finch (one of the over a dozen species on the islands) was not as accurately or frequently identified, despite high populations and frequent interactions with finches by residents. This lack of identification mirrors a lower rate of visual representation by local shops, organizations, murals etc., though there is not data here to determine causes of low identification rates despite high interaction rates. The large number of incorrect answers are predominantly the answer 'ave' or bird, which, while it does capture the genus correctly, it does not name the species, and indeed represents general ecological knowledge versus LEK. Similarly, the partially correct answers for both marine iguana and land iguana were answers of just iguana, which captures the genus but not the species.

The lowest accuracy species was the flightless cormorant, which, while unique as a bird and endemic to the islands, does not live on either of the surveyed islands and is not used in visual representations around towns. The partially correct answers here were 'cormorant,' leaving off the defining feature of 'flightless' (no volador). While this was more accurate than simply putting 'ave' or bird, it still lacked distinguishing LEK. Even combining the correct and partially correct responses for flightless cormorant, it was still the animal species with the lowest identification accuracy, and thus not a species commonly held in children's LEK.

Figure 3

Accuracy rates of survey question 18 – name these Galápagos animals



Note: This pulls from data from survey question 18 which asked children to name Galápagos animal species. Data includes non-responses and thus represents all 337 participants

Overall, children's animal species LEK was substantially accurate, despite trends for specific species inaccuracies, as illustrated in Figure X. This contradicts studies such as the one discussed previously by Genovart et al. (2013) which assessed animal species LEK of children in another island system and biodiversity hotspot, the Balearic Islands, and found that children had poor LEK despite notable conservation needs on the islands and that exotic flagship species were more likely to be known. One similarity with the Genovart et al. (2013) study was the finding that flagship animals in general were more well-known than other animals, which, by this eight-question sample, seems to be accurate, with low rates of LEK around non-flagship species like the flightless cormorant. However, there are other mitigating factors such as infrequency of interaction or sightings of this bird for Galápagos children, and the volume of other, non-flagship local species that children did name through interviews and focus groups could contradict the claim by Genovart et al. (2013).

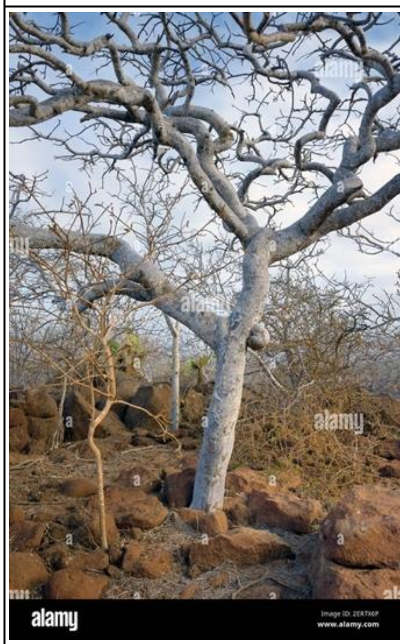
5.2.1.2 Plant Names

Children's LEK of plant names was considerably less abundant than that of animal names, illustrated by the high rates of no answer and incorrect answer for the sub-questions of survey question 20 (results in Figure 4). The infrequent case of accurate identification seemed to correspond to frequency of plant sightings (and thus presence of the plant in areas where children spent most time), flagship species status in visible murals or signage, or to toxicity of the plant. Overall, while LEK around plants wasn't non-existent, as exhibited in the following sections beyond plant names, it was a gap for children, especially compared with animal name knowledge. As a refresher, the plant photos from the survey are included below, with names listed, in Table 9.

Table 9

Sub-questions from survey question 20 with listed species names

 20.a Opuntia cactus/tuna	 20.b Scalesia

 20.c Galápagos tomato/tomatillo	 20.d Mangroves/manglar/mangle
 20.e Palo santo tree	 20.f Muyuyo/yellow cordia/uva/flor de overo

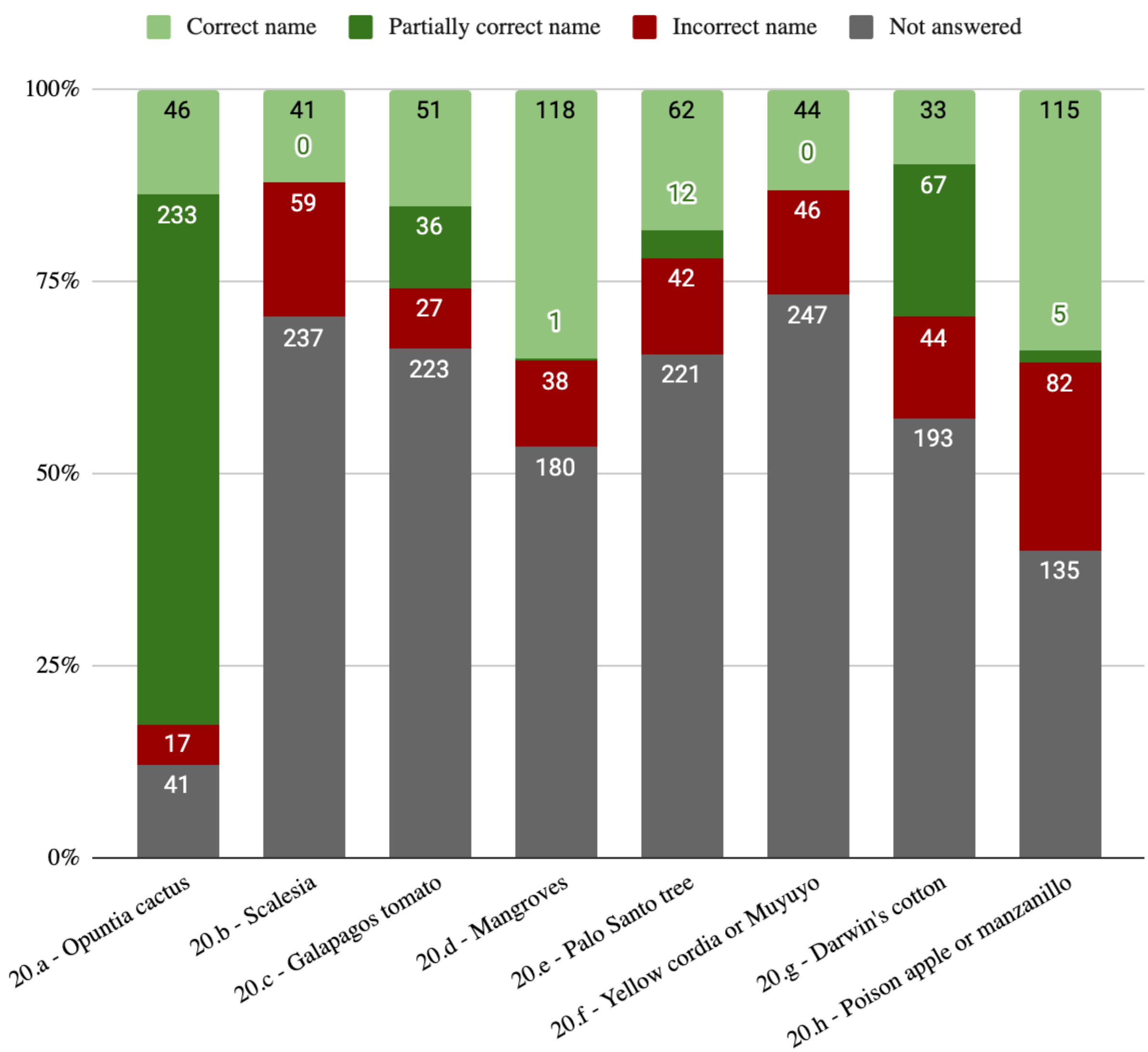
	
20.g Darwin's cotton/algodoncillo	20.h Manzanillo/árbol de la muerte

Per the results in Figure 4 below, survey results show a high frequency of no answer or incorrect answers for seven of the eight plant species photos. The large number of partially correct answers for the opuntia cactus is because the name 'cactus' on its own was accepted as partially correct, mirroring the acceptance of genus as partially correct in animal names. The findings also show that the highest rates of accuracy were on mangroves and the manzanillo tree. Mangroves inhabit the coastal zone and grow in tidal areas just on the edge of beaches or waterfronts, which means they are very common at many local leisure and visitation areas like beaches on both islands.

Similarly, the manzanillo, or poison apple tree, grows near coastal areas, though technically in the arid zone, and so is prevalent around local beaches which families, friend groups, and school groups from both highland and port towns often frequent. On top of the high experiential visibility of this tree, it is also notably dangerous, bearing poison fruit that looks like small green apples, and secreting "poisonous latex, which causes severe dermatitis" (*Hippomane Mancinella L.*, n.d.). Some children even noted the danger associated with the plant in the name they wrote in, such as a child who wrote "benenoza manzaniya" (incorrect spelling of the word poisonous and phonetic spelling of manzanillo), others who wrote in "fruta venenosa" (poisonous fruit), or even the child who mis-identified the plant but knew it was not edible who wrote in "mandarin que no se come" (mandarin orange that you don't eat). I believe that because of the danger of the plant, it may be highlighted with more frequency and emotion by parents, teachers, National Park staff, and even amongst children within peer groups, which may account for the higher rate of accuracy in naming it on the survey. This is supported by literature on the transfer of TEK specifically on toxic plant species and on the recall of toxic plant names by children (Prokop & Fančovičová, 2019).

Figure 4

Accuracy rates of survey question 20 – name these Galápagos plants



Note: This pulls from data from survey question 20 which asked children to name Galápagos plant species. Data includes non-responses and thus represents all 337 participants

The lack of accurate identification of other plants like muyuyo and Darwin's cotton could be because both plants have yellow flowers and because they mostly grow in the arid zone but not close to the coastal zone, so they are not present around beaches where locals might visit. Furthermore, all endemic flowering plant species in Galápagos have either yellow or white flowers (Hervías-Parejo et al., 2019; Kelley et al., 2019), the similarities potentially making it difficult to distinguish between flowering plant species. Additionally, there were higher rates of incorrect names than animal species, indicating that children frequently confuse one plant for another which did not happen to any significant degree with animals. This confusion was often mis-identifying a plant as something introduced. For example, 13 children mis-identified the manzanillo tree as a mandarin orange tree, 8 others mis-identified it as guava, 29 guessed lemon or lime tree, four guessed a pear tree, and one guessed passionfruit - all of which are introduced species and so do not represent LEK.

Other confusion was mis-identifying a plant as a different endemic or native plant. For example, some children confused the manzanillo with mangrove, Darwin's cotton, or muyuyo, which means they know names of endemic/native species but inaccurately identified them visually. The photo of scalesia trees was often mis-identified as an introduced species such as bamboo, acacia, avocado tree, sugar cane, guava, or mango, and then was confused with other native/endemic species like mangroves or manzanillo.

Incorrect names for the photo of mangroves included answers that still exhibited LEK, just not the correct species name. Some students wrote in "trees where pelicans eat fish," "trees in Tortuga Bay" (where many mangroves do grow), or "marine plant" - each indicating knowledge about the plant itself and even interactions with other species, just missing the name. A similar instance occurred with the photo of a palo santo tree, which one student didn't remember the name of but wrote in "trees (that we can't cut down)" indicating that they are aware that they are protected. This is reflected in literature that explores how plants are seen as more like each other, and thus there are fewer clear distinctions that humans can readily perceive between individual plant species (Jaun-Holderegger et al., 2021).

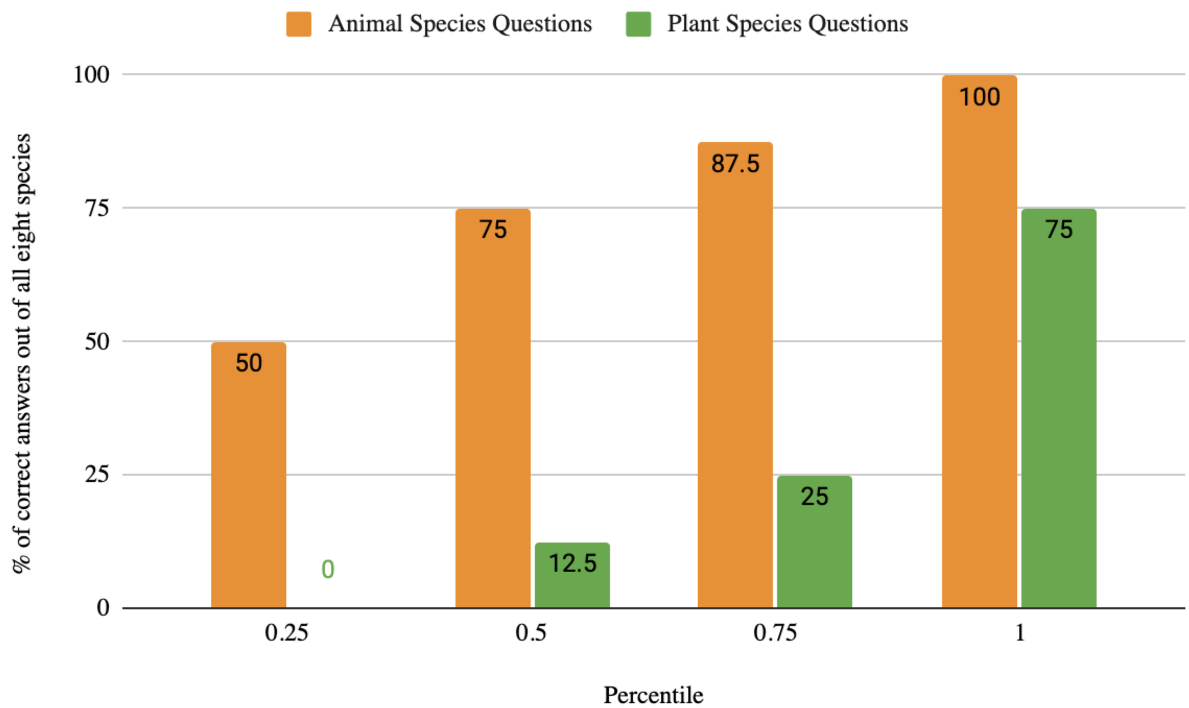
5.2.1.3 Animal vs Plant Names

This section elaborates on the finding mentioned in the previous section, that Galápagos children hold less, and less accurate, LEK of plant names vs animal names. While this difference was visibly apparent from the figures in both previous sections, further analysis was useful to confirm the difference and explore trends around other child variables/demographics. Based on survey responses and a lower frequency and abundance of names mentioned in both interviews and focus groups, Galápagos plant species were less well known for children than animal species.

The zed test detailed in the earlier data analysis section, used to compare animal accuracy with plant accuracy of survey responses, produced a z-score of 36.39 ($p = 0$) indicating that there was an extremely significant difference between the two scores, favouring a high rate of correct answers for animals and a significantly lower rate of correct answers for plants. To further illustrate this difference, in Figure 5 below, correct plant and animal species names per child were scored to see how many of the eight plants and eight animals each child named correctly. These scores were then used to chart the percentiles of correct naming. Children did very well naming Galápagos animals, but quite starkly, scores in all percentiles were significantly lower for naming plant species.

Figure 5

Percentiles of correct answers comparing animal species and plant species questions

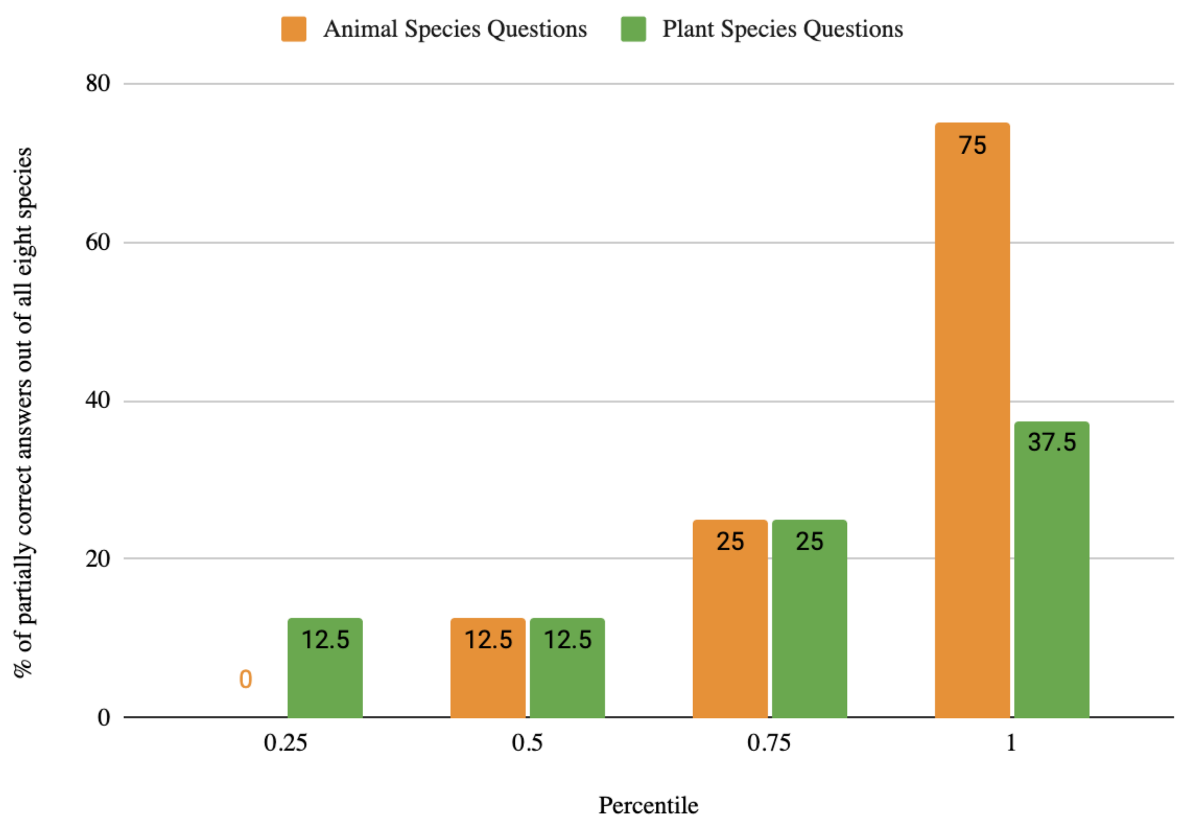


Note: This pulls from data from all 337 participants for the eight sub-questions of survey questions 18 and 20; bars show the percentage of correctly answered sub-questions within each percentile group. For example: 100% would mean a child answered all eight sub-questions correctly.

Even when looking at partially correct answers, trends in lack of plant knowledge persist, as can be seen in Figure 6 below. As a note on partially correct names, however, there were fewer names accepted as partially correct for plants than for animals, often because plant species names were single words only, such as the scalesia or muyuyo, which then leaves less room for half-name answers, unlike the opuntia cactus or animals like the sea lion, giant tortoise, marine iguana, land iguana, etc.

Figure 6

Percentiles of partially correct answers comparing animal species and plant species questions



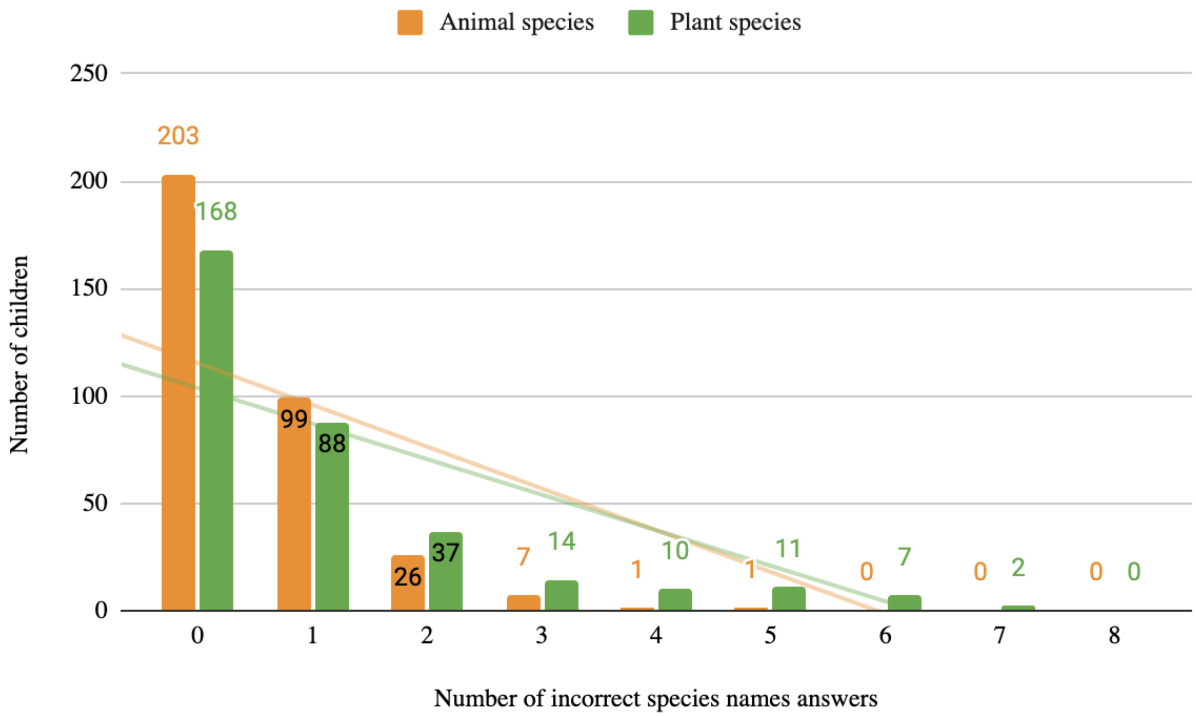
Note: This pulls from data from all 337 participants for the eight sub-questions of survey questions 18 and 20; bars show the percentage of partially-correctly answered sub-questions within each percentile group. For example: 100% would mean a child answered all eight sub-questions partially correctly.

Beyond correct or partially correct answers, though, trends in incorrect or complete lack of answers still support the finding that children in Galápagos, like other groups of children studied, are less able to share or retain plant knowledge (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018).

In Figure 7 below, we can see one possible explanation through the number of children and their frequency of the number of incorrect answers for both animal and plant species. For animal names, 60% of children surveyed got zero incorrect answers, versus plant names, which only 50% of children got zero incorrect answers for. When children got two or more incorrect answers, trends flipped, indicating that children more frequently got higher numbers of incorrect answers for plants than for animals. What these findings can also tell us is that children are less likely to confuse the names of animal species (as incorrect answers means writing in the name of a different species that was then marked incorrect) whereas children were more likely to confuse the names of plant species because they more frequently wrote in plant names that were not the correct species (but were indeed names of actual plants), therefore getting more plant name questions incorrect.

Figure 7

Frequency of incorrect Galápagos species name answers

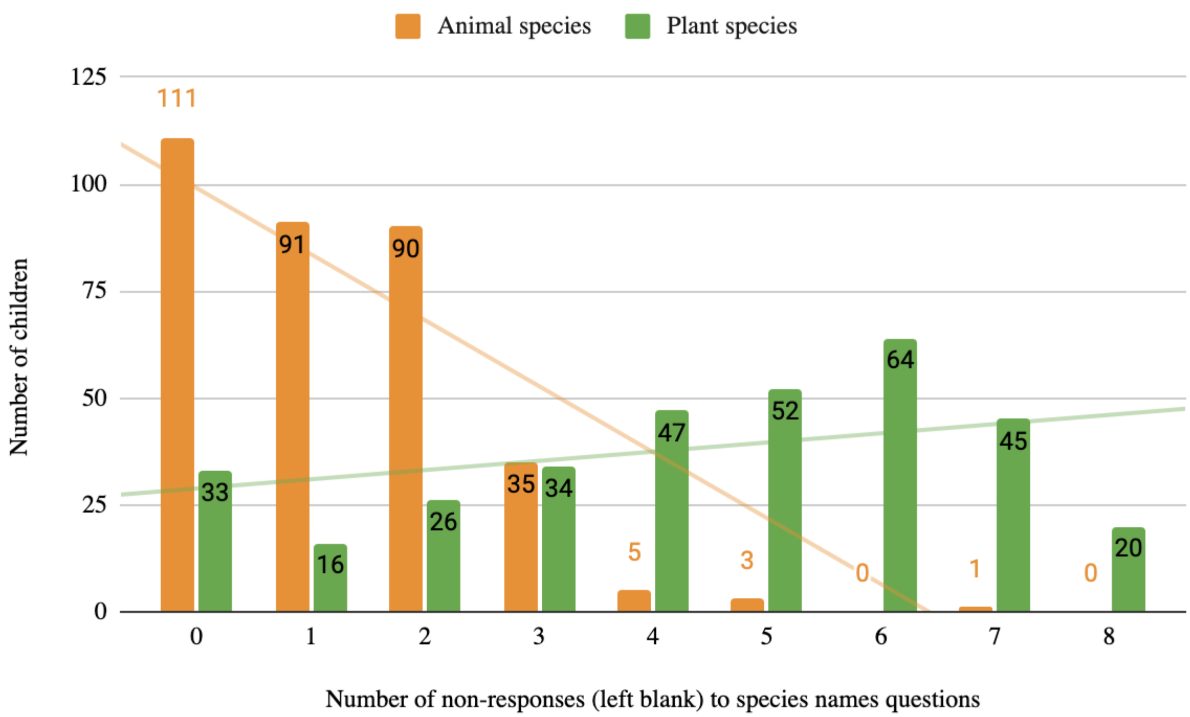


Note: This data was pulled from all eight sub-questions from both survey questions 18 and 20, which asked children to identify Galápagos species. Data includes non-responses and thus represents all 337 participants.

Further findings about non-correct species names can be seen in Figure 8 below, which shows the frequency of 'no answer' for both plant and animal species names questions. Here we see a distinct difference in the trends between animal and plant name knowledge, with more children leaving fewer of the animal questions blank than the plant questions. In the plant names survey questions, children were more likely to leave answers blank, which they were instructed to do if they felt that they did not know the answer.

Figure 8

Frequency of non-response to animal and plant species naming questions



Note: This data was pulled from survey questions 18 and 20, which each presented eight sub-questions asking children to name Galápagos plant or animal species respectively. Data is from all 337 participants.

This lack of knowledge of plant names is echoed in other literature with children and indeed even adults, noting 'plant blindness' and recorded difficulty identifying plants vs animals (Jaun-Holderegger et al., 2021; Wandersee & Schussler, 1999). Additionally, there is research that suggests that, up to a certain age, children struggle to apply the concept of life to plants and trees because of the distinct difference in or lack of movement by plants versus self-initiated movement of animals and the association of living things with autonomously moving things (Yorek & Aydın, 2009; Zogza & Papamichael, 2000).

The frequency of no answer for plants indicates a lack of knowledge and potentially a lack of confidence with plant knowledge. Often, children would raise their hand and note, while expressing concern, fear, or embarrassment, that they didn't know the names of one or many of the plant species pictured.

5.2.1.4 Highland vs Port Species Knowledge

To understand the detail within species name knowledge more comprehensively, beyond the differences between plant and animal name knowledge, I looked at differences between groups of children for overall naming within animals and plants and within individual species. Because of the distinct ecological zones in Galápagos (as described in Appendix H), both flora and fauna inhabit specific zones, which influences the frequency of interaction and sighting of those species by children.

As a note, the population of children participating in the survey who attended highland schools was significantly lower than the population size of port schools, as there are both significantly fewer highland schools on all islands (as highland communities are much smaller in size than port towns), and class sizes within highland schools were much smaller on average than those in port schools. In total, there were 41 highland school children who participated in the survey and 296 port school children. Table 10 below illustrates the sample sizes in highland and port schools including the average class size across all port schools and across all highland schools, and distinctly, the average number of children surveyed per class in highland vs port schools.

Table 10

Population of participating schools, classes, and children in highland and port schools on Santa Cruz and San Cristobal Islands

School Location	No. of Schools	Total No. of Classes	Total No. of Children	**Avg. Class Size**	No. of Classes Surveyed	No. of Children Surveyed	**Avg. No. of Children Surveyed per Class**
Highland	4	4	58	**15**	4	41	**10**
Port	8	16	382	**24**	15	296	**20**

To compare the LEK of highland vs port children, I again looked at survey questions 18 and 20. Analysis indicated that the highland school children had higher rates of correct answers for plants than port school children. For animal names, there was no significant difference in accuracy between port and highland school children. For individual species, findings here indicate LEK of animal names does not correlate to experiential visibility, whereas recalling correct Galápagos plant names might rely more on increased experiential visibility. Only one of the plant species in the survey exclusively grows in the highlands, and most of the plants in the survey grow more in the coastal, arid, and transition zones, which are zones that port children inhabit and frequent more than highland children, so the accuracy rates of naming plants even if children don't live around them in the highlands, would require more research.

When we dive into each individual plant species and accuracy rates in naming them between port and highland children, we do not see a total sweep of significant out-performance of port children by highland children. For five of the eight plant species, there was no significant difference between accuracy rates of correct naming between highland and port children. The five species were: the opuntia cactus, Galápagos tomato, mangroves, muyuyo, and manzanillo. The three plant species that did have a significant difference in accuracy rates were the scalesia, palo santo tree, and Darwin's cotton, and the difference was significant towards highland children's performance for only two of the three species.

Scalesia had the largest difference between highland and port children, with highland children named scalesia correctly at a higher rate than port children. Quotidian experiential visibility of scalesia for highland children was exemplified by the interview with a student in class GA3A, at one of the highland schools on Santa Cruz Island. While walking through green spaces within the school grounds, I asked the interviewee if they knew the names of some Galápagos trees, to which they responded "scalesia" immediately. I asked if there were any scalesia trees in the school and they said yes. Knowing that there was a stand of scalesia just ahead of us, and noting that the child was more reserved, I asked them if the stand of trees was scalesia, which they confirmed.

The palo santo tree was another species that highland children named correctly more frequently than port children. Unlike the scalesia accuracy rates, this result does not support the hypothesis that children would be more likely to be able to correctly name plants that grow around where they live, because the palo santo tree grows predominantly in the arid zone (between the coastal and transition zones), and thus would be most experientially visible to port children. The only other plant for which there was a significant difference in accuracy was Darwin's cotton, or algodoncillo, which port children named more accurately than highland children. Algodoncillo again grows in the arid zone, making it more readily visible to port children, though perhaps less noticeable than a large opuntia tree cactus or a large flowering muyuyo. Darwin's cotton, a tall shrub, again has the iconic yellow flowers as do many endemic Galápagos flowering plants, these ones looking similar to hibiscus flowers, and the fruits of the plant (not edible). This result does support the supposition that children would be more likely to correctly name plants that grow around where they live.

For animal species, seven of the eight species had no significant difference in naming accuracy rates between highland and port children: the blue footed booby, sea lion, finch, hammerhead shark, giant tortoise, flightless cormorant, and land iguana. The only animal species for which there was a significant difference in naming accuracy was the marine iguana. While this result does support the same supposition that I made with plants, that children are more likely to be able to accurately name a species if it inhabits their home space, the difference in accuracy rates was less than the differences found in plant accuracy rates. Additionally, as there was only one animal species that produced a difference in accuracy, despite most of the animals inhabiting the coastal, arid, and transition zones (making them less experientially visible to highland children), I propose that recalling correct Galápagos animal species names does not rely on experiential visibility, whereas recalling correct Galápagos plant names might rely more on increased experiential visibility. While there are studies of plant name knowledge between rural, semi-rural, and urban children which found that rural-based children could recall more plant names than those who were semi-rural or urban (Eyssartier et al., 2017), the findings with Galápagos children do not align with these findings but move beyond them to propose that children in any area are more likely to know names of species that are visible in their lived spaces.

It is still key to note overall, children did less well when naming plants than animals as discussed in the previous sections, and indeed that result persists when comparing rates of correct answers to animal questions vs plant questions within both the highland school children sample and within the port sample. For both highland and port children, analysis indicated that they got higher rates of correct answers for animals vs plants. But we can still recognize that within plant species questions, highland children were able to accurately recall and write in more correct species names than port school children.

5.2.2 Species status and category

While findings from the survey questions 18 and 20 painted a broad picture of species knowledge, findings from the interviews and focus groups revealed other segments of LEK: knowledge of species status, such as endangered or extinct, and species category, such as endemic, native, introduced, or invasive. In both interviews and focus groups, children displayed significant species name knowledge in response to questions like "what are some of your favourite Galápagos animals or plants?" or "what are examples of endemic or native Galápagos animals or plants?" The volume of responses, and length of lists of accurate names of species added to the illustratively robust LEK that children in Galápagos hold.

Because of the fragility of the Galápagos ecosystems, awareness of which Galápagos species are endangered or at risk of going extinct is particularly relevant and important for island ecosystem management and conservation. The necessity of knowledge about species status and category correlates with its presence and retention in children, as seen in the focus groups and interviews. This knowledge was predominantly accurate, though sometimes misapplication of terms occurred or confusion between statuses and categories was noted. Additionally, children seemed to know and offer up in conversation categorizations and statuses of more animal species than plant species.

5.2.2.1 Species Status

Another robust segment of species knowledge that children exemplified was knowledge about species status, meaning status of risk, such as endangered or extinct. This is reflected as an important type of knowledge in the literature (Ciążela & Gogacz, 2024). Children exhibited a high volume and solid grasp of what status terms meant and demonstrated frequent accuracy when applying these terms to local species, distinct from the literature (de Azevedo et al., 2012; Gavrilakis et al., 2024; Gomes et al., 2019). The volume and accuracy of knowledge did skew more towards animal species, which aligns with previous subsection findings. There was a trend of children assuming more species were endangered than in actuality. This tendency to over-apply at-risk labels to species seems unique to Galápagos, though other literature notes confusion or misapplication or lack thereof of the term endangered to animal species (Gavrilakis et al., 2024).

While there are more terms used to describe stages of risk for species, specifically outlined by the IUCN (International Union for Conservation of Nature) Red List, which is a database established in 1964 to list the status of species worldwide which is a "critical indicator of the health of the world's biodiversity" and serves as "a powerful tool to inform and catalyse action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive" (*The IUCN Red List of Threatened Species*, n.d., para. 1). The statuses that the IUCN recognizes are: Not Evaluated, Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct (*The IUCN Red List of Threatened Species*, n.d.). The IUCN status is also used by the Charles Darwin Foundation's dataZone database of Galápagos species. Importantly, the first four statuses denote a lack of risk of extinction, but the status of Vulnerable is the first in the group of statuses that do denote risk of extinction (*dataZone*, n.d.).

In class GA8A, when asked if they knew any at risk species in Galápagos, the interviewee noted "the pink iguana [...] um...the saddleback tortoise [...] and I think that the...the masked booby" all three of which are in some way at risk, the pink iguana and saddleback tortoise being critically endangered, and the masked booby being vulnerable. All three animals are pictured below in Figure 9, 10, and 11.

Figure 9

Photo of a National Park exhibit on Santa Cruz Island of the pink land iguana (iguana rosada) (photo by author)

Figure 10

Photo of a saddleback tortoise in the tortoise breeding centre on Santa Cruz Island (photo by author)

Figure 11

Photo of the masked booby

Note: https://commons.wikimedia.org/wiki/File:Starr_080606-6808_Coronopus_didymus.jpg (reproduced with permission under the Creative Commons Attribution 3.0 Unported license)

In the focus group for class GA5A in a port school on Santa Cruz, when I asked children to share interesting facts about the Galápagos environment, two students noted endangered tortoises, saying "there are some that are going extinct," and that "George the tortoise was the last of his species," referencing the passing of Lonesome George, the last of the giant tortoises from Pinta Island in 2012. I then asked if they knew other species that were in danger of going extinct, which elicited a string of animals from various children including sea lion, iguana, tortoise, boobies, finches, and the giant frigate bird (GA5A). A child in the GA2A focus group also noted that the sea lion was in danger of going extinct, and children in the GA7A focus group stated that vermilion flycatcher, spotted scorpionfish, red footed booby, and finch were at risk. The vermilion flycatcher was also noted as going extinct by a child in the GB3A focus group.

While for the most part these answers are correct, as the Galápagos sea lion, also an endemic species, is classified as endangered, some were miss-identified, and some indicated a lack of specificity in their knowledge of status. Correctly, tortoises in Galápagos are all at risk, as all 16 tortoise species in the Galápagos (many of which are island-specific) have been or are currently endangered (those not currently endangered are now extinct), or vulnerable (*dataZone*, n.d.). Incorrectly though, there are 17 finch species in Galápagos and while many of those are at risk, some are classified as "least concern" which indicates lack of risk of extinction (*dataZone*, n.d.). The same is true for the booby birds, of which there are three main species on the islands, ranging from critically endangered (blue footed booby) to least concern (red footed booby) (*dataZone*, n.d.). For the vermilion flycatcher (pictured in Figure 12) the child noted risk correctly, as there have been two species of the bird on the islands, and while one is extinct, the surviving species is currently listed as vulnerable (*dataZone*, n.d.).

Figure 12

Photo of the elusive and endangered vermillion flycatcher

Note: "Galapagos Species Database, Pyrocephalus nanus", dataZone. Charles Darwin Foundation, https://datazone.darwinfoundation.org/en/checklist/?species=17274. Accessed 30 November 2025 (reproduced with permissions stated on the above website page)

Incorrectly classified was the scorpionfish, which is of least concern and indeed is locally fished in Galápagos. Correctly, one child in the GB3A focus group noted that the flightless cormorant was "going extinct because of humans," which is supported by the bird's vulnerable status (*dataZone*, n.d.). Another child in the GB3A focus group noted that "they told me that the mangrove warbler was going extinct because they hardly saw them anymore." While the child didn't clarify who 'they' were, the yellow warbler is listed as vulnerable and so this was an accurate classification (*dataZone*, n.d.). Another child from the GA7B focus group noted that "the sea horse is in danger of extinction," which is also supported by its vulnerable status.

Overall, knowledge of species status was good and infrequently incorrect. That being said, there seemed to be a tendency to assume that most Galápagos species were at risk, because children frequently listed flora and fauna as endangered even when it wasn't. As a whole, though, it is promising for conservation work that children assume that more species need protection rather than assuming the opposite and indeed this indicates substantial awareness of and an ethic for the need to protect Galápagos species. Understanding of actual terminology seemed to be in good shape for the statuses used most frequently, as children exhibited an understanding of the words extinct and endangered and one child even noted that "the species that are the most endangered are the ones that only have a few remaining," (focus group GA7B). However, further distinction between statuses that denote risk (i.e., the difference between vulnerable, endangered, and critically endangered) could be further developed. In a continuing theme, when offering unprompted species status information, or when directly asked for it, children offered examples of animals but no plants. This an area of knowledge related to species names that could be fortified through specific inclusion of plant statuses in classrooms or organizational programs.

5.2.2.2 Species Category

Species category is also a relevant and important type of LEK, especially for conservation awareness in a protected area (Panisi et al., 2022; Shapiro et al., 2017). Galápagos children accurately understood and applied category knowledge, which departs from a general trend of inaccurate and low volume of knowledge in the literature for both children and adults (Rigoberto et al., 2021; Sosa et al., 2021; Stazione, 2025). The categories most applicable to the Galápagos context are native, endemic (implying nativity), introduced, and invasive (implying introduction). Children exhibited robust, and frequently accurate knowledge about the terms used to define these categories, despite some inaccuracies and confusion about which term to use for which grouping of species. Consistent with other segments of LEK, there was a skew towards animal species with category knowledge, with less surety and volume of LEK on categories for plants. Within plant names, the volume of LEK of introduced and invasive species seemed to outweigh that of native or endemic plant species. Within the categories of invasive and introduced, there was a slight tendency for children to recall invasive species more readily than non-invasive introduced species. Within focus groups, peers were often a source of corrective knowledge when confusion arose, indicating accurate group-sourced knowledge. More frequently, children exhibited clear and consistent understanding of native and endemic as categories, with slightly less accurate application of invasive or introduced categories, except for some flagship invasive species that received more attention locally.

5.2.2.2.1 Endemic and Native

The terms endemic and native seemed to be well understood by children, noted by long lists of animal species that followed me asking "what are some examples of native or endemic Galápagos species?" Occasionally, clarification was needed when I asked the question "what are your favourite Galápagos species?" as children sometimes answered by listing any species that live in Galápagos, often heavily skewed towards introduced species, such as horses, dogs, cats, ants, bears, wolves, chickens, cows, pigs or goats, orange, guava, apple, strawberry, and sunflower (focus groups GA3A, GA5A, GA6B, GA6C, GB1A, GB2A, GB3B). When these answers were given, I would clarify my question by adding either the phrase "that are from here" or including the terms "endemic" or "native" and then children listed native or endemic Galápagos species. Children seemed to also understand that endemic and native were closely related categories, exemplified by one child correctly pairing terms by noting that the Galápagos species "can be endemic or native" (focus group GA6C).

Children also displayed an understanding of endemic through impromptu conversation moments, such as when on child dodged a poke from a classmate, saying "don't touch me, I'm endemic" (focus group GB3C), joking about the no-touch and two-metre rule for all endemic and native fauna in Galápagos. Or, when asked if their family agreed with them that protecting the Galápagos environment was important, one interviewee said, "yes yes, it's very important to protect and they also believe that I need to learn more about [Galápagos] species because it might be that I confuse them with other species that aren't from here aren't' the ones we're protecting" (GA5A).

The idea of endemism was frequently explained or swapped out for the term único, or unique/singular, which does reflect the definition of endemic as a species that occurs only in one location (and thus is unique to that location). One child, when we were talking about protecting the Galápagos species in focus group GA3A, interjected excitedly and said "they're unique! Endemic". Another child in focus group GA4A said, "the animals [here] are unique." This comment was followed by another child explaining that "the [Galápagos] environment is the flora and fauna of Galápagos that is unique to here". The interviewee from GB3B also noted that the red footed booby "is an animal unique to here." Additionally, the interviewee from GA8A noted that "there are unique species that are only here." Another interviewee noted uniqueness as a driving reason to protect the Galápagos, and when asked if it was important to protect the islands, said "yes it's very important! Because there are unique species that aren't anywhere else in the world" (GB1A). These comments were frequent, with others including a note in the GA7A focus group that "there are lots of animals [here] that aren't' in any other places," or the interviewee from GA1B who said, "you can't find the marine iguana anywhere else in the world." Marine iguanas are pictured in Figure 13. The interviewee from GA6B spoke on a similar theme when explaining why they liked Galápagos, noting that it was "because here we have species that aren't in any other part of the world." They went on to describe the Galápagos environment by noting that "it's like…[Galápagos] has different species that are not like others, like plants and lots of things that won't be found in other parts of the world" (GA6B).

Figure 13

Photo of young marine iguanas on the sidewalk in Puerto Ayora, Santa Cruz Island (photo by author)

Though infrequent, some children did display miss-application of the term endemic when giving examples of species. One interviewee, when asked for examples of endemic Galápagos plants, took a while to think, then noted "the…let's see the…apples," (GB3C). They then went on to list more species, the first of which was still incorrect and not endemic, but the latter of which was, indicating inconsistency in bucketing species: "oranges […] the…what are they called, the the poisonous plants like like…a fruit that is really poisonous that if you eat the fruit you die" (referencing the endemic manzanillo tree) (GB3C). Another interviewee, from GB3B, made a similar mistake, bucketing endemic with introduced species when asked for examples of endemic Galápagos plants. They first responded with "matazarno" which is an endemic plant (Figure 14) and then correctly confirmed "yes they're endemic [...] because of that they're from here" which indicates that they understand what the term endemic means. But they then went on to say, "also the blackberry because outside [of Galápagos] there aren't any," which again indicates a correct understanding of what endemic means, but they've miss-applied the term to an introduced and invasive plant.

5.2.2.2.2 Invasive and Introduced

Children displayed a good grasp of the concepts of introduced and invasive, especially in relation to the terms endemic and native. For example, children in focus group GB3A who, when asked about endemic plant species, correctly noted that "not all [plants] are endemic," that "the blackberry and papaya are introduced and I don't like them," (negative sentiment connected to the category of invasive), and that "there are a lot of species that are definitely introduced." The interviewee from GA5A noted that "Galápagos has lots of different beautiful things... that aren't in other places, but also mankind brings lots of things that aren't from here and that hurts the species that are from here".

Children often mentioned introduced species in a note about native or endemic species, such as one child in the GB3A focus group who noted that "cats have been seen eating the iguanas" (two other children confirmed this), and that cats (Figure 14) were also "bothering the iguanas and eating the birds that live here like for example the finches."

Figure 14

Local cats in the highlands of San Cristobal Island (photo by author)

Similarly, but with an invasive plant species, children in focus group GA6A discussed the harms of a common invasive plant, blackberries, starting with a child who noted that it was important to "not introduce more species that are not from here from Galápagos," followed by a child who added "because the blackberry is introduced an it hurts the giant tortoises" followed by a child who disagreed and noted "no not that no the blackberry affects plants not animals," which was corrected by another child who noted "[it hurts] birds too." This entire discussion established that these children understood both what the terms invasive and introduced meant with this species example.

When asked to name invasive species, children in focus group GB1A were able to provide a nearly-correctly categorized list (C representing a single child):

C – cat!

C – the blackberry

C – the cat

C – flies!

C – dogs

C – rats

C – ants

C - ants!

C – cockroaches

Similarly, children in focus group GA4A provided a nearly correct list of introduced animal and plant species, and when a species was incorrectly named, it often was corrected by classmates (R comments denote my interjection as researcher):

C – dogs and cats?

C – cows

C – chickens

C – the chicken

C – the sea turtle

R – the sea turtle?

C – the rat

C – the sea lion

R – the sea lion is introduced?

C – no no

C – it's endemic

When asked for examples of introduced plants, the same children from GA4A provided a shorter, but accurate, list including the blackberry, noted by three children, and the orange tree. While animal species were still noted more frequently in all categories, including introduced and invasive, the knowledge of introduced or invasive plant species seemed to be more substantial than shared knowledge of endemic or native plant names.

Based on frequency of naming blackberries and omission of naming other introduced plant species and supported by the mention of cats frequently when noting introduced animals, it may be that children are more likely to remember and accurately recall the names and categories of introduced species if they are also invasive (as not all introduced species are also categorized as invasive), or if they are flagship invasive species which receive plentiful attention through campaigns locally. While it's important for children to remember invasive species because they do pose ecological harm, helping children to correctly categorize other species as introduced would still be beneficial to defining and concretizing their LEK.

5.2.2.2.3 Confusion

Confusion between the four categories was infrequent but notable, especially with introduced and invasive as categories. Often, children seemed to lack confidence with the application of invasive and introduced. The terms introduced and invasive were often miss-applied them or used the term without appropriate context, such as the child who interjected "they're introduced!" when, in the GA1A focus group we'd been talking about animals in Galápagos, but not specifically mentioning introduced species. Or the child who, when talking about Galápagos as a place, said "it's an endemic, native, and introduced space" (focus group GA6C). Or children in the same focus group noting that there were introduced species in Galápagos, but not correctly labelling animals listed, or miss-combining terms by noting, after students began listing native species, "they're native and introduced" (focus group GA6C). One child in the GB2A focus group recognized their own confusion when trying to remember something they'd learned in school: "like the professor said, the fruit was endemic or invasive and cats eat it."

Confusion in focus groups was often met with correction from classmates, indicating that some children held more concrete knowledge and could act as a source of learning for peers. Additionally, more consistent and clear support from educational programs could be beneficial. In interviews, without the corrections of classmates, some students simply didn't respond to questions about introduced or invasive species, such as the interviewee from GA4A who, when asked directly for examples of introduced species, said that they didn't know any.

Overall, Galápagos children demonstrated a keen awareness of the terms native, endemic, introduced, and invasive that added to their overall LEK. While there were some inaccuracies and confusion about which term to use for which grouping of species, frequent corrections by classmates, or overall correct grouping despite incorrect label, indicated robust LEK around categorization of flora and fauna. This departed from the small body of literature that assesses category knowledge which shows low rates of this particular LEK segment (Rigoberto et al., 2021; Sosa et al., 2021; Stazione, 2025). More specifically, children exhibited more consistent and clearer understanding of the terms native and endemic, and there were gaps when categorizing introduced and invasive species.

5.2.3 Species location, diet, behaviour, and interaction

In addition to knowledge of species names, statuses, and categories, Galápagos children also collectively exhibited substantial knowledge about species such as species location, and some information about species diet, behaviour, and interactions. Like previous subsections, this knowledge was heavily weighted towards that of animals and significantly less knowledge was volunteered from children about plants. These bodies of knowledge were supported by conversations in focus groups and interviews, and often were recalled and conveyed through stories, though some of this knowledge was shared in the form of discrete pieces of information.

5.2.3.1 Species Location

Species location knowledge was the most frequent, with children citing where they'd seen animals or where they had learned that they live or migrate to. This is not often used as a metric in the literature with children, but Galápagos children's location knowledge as frequently accurate is distinct from one study with children that noted significant disorganization and confusion with habitat location (Strommen, 1995). This knowledge was usually more skewed towards animals, with only a few examples about plants. One study notes greater location knowledge held by high schoolers, which may indicate that Galápagos children have more than expected knowledge (Tunnicliffe & Reiss, 1999).

In focus group GB3A below, children shared location knowledge about local species by detailing where both the endemic penguins (Figure 15) live and where Galápagos dolphins live in the ocean. Slightly farther along in the conversation, a child contributes more location knowledge, noting that dolphins around Galápagos live and swim in deeper waters.

C – the penguin!

C – but here there aren't any because particularly they're in Santa Cruz or in Isabela

[…]

C – the dolphins are in the water where it's the deepest

Figure 15

Photo of endemic Galápagos penguins

Note: "Galapagos Species Database, Spheniscus mendiculus", dataZone. Charles Darwin Foundation, https://datazone.darwinfoundation.org/en/checklist/?species=5176. Accessed 30 November 2025. (reproduced with permissions stated on the above website)

In the GA7B focus group, children alluded to location knowledge by recognizing low animal (in addition to low human) populations on Floreana Island. At this point, an incorrect piece of location knowledge was shared (that the pink iguanas live on Floreana), which was not corrected by classmates.

C – almost in Floreana there are almost no people

C – and there are also not a lot of animals

C – just the pink iguana

In the same focus group, later in the conversation, a child offered correct knowledge about one of the locations of the yellow land iguana, stating “the yellow iguana lives in Baltra”.

More location knowledge was shared, and contended, in focus group GA7A when a child referenced flamingos in Galápagos, which another child qualified by reminding that there aren’t any in Santa Cruz, which another child refuted by citing that the flamingos are returning. Another child confirmed this by adding the exact location on Santa Cruz. Another child then refuted this and noted that they had left. Flamingos do move across islands but are usually consistently found on Isabela and Floreana and sometimes stay on Santa Cruz Island, so at this point, all of these children could be sharing accurate knowledge.

C - there you see flamingos

C – but but but here there aren't’ any because they left

C – yea yea

R – not in Santa Cruz?

C – no no

C – the flamingos are coming back!

C – there in the Garrapatero

C – in the in the Garrapatero they left

Flamingos returned as a location knowledge topic in focus group GA6A, when children noted that there are flamingos on Santa Cruz and they're at the Garrapatero. A child even provided both a personal experience story, noting they'd seen a group of flamingos, and a story from someone else who told them that flamingos migrate following water sources. Additionally, children mentioned penguin location knowledge, which was contended between children.

C – penguins

C – ah yea

R – they're here in Santa Cruz or…?

C – they're here too

C – but no!

C– no, they're not here!

C – no

C – in Isabela

C – sometimes [referencing Santa Cruz]

C – flamingos

R – yes flamingos, they're here in Santa Cruz or?

C – yea yea

C – in the Garrapatero

C – manta rays

C – one time I saw a group [referencing flamingo] he says that they follow streams of water and go to another island and then return

Location knowledge about finches came up in focus group GA7A, as cited below. There are 17 finch species on Galápagos, many of which look quite similar. There are distinctive differences, though, especially in beak size and shape, plumage, and location. The first child seemed to be struggling to remember what type of beak one finch had. Two children immediately responded to my question about finches living in cacti and then a third and fourth shifted slightly to note that there were three types of finches 'here' which they couldn't remember. Finches then appeared near us, and, in excellent real-time species identification, three children recognized them and excitedly pointed them out.

C – ehh a finch….no not finch, like a beak…chubby!

R – are there some that live in a cactus?

C – uh huh!

C – in a cactus

C – here there are three types of finches, but I don't remember them

C – here in the school

C – no, that's one! (pointing to a finch)

C – that's a finch!

C – another finch!

Finally, still in focus group GA7A, a child noted location knowledge of sharks in Galápagos. The first child noted that there are a lot in Tortuga Bay, one of the largest beaches in Santa Cruz. This was confirmed and elaborated on by two other children who listed two types of common sharks, the whitetip [reef] shark, and a 'black stripe' shark which may have referenced the Blacktip reef shark.

C – more sharks come to Tortuga Bay in Tortuga Bay is where sharks are seen

C – Whitetip sharks

C – black stripe sharks

Detailed species location knowledge, some of it accurate, was shared by the interviewee of GB3B when talking about blue footed boobies. They noted that the boobies do live on San Cristobal Island, and when asked where, they correctly identified Puerto Chino, a popular beach on the southeast of the island, as somewhere they live. They then went on to add that, "in Puerto Chino there are the blue footed ones and…in Cerro Gato there are the red ones, the red footed boobies" (GB3B). While there are blue footed boobies in Puerto Chino, there aren't any boobies in Cerro Gato, as this is a highland site and boobies are coastal birds.

In other interviews, location knowledge was frequently mentioned, such as the child in interview GA5A who noted that there were a lot of giant tortoises in the highlands (of Santa Cruz) but that there were some in the port, in the tortoise breeding centre. Another child echoed this and specified tortoises in port lived in the Charles Darwin Research Station (GA6B). Species location continued as a theme back in the GA5A interview, when the child noted that, "there are more, there are a lot of tortoises and a lot of sea lions," on San Cristobal. The interviewee of GA8A noted that "the land iguanas are yellow, and you can find them on Baltra Island […] because it's very hot there." They also noted that “in Santa Cruz you hardly ever see” the masked booby. The interviewee of GA6A also noted that “there are more sea lions” in San Cristobal than in Santa Cruz.

In an example of species location and population knowledge that happened to be negative, the same child then shared that the Garrapatero beach was lovely to visit with family but “the bad thing is that there are lots of birds that always bother you” (GA6A). While most species knowledge was shared in a positive light, it is important to acknowledge and give space for potentially negative interactions with local species.

Examples of plant location knowledge were few and far between. However, one example was in interview GA1B, after I asked the child to describe the Galápagos environment. They noted that the environment has a lot of trees, which I echoed, and then asked if the trees were in the port or up in the highlands. They said in the highlands but sometimes below (in the port). While this isn’t specific species knowledge, it was interesting to hear how this child saw the highlands vs the port and how they characterized those spaces in terms of trees.

C – I would describe it as everything is big, beautiful, that it has trees

R – lots of trees

C – trees

R - here in the port or in the highlands?

C – in the highlands and sometimes they also know how to live below, but…

Figure 16

Photo of the scalesia zone in the highlands of Santa Cruz Island

Note: https://commons.wikimedia.org/wiki/File:Scalesia_pedunculata.jpg (reproduced with permission under the terms of the GNU Free Documentation License)

The only other example of plant location knowledge occurred in focus group GA6B. We had been discussing native plant species, and I asked the group if there were plants that lived in the highlands and weren't in the port. One child noted that plants lived everywhere, and then one child accurately said "in the highlands there aren't any mangroves. There aren't any mangroves because they're closer to the beach" (GA6B). Additionally, in focus group GA2A, also when listing native plants, one child mentioned two native cactus species, opuntia and lava, and when I asked if they were mostly in the port, a child responded and said, “some are in the highlands, but you don’t see the opuntia [there].” In both instances, plant location knowledge was only provided when prompted.

5.2.3.2 Species Diet and Behaviour

Though significantly less frequently shared than location knowledge, knowledge of species’ diet and behaviour, was occasionally shared in both focus groups and interviews. This type of LEK is not referenced in the literature frequently, and only one study noted children’s knowledge of some food sources for favourite animals (Myers Jr et al., 2004).

In focus group GB3A, children provided location and food source knowledge about the flightless cormorant, which was the least-accurately-identified animal species photo in the survey. They noted that the flightless cormorant lives around San Cristobal and that it eats fish. While the latter point is true, the location knowledge was incorrect, as the bird only lives around Isabela and Fernandina islands. Similarly, in focus group GA2A, children offered story-based species trait knowledge in the form of information about sea lion diet:

> C – I’ve seen how I’ve seen a… that fishing is harming the sea because they are fishing, if they catch all of them, almost all the fish, there are not many fish to…
>
> C – the sea lion if they eat its food
>
> C – it’s becoming endangered

The interviewee from GA1B shared knowledge about nesting behaviour of sea turtles at Tortuga Bay, using personal experience to corroborate that knowledge. They also shared additional knowledge of species interaction and impact between species.

> C – the turtl– yes there are turtles, sometimes there are some turtles there, because there a turtle came and laid eggs
>
> R – ah yes perfect
>
> C – Yea, and there will be guards there collecting the eggs to take care of them
>
> R – ah perfect, to protect them or something?
>
> C – yea to protect them they cover them up because they say because here there is this one....there are rats...that they say...the species I don't remember

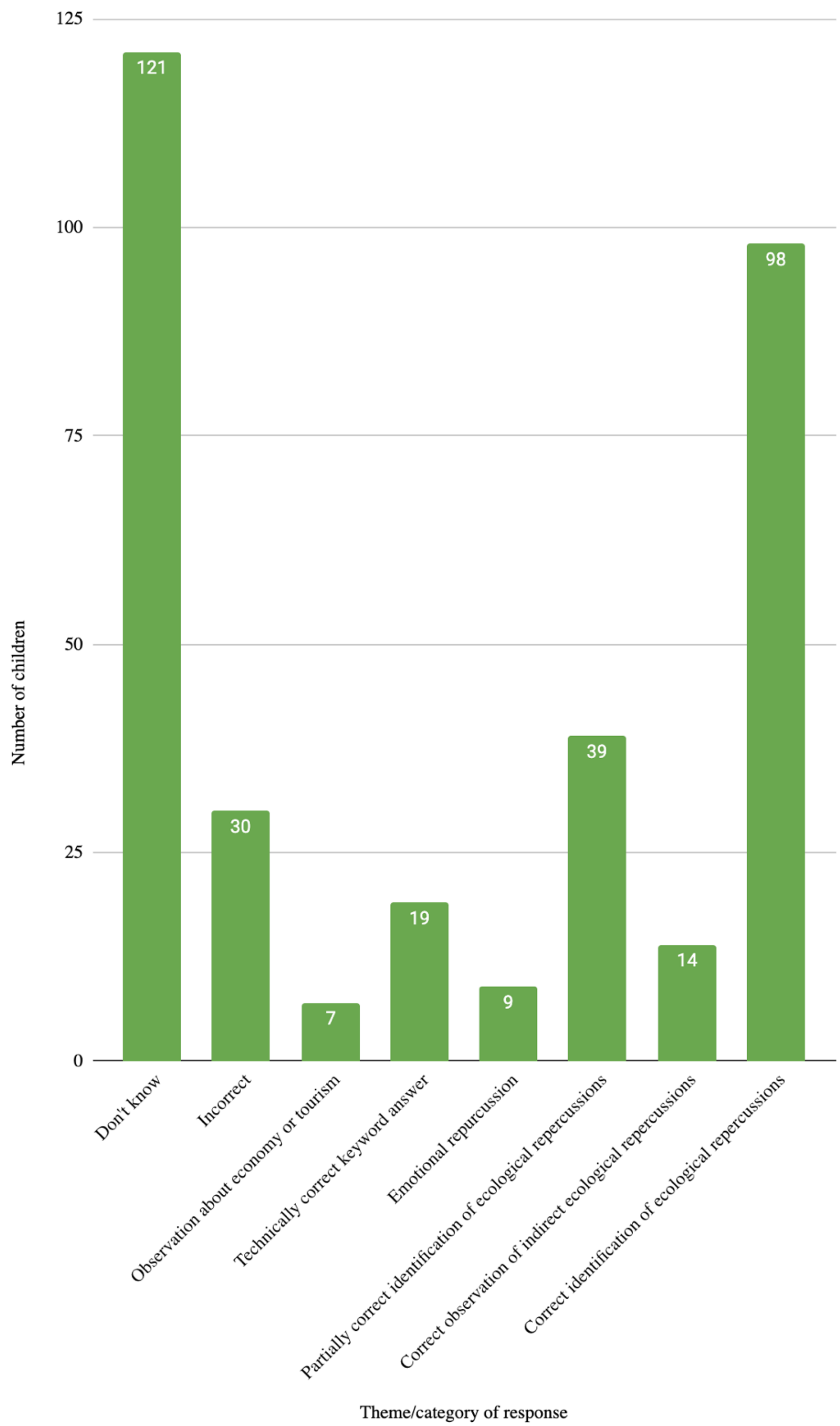
Ultimately, an overall low frequency and volume of species diet and behaviour knowledge could represent a gap to be filled. However, because I did not explicitly ask about species diet or behaviour, it is unclear whether, if asked directly, children may be able to share more of this knowledge.

5.2.3.3 Species Interactions

While small instances of species interaction knowledge were shared within interviews and focus groups, it was overall infrequent as a segment of LEK. This type of knowledge was again not frequently referenced in the literature, though one study noted very infrequent mention of ecosystem interactions between species from children (Myers Jr et al., 2004). One example of this type of knowledge was in survey question 16, which asked children "what would happen if the opuntia cactus disappeared from the islands?" While varied, some answers to this question exemplified a grasp of ecosystem and thus species interactions. Children frequently raised their hand to clarify or ask about this question during the survey, already indicating that ecosystem interaction knowledge may be a challenge. The answers provided were creative and thought provoking, indicating nuanced thought processes and even emotional responses to the prompt. As this was a short answer question, answers were sorted into the following eight categories: 1) don't now, 2) incorrect, 3) Observation about economy or tourism, 4) Technically correct, 5) Emotional repercussion, 6) Partially correct identification of ecological repercussions, 7) Correct observation of indirect ecological repercussions, or 8) Correct identification of ecological repercussions. Overall, results showed that this was an area of low rates of group knowledge, with only 44% of children providing an answer that was correctly identified some ecological repercussion. All results are illustrated in Figure 17 below.

Figure 17

Thematic Codes for: What would happen if the opuntia cactus disappeared from the islands?


125
100
75
50
25
0
Number of children
121
30
7
19
9
39
14
98
Don't know
Incorrect
Observation about economy or tourism
Technically correct keyword answer
Emotional repurcussion
Partially correct identification of ecological repercussions
Correct observation of indirect ecological repercussions
Correct identification of ecological repercussions
Theme/category of response

Note: This data is pulled from survey question 16 and includes non-responses, thus representing all 337 participants.

Over 35% of children either didn't know or got the answer incorrect, and seven children noted what the economic repercussions of this would be, which, while not incorrect generally, was not answering the ecological question. Another 19 children technically correctly answered the question simply by rephrasing what the question asked, such as stating "there would not be cactus in Galápagos," "we would not have any cactus," or "that species of cactus wouldn't exist." While these answers indicate an understanding of species status, such as extinction, it does not provide information about what happens ecologically. A few children interpreted the question emotionally and noted how they would respond to the opuntia cactus disappearing. Examples of this include: "I would be very sad to see a plant go extinct" or "wouldn't be a beautiful place" or "it would be the worst because it is native to Galápagos."

Direct knowledge of species interactions was exemplified in answers that were categorised as partially correct, correct observation of indirect repercussions, and correct observation of direct repercussions. Examples of partially correct answers include "the animals wouldn't be able to eat" which captures the correct assumption that there would be a lack of food for animals in the Galápagos food web but fails to clarify that this would only directly impact the animals that eat the cactus. Or a student who noted that "there wouldn't be homes for the finches and iguanas" which isn't entirely true, as without Opuntia, there indeed would not be homes for cactus finches, and they know something would happen to land iguanas, but they mistakenly lump that impact in with homes. Still another noted that "finches wouldn't have food" which is partially correct, but not all species of finches eat the "tuna" or cactus fruits. Examples of correct observation of indirect repercussions include: "the water would be dirty" which references how cactus pads serve as natural filtration. Other students noted that if the cactus disappeared, that "we would be losing our biodiversity," or that if Opuntia cacti were gone, then "the only cactus that would remain would be the candelabra cacti" referencing one of the other local cactus species on their island. Finally, examples of correct observation of direct repercussions include: "the tortoises wouldn't have any food"; "the land iguana wouldn't have food" or "there would be a smaller population of cactus finches".

While this question is only one example of interaction knowledge, it shows that, while 44% of children did grasp the question and, in some way, provide accurate ecological repercussions, a large portion of children weren't able to, and still others interpreted it anthropocentrically, noting economic repercussions. Children who did provide correct knowledge show that these concepts are appropriate and understandable to children of this age group.

Despite lower results from this question, and low frequency and volume of species trait knowledge, children's species location knowledge was accurate, frequent, and voluminous, though skewed more towards animals. Overall, this section isn't an indictment of children's LEK, but a celebration of certain aspects where they have substantial knowledge, and other areas where there is room to grow.

5.3 Knowledge of climate, geography, and geology

Children had significant knowledge on broader (beyond knowledge of and about individual species) ecological topics, particularly on local geography, and occasionally on local climate, weather, and geology. Geographical knowledge is highlighted as important for children and is frequently included in curricula (Winter, 2012). Local geographical knowledge was rich in the nearby space in terms of awareness of home-island and close-to-town geography, but some children struggled with larger-scale geographical knowledge at the island system and regional scale, which is reflected in the literature in line with lack of spatial cognition content taught to children which is essential for conceptualizing more complex and literally larger geographies (Gersmehl & Gersmehl, 2007; Piaget, 1929; Reynolds & Vinterek, 2016). Geology, noted as important for children (Vasconcelos & Paz, 2023), was a frequently mentioned knowledge in relation volcanic activity, and climate and weather were often mentioned but also often misunderstood or contended by other children, which is echoed in the literature (Henriques, 2002).

5.3.1 Geography

In both interview and focus groups, children would frequently be able to provide knowledge and names of nearby geographies, such as locations and names of local beaches, other geographical sites and features of their home island, and even well-known sites on other islands, representing location knowledge. Analysis of the interview and focus group data shows that this knowledge seems to come from children's experiential engagement with local geography. It is noted that children through elementary school start to construct geographical knowledge and understanding of it through experience (Reynolds & Vinterek, 2016; Sheridan, 1968), and with more experience, comes stronger grasp of and volume of geographical and location knowledge (Cin, 1999). From these studies, the fact that Galápagos children held significant and nearby location knowledge made sense, further supported by recognition that children have less mobility through space than adults and thus their experiences would inform nearby location knowledge (Sebastián et al., 2024). Additionally, the lack of and frequent inaccuracy with larger scale geographic knowledge reflects noted challenges conceptualizing hierarchies and regions of space (Gersmehl & Gersmehl, 2007; Sebastián et al., 2024).

Nearby knowledge was highly accurate and readily mentioned by children. For example, the interviewee from GB3B mentioned the Galapaguera as a local site, and when asked where it was, they explained that it was “farther below…almost close to Puerto Chino” citing another local beach. They went on to say that they enjoyed Playa Mann, or Mann Beach as well. The interviewee from GB4A also mentioned beaches and noted that they thought there were about eight beaches on San Cristobal. When asked what their favourites were, they said “umm, Villamar Beach […] Mann Beach, and…the beach, I don’t remember there are so many beaches” (GB4A). Similarly, the interviewee from GA6C confirmed that there are a lot of beaches in Santa Cruz. The interviewee from GA6A, also on Santa Cruz, noted that they really like Galápagos “because there are lots of touristy places, I like the beach,” then added “the tunnels, the lava tunnel, there are lots of touristy things here.” When asked where the lava tunnels (common on most islands due to the volcanic origin of the Galápagos), they noted, correctly, that “the tunnels are in the highlands” (GA6A).

Focus groups were similar to interviews with the frequency of local place names and touristy geographical sites. In focus group GA3A, a child noted that they "went to Playa Roja and we walked because it is like…an hour" followed by a child describing "it's like Tortuga Bay but farther away." Similarly, in focus group GA6B, when asked what some favourite Galápagos sites were, two children noted the beach, one specifically said "I went to Tortuga Bay that's a beach umm the Garrapatero which also is a pretty beach," both in Santa Cruz which another child noted is "a really big beach." This was perhaps misheard by another child who responded with "no, the biggest beach is Playa Mann" (in San Cristobal). This reminded another child of a different beach, and they shared that "at the Sea Lion Beach there's an island that's separated here [motioning] it's a separate island".

In both interviews and focus groups, mostly from San Cristobal, one particular site was frequently mentioned as an important and interesting geographical feature: the El Junco Lake on San Cristobal. El Junco is the only source of freshwater in the Galápagos Islands, a fact that was well-known by children. In interviews, two children, both from San Cristobal, mentioned El Junco, noting that it had freshwater. One noted that it was formed long ago and noted that it was one of their favourite places in Galápagos "because the environment there is very, well very natural and it is very cool [temperature] and I like the cool" (GB1A).

Still on El Junco, in focus group GB3A, the below conversation occurred. All children in this focus group jumped in at once when I asked the inciting question, "what is El Junco?" indicating that this was knowledge they all felt confident and excited to share:

C – El Junco is a lake

C – a lake

C – a freshwater lake

C – a lake

R – and it has freshwater?

C – yes! (all in chorus)

C – and because of that we can all drink water

C – it's the preferred lake for Magnificent Frigate Birds

C – it's like the the…it's like the most famous lake here

Additively, in focus group GA1A, one child mentioned El Junco pointedly as the only source of freshwater in Galápagos. Other children chimed in with contextual information about El Junco, again indicating confidence and ubiquity in knowledge:

C – and in San Cristobal it's the only point of freshwater in the islands

C – yea it's a lake El Junco was the lake it's called El Junco

R – the lake?

C – yes, it's a volcano a volcano

In addition to nearby location knowledge, children were able to share some larger-scale geographical knowledge, though frequency of confusion and inaccuracy at this level was more noticeable, and supported by the literature (Gersmehl & Gersmehl, 2007; Sebastián et al., 2024). For example, in the focus group GA8A excerpt below, there were differing answers on number of islands in the archipelago, a correct statement about human population, an incorrect correction of that statement

(Isabela has the second smallest human population), and a final correct statement about Isabela's landmass. While there are hundreds of parts of the archipelago, it is generally accepted that there are 13 main islands:

R – and how many islands [in Galápagos] approximately?

C – twelve!

C – twenty-four

C – and Santa Cruz is the most inhabited…of humans

C – no Isabela

C – like Darwin more

C – Isabela is bigger

A similar issue occurred in focus group GA7A, when a child said that "the Galápagos is four islands" perhaps referencing the four inhabited islands.

Other mentions of island and larger scale geographical knowledge did occur, such as the child in focus group GA7A who noted correctly that Galápagos is a province of Ecuador. Or the conversation with accurate knowledge about Isabela Island in focus group GA1B below:

R – what's your favourite place in the islands or on this island?

C – Isabela

R – Isabela, why?

C – it's the biggest

C – it's bigger than here [Santa Cruz]

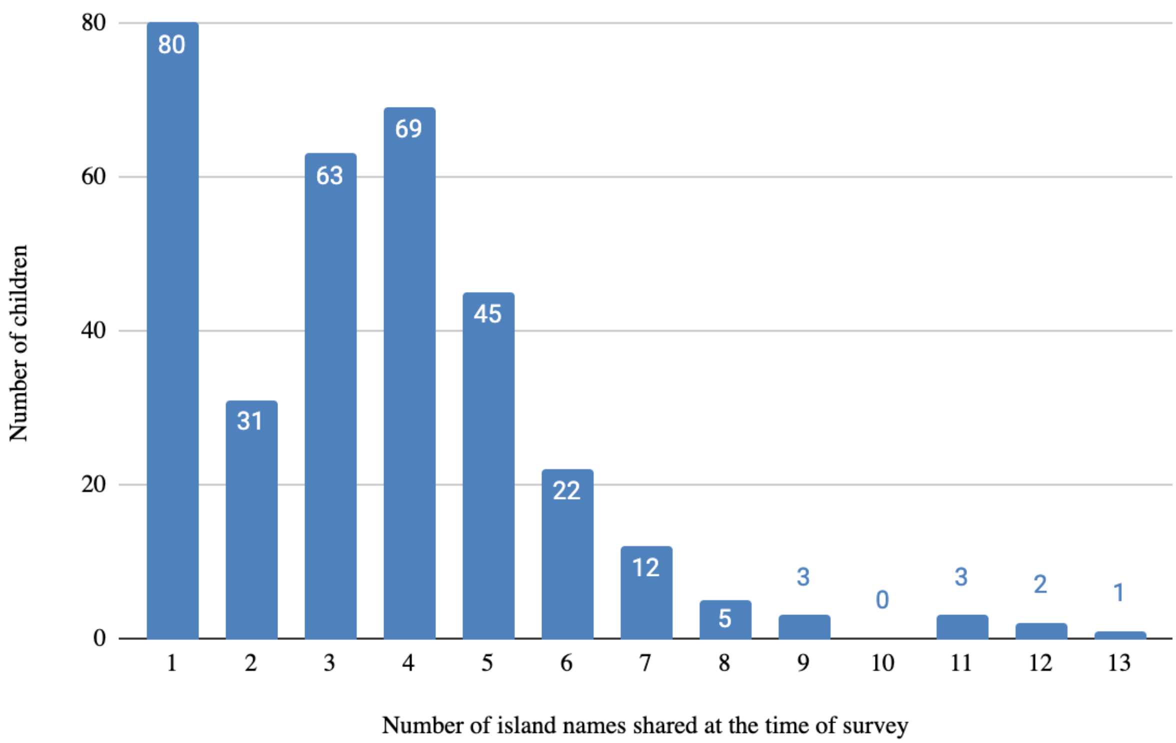
C – it's the biggest in all of Galápagos

C – in in the islands there are looooooots of things

In addition to larger scale island geography mentioned in focus groups and interviews, survey question six, "Do you know the names of other islands in Galápagos?" also helped to understand children's conceptualization of the Galápagos as a whole archipelago and analyse their knowledge about island names and understanding of what regions and spaces were included in Galápagos. Children were encouraged to write down as many island names in Galápagos that they knew. Many children new multiple island names, including their home island, either Santa Cruz or San Cristobal. However, in Figure 18 below, we can see that the mode number of island names that children knew was only one, their home island. On average, though, children knew almost four island names including their home island, and some children knew and recalled up to 14 correct island names. Some children recognized that they did not know many names. For example, 14 children, instead of writing in names of other islands, wrote in either "no" (as in no, I don't know names of other Galápagos islands), or "just this one" referencing just their home island, or "I don't know any more," or even the one child who wrote "I don't know I'm sorry :(". From this, it was clear that larger geographical knowledge could use support from schools, organizations, peers, or adults.

Figure 18

Volume of Galápagos Island names shared by survey participants



Note: This data was pulled from survey question six: Do you know the names of other islands in Galápagos? Data does not include non-responses, and thus represents 336 out of 337 participants

Out of 336 children, 200 children (59%) listed island names that were only inhabited islands (one or more of: Santa Cruz, San Cristobal, Isabela, and Floreana), with only 137 (40.7%) of children able to name islands that were not inhabited, such as Darwin, Wolf, Santiago, Marchena, Rábida, Santa Maria, etc. This perhaps indicates that knowledge of uninhabited islands is not shared with children, and most children will not have had the chance to visit uninhabited islands.

Sometimes, children would list names that were not of islands, and this was where conceptual understanding of larger-scale geography came into question. Again, I look to the survey question, Do you know the names of other islands in the Galápagos? Correct answers to this question require children to know the names of Galápagos islands, but it also requires children to understand what an island is, and what an island is not, and to be able to geographically visualize large-scale space (i.e., the whole archipelago, and what is and is not a part of that archipelago).

Overall, most children did not include non-island names in their lists. In fact, 290 of the 337 children (86%) listed names of only Galápagos islands. The remaining 14% of children (47 out of 337), wrote in at least one Galápagos Island name, and at most five, names of places that were not Galápagos islands. In seven instances, a child wrote down “Galápagos” as a name of a Galápagos Island. Other instances of incorrect names included country names, such as Ecuador (1), Colombia (2), Panama (1) or Mexico (2), or writing in names of either non-Galápagos cities, like Loja (2), Esmeraldas (1), Quito (3), or Guayaquil (8), or names of Galápagos towns like Puerto Ayora (1), Bellavista, Santa Rosa (2) Baquerizo Moreno (1), or Galápagos sites such as Los Gemelos (1), Puerto Chino (1), El Junco (1), or the Loberia (1). Confusion, then, occurred when understanding distinctions between hierarchies of places, i.e., countries, cities, islands, local park sites etc, and conceptualizing regions of space. This type of geographical knowledge is noted as a challenge for children (Gersmehl & Gersmehl, 2007). Overall, conceptualizing hierarchies and regional geography could be supported more fully, but the high volume of nearby location knowledge indicates substantial experiential learning from children.

5.3.2 Geology

Again, in both interview and focus groups, geology knowledge frequently surfaced. Children tended to be excited to share knowledge about the volcanic origins of the islands. While frequent, the scope of this knowledge was limited to volcanoes. The limitation is supported by the literature looking at children's geological knowledge which notes that it is generally poor in most countries (Dolphin & Benoit, 2016). However, Galápagos children did seem to be able to conceptualize underwater volcanoes and islands with some accuracy, which is noted as a frequent challenge and misconception for children in the literature (Vasconcelos & Paz, 2023). Generally, studies note challenges and confusion with geological knowledge for both adults and children because of the size of spatial and temporal scale through which geology functions (Blake, 2005; Cardoso et al., 2018; Conrad & Libarkin, 2022). Even though geology knowledge for Galápagos children was low volume, it did seem to reflect a decent grasp of these large temporal and spatial scales when discussing Galápagos volcanoes.

In focus group GA6A, a child explained that "Galápagos is very interesting because I…the Galápagos islands were created many years ago by volcanoes." Similarly, the interviewee from GB3B, when asked what else they could tell me that was special about Galápagos, said "that…here this island at the beginning wasn't an island, it was a volcano." I responded, "all the islands were volcanoes?" and the child elaborated and said, "uh huh, in all the islands there's a volcano" (GB3B). In Focus group GA5A, children confirmed this by stating that "the islands were volcanoes" and that "with time they made more volcanoes." The interviewee of GA5A echoed this knowledge when they said "umm…that the islands used to be volcanoes, but over time they dried out and became islands where a person came to see them, and they became like a territory to live there." While this is incomplete knowledge, missing the fact that there are still active volcanos in the West of the archipelago, it does capture the reality of the island where they live, Santa Cruz, which has no active volcanoes.

This narrative was accurately captured in the excerpt from focus group GB3A below. I had asked if there were any active volcanoes, and a myriad of answers followed. Inaccurate knowledge is highlighted in pink. The first inaccuracy may be a misunderstanding fuelled by the fact that volcanic activity around the Galápagos hotspot does start in the ocean. The dispute at the end of the excerpt about the number of volcanoes on San Cristobal is understandable, as it's difficult to know for sure how many distinct but now-fused volcanoes the island is made of:

R – and does it [Galápagos] have active volcanoes?

C – so here [in San Cristobal] therefore there aren't any

C – in Isabela there are

C – in Isabela yes there's one

C – at any moment they are going to explode but they cannot explode on the island, it explodes under the water

C – nooooo

C – they create more and more and more things

C – more

R – here in San Cristobal were there also volcanoes?

C – yes no, no let's see our islands are created by volcanoes

C – here too there's a volcano

C – for example the El Junco Lake

R – ah okay

C – there there's a volcano

C – uh huh I went!

S – there are two volcanoes here but the two are inactive

S – inactive

S – what is the other one?

S – there's only one here!

S – there are two!

A similar dispute occurred in focus group GA8A when discussing how many volcanoes Isabela Island has. One child does note the correct number of active volcanoes (five), though there is one inactive as well:

C - …. Isabela has lots of volcanoes, like five volcanoes

C – four

C – like four

While I explore correction as a potential form of effective peer learning in the next chapter, it is important to remember that not all corrections by peers will be correct themselves, and so peer corrections only serve as methods for learning accurate LEK if the student doing the correcting already has that accurate knowledge.

The knowledge around submarine volcanic activity surfaced again in focus group GA1A when students accurately and collectively noted that the islands were formed by volcanoes and then referenced that the volcanoes started under the ocean and grew from there:

C – Galápagos was created by volcanoes

C – uh huh!

C – uh huh below the...

C – from a volcano! A marine volcano

R – ah okay, like below the ocean?

C – uh huh below the ocean

C – they came out of the ocean and that produced the islands

Overall, geological LEK mostly encompassed volcanic geological topics, understandable for children living on volcanic islands. While the breadth and depth of geological knowledge was limited, the geological LEK that children did share was predominantly accurate and often accompanied by stories and positive emotions, indicating that this is an area of knowledge that could easily grow with more support.

5.3.3 Climate and weather

Knowledge about the local weather and climate was also frequently mentioned in both interviews and focus groups. Much of this knowledge was based on experience and observation, and thus temporal weather or seasonal hallmarks were often disputed between children. Conceptualization of climate vs weather is cited as challenging for some children (Henriques, 2002). More consistent climatic knowledge, such as knowledge that the highlands are cooler and get more rain and damp weather, were less disputed and more accurately shared, which departed from one study which noted that often subjective experience of weather and climate caused people to disagree with recorded data (Goebbert et al., 2012).

Some children seemed to be grappling with the concept of weather vs climatic patterns. Often, observations were based on experience and subjectivity, which opened them up to contradictions from classmates in focus groups. Reliance on subjectivity and not noting broader climatic or weather trends, is a challenge noted for both children and adults (Goebbert et al., 2012; Henriques, 2002; Lang, 2014). For example, when asked the above question, the interviewee from GB3A responded with "like sometimes, every month has its cold, hot or warm season" indicating perhaps a misunderstanding of seasonal changes versus quotidian temperature fluctuations. Confirming this presumption, they went on to say, "as now it's September and so right now it is warm, but sometimes at night it gets a little cold."

In focus group GB3A, a debate over when certain seasons and temperature patterns occurred ensued, after mixed responses to the question about how to describe the Galápagos environment:

C – it's a little cold

C – and a little hot

C – in May that's the coldest time

C – in May and in September

C – yea May and September

C – in contrast, in December it's it's like warm

C – it's warm and until until August it's hot

C – no it's cold season!

C – no May to

C – in August I'm cold

C – but...

C – it's now a cold season

C – we're going into a cold season

Sometimes, observations reflected correctly recognized weather or climatic trends vs isolated experiences with temperature. The interviewee from GA2A, noted, while describing the general Galápagos environment: "it's peaceful it's...although there are some days it's also rainy." The comment on rain was echoed by children in focus groups GA2A and GA3A, both port schools on Santa Cruz, with comments like "in the highlands...there it rains more," (GA2A) or "not like leaving because it rains a lot." While some zones, like the highlands, do receive more rainfall year-round, it is frequent to have a short or light rain shower most days even along the coast in lower elevations.

In focus group GA8A, children also had a lengthy discussion about weather and seasonal changes on the islands, indicating that this was a substantial area of thinking for children, even if the knowledge shared wasn't entirely accurate or consistent:

C – here the environment is hot

R – the whole year?

C – no sometimes there's some rain but when it rains it's cold

R – ah yes, in the highlands as well?

C – yea

C – …when there's a little bit of rain in the port, there's a ton of rain in the highlands

C – um that sometimes when it rains it's not very hot, it's like it's not cold, it's very hot where it's super humid and when it's cold it doesn't rain […]

C – like what [other child] said, in the hot season it is quite hot, but it rains. In the cold season, it is cold, but it hardly rains but…when seasons change things can happen like it is very hot, but it doesn't rain, or it is very cold but if it rains and in times of seasonal change like the one we are in right now…

Overall, children exhibited a high frequency of thought and ideas about weather and climate, despite confusion with experiential and subjective data that each child brought to the table. Similar to geology knowledge, affirmative direction on accurate understandings of climate and weather (and the differences between them) could greatly increase this area of LEK for children. There were definite examples of accurate experiential learning children had around climate and weather, especially in regard to experiences within different ecological zones, such as the rainy highlands and more arid coastal zone.

5.4 Knowledge of human impact on local ecology

Children were deeply and consistently aware of the impact that humans have on the Galápagos marine and terrestrial ecosystems and on individual species. Though infrequent, human impact knowledge is obliquely mentioned in some studies (Aguilar-Gomez et al., 2025; Choi & Woo, 1999;

Duran, 2021). These studies highlighted recognition of pollution, although Galápagos children seemed to go above and beyond this to long lists of instances and specific situations of human impact on the local environment. The frequency of Galápagos children recognizing and understanding human impact on marine environments was echoed more by the literature (Canosa et al., 2021; Praet et al., 2023). This knowledge seemed to fall into three categories: knowledge of negative environmental behaviours; knowledge or perception of the impacts on the local environment; and knowledge of pro-environmental behaviours. Through these areas of human impact knowledge, emotion was nearly always present indicating a strong connection to this knowledge and development of environmental values.

5.4.1 Knowledge of negative environmental behaviours

Children exhibited a keen awareness of human behaviours and human-caused events that were negative towards the local environment. Studies covering this with children were infrequent at best, though some highlight awareness of negative impacts on local environments (Canosa et al., 2021; Praet et al., 2023). The volume of knowledge and emotion on this topic seems to depart from the literature that did exist. Often, this knowledge was based on observations that included frequent experiences noticing trash and plastic in places that they shouldn't be, and other types of pollution. Specifically, pollution and littering awareness is cited as common in areas where significant attention has been paid to local conservation (Canosa et al., 2021; Praet et al., 2023), which aligns with Galápagos. Additionally, children mentioned indirectly and directly hurting local flora and fauna as examples of observed or heard-of negative environmental behaviours of people. This knowledge would often surface when children were asked to describe the Galápagos environment, or in response to questions about if and why it was important to protect the local environment.

The interviewee from GA5A mentioned both indirect and direct harm to local flora and fauna. They noted the harm that introduced species cause to local species and that sometimes people cut down endemic trees or plants which is not only harmful to those species, but in turn causes harm to the animals that depend on them:

> R – And what else what else? How would you describe the Galápagos environment?
>
> C – ummm it's very beautiful and it has some very...very beautiful things that are not found anywhere else, but also, it's that mankind brings lots of things that are not from here and that harm the species here
>
> R – yes of course
>
> C – and they also uproot trees that are endemic like mangroves or other plants like matazarno and that... and that means that some of the animals no longer have homes like the birds that live in the cacti

A child in focus group GA5A also was able to recognize ecosystem disruption caused by humans with a story about past intentional movement of species by people on the islands, referencing the first half of the 1900s when the US actively ran a military base on Baltra Island and removed all land iguanas from the island. While the child does not immediately recognize the past negatives of removing an entire species from one island on that local ecosystem, they do recognize that reintroducing the iguanas to their original habitat was good, and recognized that the ecosystem is now unbalanced because the reintroduction has meant that more cacti are being eaten:

> I really like….the iguanas Because of their story, that a long time ago there was a man who was informed that there were going to be a war in the United States about military things, so he went to look for all the iguanas and put them on another island. Now it is by the airport there and and….so there are many and the story is good but also bad because they are eating all the cacti

Pollution, in the form of trash and air and water pollution, were noted by many children. The interviewee from GB3A noted instances of plastic pollution with bottle caps, other plastic, and toys lying in the street, and noted a lack of recycling of plastic, such as with soft drinks bottles. In focus group GA5A, when one child had a negative response to how to describe the Galápagos environment, other children initially were confused but then understood and added on when the first child explained that it was unpleasant because of trash and pollution:

> C – the environment is unpleasant
>
> R – it's unpleasant?
>
> C – what?
>
> C – what?
>
> C – because of the drunks
>
> C – because of trash and fumes

Similarly, in focus group GA5A, a child noted that the Galápagos wasn't beautiful because people were polluting everything, stating "it's not very nice because they throw garbage and begin to pollute everything," echoed by another child in the group who added "there are a lot of people throwing trash." The interviewee from GA1A also noted pollution and trash when describing the Galápagos environment, in both the towns and potentially the highlands:

C – mmm, ehhh, as they say…polluted, with a lot of trash

R – with a lot of trash? Here in the city or in other places?

C – here. In other places and here too

Children in focus group GA1B also called out active problems with negative environmental behaviours, noting that some people did not recycle or that some people threw things in the ocean or, more generally, that people did not take care of (cuidar) the environment:

C – people don't recycle

C – they don't take care of the environment!

C – they don't take care [of it]!

C – they don't take of the Galápagos

C – things are taken into the ocean

Children in focus group GA4A also noted that trash was a significant danger to local animals because animals would often eat plastic or trash lying around which was very harmful to them. This conversation, contributed to by many children telling stories of seeing or hearing about local animals eating trash, was initiated by a comment from one child who said, “people cause disasters by throwing garbage into the water and then the animals come and eat it”. Similarly, in focus group GA7B, children noted observations of trash and other water pollutants including gasoline from boats that they connected with seeing dead fish in the water:

C – You can also see a lot of trash around the docks at night

C – uh huh and gasoline

C – the gasoline looks like a galactic colour and, the bad thing is I found two fish and two....

C – I found a fish… it was dead

This was echoed by the interviewee of GB3C, who also noted that they saw dead fish at the beach and connected that observation with the note that the ocean was infected, or polluted:

C – no no no but…like before, before, I went to the beach I saw some dead fish

R – oh no!

C – because the water was infected

Children sometimes shared stories about violent harm directly done to species including a story about a sea lion that had been killed by a dog, shared in focus group GA4A below. Awareness of the harm that introduced species can cause native species was prevalent, and often elicited emotive reactions from children:

C – because the sea lions come to Pelican Bay here

C – at three in the morning there was already…and the dog had killed the sea lion

C – poor thing

Overall, children exhibited substantial LEK about the negative human impacts on the local environment, frequently driven by visceral and emotionally impactful experiences and observations around the islands. While recognition of pollution and negative impact does mirror studies with other coastal and island communities (Canosa et al., 2021; Praet et al., 2023), the volume and emotive nature of this knowledge departs from the literature.

5.4.2 Knowledge of impact on the local environment

Beyond observations of negative environmental behaviours by humans on the local environment, children were also very aware of larger scale impact on the environment because of humans, including often hyperbolically noting what might happen to the Galápagos and its flora and fauna if humans did not actively work to protect it. This often took awareness and knowledge of pollution or negative behaviours and extrapolated from them.

The interviewee from GA6B noted that it was important to protect Galápagos "because with so much pollution we are going to see our species are going to disappear," recognizing the negative environmental behaviours of polluting and the consequence of loss of species. The interviewee from GA1A also noted that if they don't take care of the local environment, there would be a negative impact on animals because of the trash. Children in focus group GA5A also all agreed that it was important to protect the Galápagos environment, and one child noted that they should protect it "because it's important that the animals don't get entangled with the trash and…go extinct." Relatedly, a child in focus group GA6C noted that people "cannot throw garbage in the sea because…the fish eat it, and they can die".

Children recognized species loss as an obvious impact of human activity. In focus group GA4A, for example, after a chorus of agreement that it was important to protect the Galápagos environment, children noted that it was important because:

C - because of the animals and plants

C - for the flora and fauna

C - because if there isn't flora and fauna no…

C - because…the tortoises went extinct with other animals

Other children connected explicit mention of species loss with mentions of the endemic, native, or unique qualities of the species themselves, such as the children in focus group GA3A, who, after agreeing that it was important to protect the Galápagos environment, noted why:

C – because it is a…. unique?

C – because….there isn't as much flora and fauna in other countries?

C – I have to take care of it for….

C – they are unique! Endemic

C – because vegetation can be lost and become extinct

C – and the animals

C – can go extinct

C – die

In focus group GA8A, there was a mix of implying species loss and speaking directly to uniqueness of the species, and, in detail, noting how human impact could cause species decline. The comment about the possums, while incorrect (they have not been introduced), notes the sentiment around introduction of species:

> C – yes because the animals and plants of the Galápagos are endemic to the island and are not found anywhere else in the world.
>
> C – taking care of the animals is very good. For example, someone touches a baby sea lion and when or… its mother does not give it food and none of its milk so it dies, so we must take care of the environment of the Galápagos
>
> C – the Galápagos environment is a very precious place that must be protected and because again or recently something terrible has happened that the possums have been introduced to the islands so there is a lot…… about what enters what leaves and what happens to the islands
>
> C – we must protect because if not the species may die…

Children in focus group GA6C and GB3C also blended acknowledgement of species loss with clear recognition that it was particularly bad to lose endemic or native species. In focus group GA6C, children noted that it was important to protect the Galápagos environment:

> C – because the endemic animals can go extinct
>
> C – uh huh yea
>
> C – they're unique to Galápagos

Similarly, in focus group GB3C, children noted it was important:

> C – because they [species] are unique in the world and
>
> C – because if you have a lot of garbage, it can be...
>
> C – that can't happen
>
> C – animals can suffocate with plastic bags

In one focus group, children began discussing the perils of gasoline in the ocean, bringing up a detailed story of an fuel spill in the ocean and it's observed impact on the marine wildlife: "There was a little fish that died like a thousand fish because...they poured gasoline, I don't know what they poured a big pile of, I think they poured...because you had all the little fish floating around in the...I think because of the.... And sea lions are on the other side" (GB2A).

Children were readily and passionately able to describe future events and knock-on effects of human impact, though sometimes this veered into hyperbole, blending perceptions of negative impact in a way that was not entirely inaccurate but jumped scales to unlikely or non-immediate possibilities or events that were not reasonable to connect in the near term.

An example of non-hyperbolic future events knowledge was in a comment made by a child in focus group GA8A, who described multiple sequential effects of human impact, through lack of protection, on local species, resulting in a trophic cascade:

> We must protect the islands because if animals are not protected, essential animals could disappear, and the balance of the islands and the food chain would be most affected. If the

> lobster disappears, the… there are many giant tuna that would disappear, and since it is the lobster, the sea lions would only have fish to feed on, so the sea lions would be hungry… the fish would also become scarce and if the sea lions become scarce, the tiger sharks or other sharks will become scarce […] and without sharks there would be an abundance of marine species and a natural disaster (GA8A).

In focus group GA7B, there was an example of both hyperbole, which was based on accurate understanding of potential impact, and a reference to climate change (which was not mentioned in any other groups, though was also not explicitly asked about), indicating awareness of larger-scale environmental impact:

> C - … [important to be] the people who do not litter and who take care of the environment because otherwise all species will die
>
> C – now more sun will come because they are polluting too much

Another example of hyperbolic thought, while based on accurate knowledge about human impact, was in focus group GB3B, when children mentioned a leap from trash pollution to becoming ill to pollution of all air, people dying, and loss of plants leading to a total loss of oxygen. While these are not entirely incorrect ideas, they indicated a level of impact that was hyperbolic. The conversation was prompted by agreement that it was important to protect the Galápagos environment, because:

> C – because if we don't take care of it and throw garbage away, the animals and we can't get sick because all the air gets contaminated

C – people die

C – and also if they throw a lot of garbage and if there are no plants there will be no oxygen

C – and if they throw garbage into the water the animals can go extinct

C – you won't see tourism here anymore since they are going to become extinct since we are throwing so much trash

The final jump to tourism was an interesting turn to impact on human communities, instigated by initial negative impact by humans on the non-human ecosystem. It was echoed, though, by another hyperbolic example from focus group GB1A, in which a leap was made between total species extinction in Galápagos, to the statement "Galápagos wouldn't exist" to the destruction of the economy and tourism. Again, this conversation followed agreement that it was important to protect Galápagos:

C – because animals can become extinct and so can plants and if these endemic animals did not exist, Galápagos would not exist.

C – and tourism and the economy

C – there would be no tourists

A final example of noting impact back to humans from human-caused harm to the environment was another mention of loss of tourism, amongst comments about species loss and general environmental degradation in a conversation in focus group GA7B. Children were mentioning why it was important to protect the environment, or in other words, mitigate negative human impact:

C – so so that the animals don't die

C – the species

C – native species

C – and to protect the environment

C – and so that animals don't die because if there weren't any animals, there wouldn't be any flora and fauna

C – uh huh

C – yea

C – yea and tourism!

C – yeaaa tourism

While one of the children's comments about animal loss leading to no flora and fauna includes a slight misunderstanding of what flora and fauna means, the general sentiment of the conversation was one of need for protection against harm for local species before a mention of potential impact back on human communities economically.

Overall, children exhibited frequent, accurate, and emotive LEK around human impact on their local environment, which also predominantly displayed ecocentric values – noting inherent value of ecosystems and species separate from their value to humans. Much of this knowledge was constructed through personal experience, or through stories of experience shared with them. Awareness and knowledge sharing of human impact on the Galápagos environment shows nuanced understanding of the socio-ecological sphere in the islands. While some children did hyperbolically state human impact, the willingness to think big and far into the future should not be discouraged and the emotions and concern about large-scale knock-on effects of human impact on their own environment and more broadly aligns with an overall need for humans to see global environments as entities with inherent value (independent of their value to humans) thus imbuing nature with inalienable rights, and which addresses parts of the environmental polycrisis, including unsustainability, biodiversity loss, deforestation, ecosystem collapse, and climate change that all human communities must be aware of and seek to remedy.

5.4.3 Knowledge of pro-environmental behaviours

Throughout conversations in both interviews and focus groups about protecting the environment, children displayed passionate knowledge about pro-environmental behaviours (PEBs). While frequent, the listing of PEBs was often limited to a few immediate and superficial behaviours, most frequently, correct waste disposal, or engaging in recycling, which is reflected in literature with both adults and children on the PEBs taught to them or encouraged by programs (Collado & Evans, 2019; Lauren et al., 2016; Liu & Green, 2024; Thomas & Sharp, 2013). This narrow and superficial focus does a disservice to children, especially when they display enthusiasm and ability to do more. Some literature does note the need for programs to teach and encourage more complex and impactful PEBs, beyond the easy superficial ones (Lauren et al., 2016; Thomas & Sharp, 2013). Sometimes, answers didn't get as far as PEBs, with children answering the question "how do you protect the Galápagos environment" with an answer like "we take care of it", indicating an understanding that care needed to happen, but not actually providing an answer to the question of how. This reflects robust environmental attitudes and emotions but doesn't quite make the leap from attitude to behaviour understanding (Otto et al., 2019; Schmitz & da Rocha, 2018). An example of this is in focus group GA4A below:

C – don't throw things on the ground

C – do not harm the environment

C – take care of the flora and fauna of Galápagos

C – without throwing garbage

C – we must take care of all the animals and all the plants so that they do not die

C – you have to take care of Galápagos

Other circular or non-answers included a child who, to the question, how do we protect the Galápagos environment, responded with "protecting the environment" or more uses of the phrase 'take care of' such as "take care of the plants!" (both from focus group GA7A), or simply the word "cuidar" ("take care of") on its own (focus group GA6C), or "take care of the animals" (focus group GA3A) or "taking care of the animals" (focus group GA8A). Taking care of was mentioned in a total of 10 focus groups, though is not an explicitly behaviour that can be undertaken.

The most common PEB was 'don't throw trash,' mentioned in 15 focus groups (GA1A, GA1B, GA3A, GA4A, GA5A, GA6B, GA7A, GA8A, GB2A, GB3B, GA6C, GB3C, GA7B, GA6A, GB2A) and was usually connected to a location (on the ground, in the street, in the ocean or water) or sometimes, but not frequently, related to recycling. Relatedly, 'collect or pick up trash' was mentioned in four focus groups (GA1A, GA4A, GA6B, GB3C). Other PEBs such as 'don't pollute,' was mentioned in three focus groups (GA1A, GA5A, GA3B), and 'recycle' was mentioned in five focus groups (GA1B, GA7A, GB2A, GB3B, GA7B). In focus group GA7A, students mentioned two of these and a reason for one while talking about how to protect the local environment, noting:

C – um…don't throw trash, don't poison the water

C – and….don't kill tortoises […] and don't don't…hmm…don't throw anything toxic in the water so that it doesn't poison the dolphins or whichever other species

In Interview GB3C, the child also mentioned not to throw trash and not to pollute, stating "tell people not to throw garbage, not to throw garbage into the water and and not to…and not what is it called, not to pollute." In focus group GB3B, multiple children mentioned not throwing trash and not polluting:

C – don't throw trash

C – don't throw trash so that we don't harm our ecosystem

C – don't pollute the environment

[…]

C – it does not set up factories, it makes the air polluted

Other children mentioned not harming animals or the environment, "don't maltreat" the animals (focus group GA3A), "don't hurt the environment because it is beautiful" (focus group GB3B), or simply, "don't harm the environment" (focus group GA4A). Or mentioned not driving cars to reduce pollution such as the mention in the longer conversation from focus group GA6B that covers many of the PEBs and is an example of children both correcting each other ("*don't* use vehicles"), adding information "to not pollute the air" and referencing related topics like renewable energy with the mention of the wind turbines on Baltra island:

C – umm don't throw trash

C – don't throw trash in the ocean

C – don't throw trash on the beaches

C – when we see a person throwing something into the ocean, tell them not to throw anything dirty

C – collect trash

C – use vehicles…

C – *don't* use vehicles

C – to not pollute the air

C – sometimes with vehicles we saw that they also run over animals

C – the better thing is walking or going by bike

C – no no not on motorbikes no!

C – because electricity can be obtained from solar panels for electric motorcycles

C – now that it's sunny

C – they recharge

C – in Baltra it is quite windy ready for the turbines to…

Other less frequently mentioned actions were: “don’t burn trees” and “make fires in zones where it is permitted” in focus group GA1A; “keep your distance” followed by “in zones where animals live” in focus group GA6C; “don’t touch the animals” mentioned by two children in focus group GA6A and one from focus group GA8A; “not poisoning plants” from a child in focus group GA3A; “don’t dump gasoline!” by one child in GB2A; “plant more endemic species” from a child in focus group GB4A or “planting new trees!” by a child in focus group GA7A; or “save water” by another child in focus group GA7A. Three focus groups touched on actions around fishing, noting that it was important not to have illegal fishing (focus group GA8A), or in some way being careful with the types of species being fished (focus group GB3A).

Many of the actions mentioned were specific to Galápagos, which, as that was the question, is appropriate. But it does show that the focus for PEBs is on visible and direct impact and often is framed in the negative, in terms of what not to do. PEBs can be both negatives, as in what to avoid doing, and positives, in terms of actions to engage with (Liu & Green, 2024), but the prevalence of negatives in Galápagos seems distinct in the literature. Supplementing this list with a resource for positive PEBs which entail engagement with positive action, instead of avoidance of negative action, could help children to expand their PEB vocabulary and abilities.

Overall, the breadth of appropriate local action seems to be limited and nearly all PEBs were avoidance of negative actions with immediate and direct impact. Children did align with literature which highlighted simplistic PEBs such as saving water or energy or recycling (Lauren et al., 2016; Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Thomas & Sharp, 2013). For example, despite the Galápagos being at high risk for climate change-caused harm, only one mention of reducing carbon emissions or attempting to mitigate climate change was offered as ways to protect the Galápagos environment, by one child in focus group GA5A: “and we have to connect the electricity so that when the smoke from… gets among the atmosphere, the sun is very hot and is bad and things can die.” The paucity of climate change references could reflect themes that have not yet been included in formal education for children in 5th grade but could very well still be an area to strengthen. The emphatic insistence by children that it is important to protect Galápagos indicates willingness to engage in PEBs, so providing them with more ideas and examples of actions they could take would be beneficial.

5.5 Chapter Conclusion

Children shared a tremendous volume of LEK through all data collection sources. Most bountiful was the presence of species name knowledge, which was exhibited through rates of correct identification of Galápagos animal and plant photos on the survey, but also in the prevalence of names of local species during interviews and focus groups. Species name knowledge as the most plentiful is echoed in the literature (Hooykaas et al., 2022). This knowledge was more accurate and more substantial for local animal species than for local plant species, which is aligned with common trends in species knowledge for both children and adults (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018) but could also indicate that there is more emphasis and use of animal names and animals in general around the islands in conversation, teaching, informal programs, signage, murals etc. which children receive. Highland children displayed more accuracy when identifying common local plant species than port children, which could indicate that highland children are more aware of plants, living in a more rural, highly vegetated area than their peers. Rural children with greater plant knowledge than urban children are noted in the literature (Díez et al., 2018; Eyssartier et al., 2017). Children also exhibited significant knowledge about species status, such as endangered, and species category, such as endemic or introduced, which departs from the data (Ciążela & Gogacz, 2024; Gavrilakis et al., 2024; Rigoberto et al., 2021; Sosa et al., 2021; Stazione, 2025). Children were generally accurate when connecting status and category to plant and animal species when conversing about endemic, endangered, native, invasive, or introduced species, with minor confusion points that, in focus groups, were often corrected by peers. Children also displayed a high volume of accurate species location knowledge, which departs from the literature (Strommen, 1995).

Less abundant but still notable was children's knowledge of local geography, geology, and climate and weather - all elements of LEK but not the most popular or well-versed ones. Children's volume of accurate, nearby location knowledge was beyond what is noted in the literature but aligns with assumptions for type of location knowledge children construct (Gersmehl & Gersmehl, 2007; Reynolds & Vinterek, 2016). Children did struggle with larger-scale geography such as describing different islands in the archipelago other than inhabited islands, which reflects literature noting challenges for children with hierarchical and regional geography (Gersmehl & Gersmehl, 2007). Knowledge of geology was present but limited to the awareness of volcanic activity, which reflects limitations noted in the literature (Dolphin & Benoit, 2016), although grasp of volcanic activity and island formation was better than noted in studies (Vasconcelos & Paz, 2023). Finally, children exhibited advanced knowledge of human impact on local ecosystems, often paired with highly emotive stories of observation and experience witnessing real-time impact on animals in Galápagos or specific and highly visual examples of human impact on local plants and trees through citing what behaviours should not happen locally. Knowledge of impacts such as pollution was well documented in the literature especially in other protected areas (Canosa et al., 2021; Praet et al., 2023). Knowledge of PEBs that could be locally enacted to take care of the local environment was present, though the breadth of these PEBs was limited and often included behaviours such as recycling or picking up trash, this limited list echoed in the literature (Lauren et al., 2016; Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Thomas & Sharp, 2013).

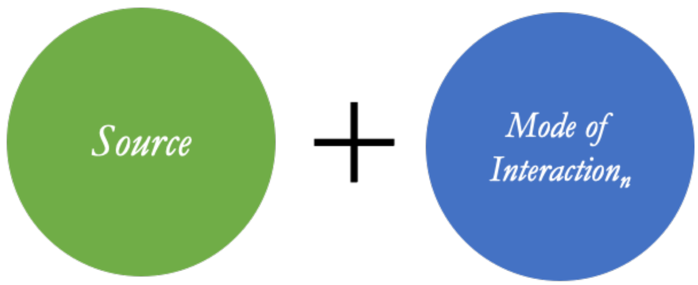
6. Bountiful Local Sources

6.1 Chapter Introduction

This findings chapter explores how each of the data sources collected help to answer the second research question of this study: How do children describe the sources from which they learn about their Galápagos environment? To clarify, a source is not a physical location, but a provisioner of knowledge, which may include other people. Physical locations of learning often correspond to sources but will be explored separately in the following chapter. It became clear while analysing data, that sources were nearly always connected in some way to a channel or way of interacting with that source. Because of this, in this chapter, I not only explore the sources of learning about the local environment, but also the corresponding described modes of interaction with each source of knowledge. Figure 19 below visually represents this arrangement, noting that a single source of learning is always paired with at least one mode of interaction with that source. This combination of source and modes of interaction was how children described their learning and thus the below model emerged.

Figure 19

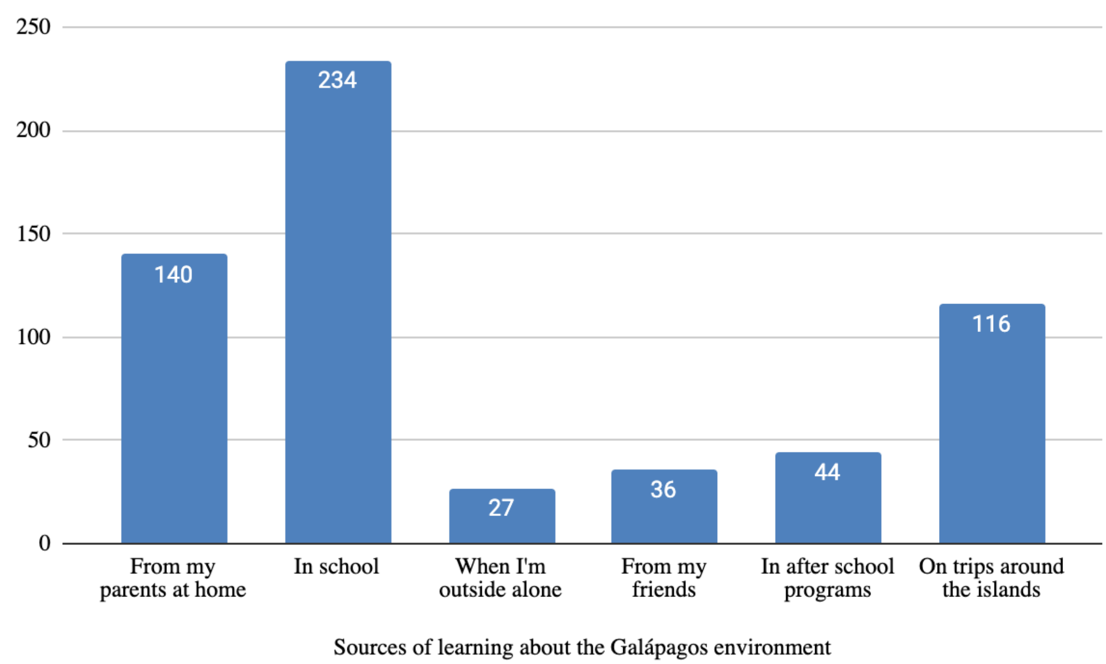
Proposed model of connected sources of learning and modes of interaction



To introduce sources, we look to one of the survey questions which asked Where do you learn things about the Galápagos environment?" and provided multiple choice options of sources for environmental learning as answers. Children could circle as many answers as they felt were true for them. The use of the word where in this question, upon reflection, was not the correct term to use and muddied the waters between research questions. The wording of the multiple-choice answers to this question, however, reflect sources more than physical locations. The responses are collated below in Figure 27 and show that a large portion of children perceive the school as a source for learning about the environment. Just under half of children thought the same about parents, and just over a third felt that they learned about the environment during trips around the islands.

Figure 20

Sources from which Galápagos children perceive learning about the local environment



Note: Data taken from survey question seven: Where do you learn things about the Galápagos environment? Children selected as many responses as fit their perceptions; with non-responses removed, there were 327 charted responses

While the answers provided to the survey question delineate six possible sources, it became clear through interviews and focus groups that there were other sources not included in the list above. The subsections in this chapter are organized to explore each source of learning and the corresponding modes of interaction with that source that emerged through the described analysis above. Five main sources emerged, and each had at least one mode of interaction described by children, as outlined in Table 11.

Table 11

The sources from which children perceive learning about the environment and modes of interaction with those sources

Source	***Modes of Interaction***
Time in Nature	1. Conducting solo exploration 2. Conducting exploration together with friends
Family	1. Receiving direct instruction from family members 2. Observing family member behaviour 3. Participating in family-facilitated activities
Organizations	1. Engaging in unplanned encounters with organizational staff 2. Receiving instructive presentations from organizational staff in schools 3. Participating in planned visits to organizational centres and sites
Schools	1. Receiving direct instruction in classrooms from teachers or staff 2. Conducting outdoor projects at school
Peers	1. Knowledge snowballs 2. Correction

	3. Confirmation

It was clear in these findings that a diversity of sources was beneficial and necessary for constructing the considerable LEK, which is supported by the literature (Amin et al., 2019; Pretelli et al., 2022; Takyi et al., 2023). Some sources provided a mix of both general ecological knowledge and LEK, particularly schools, while others provided higher concentration and diversity of LEK, such as time in nature, family, organizations, and peers.

6.2 Time in Nature + (Solo exploration, Exploration with Friends)

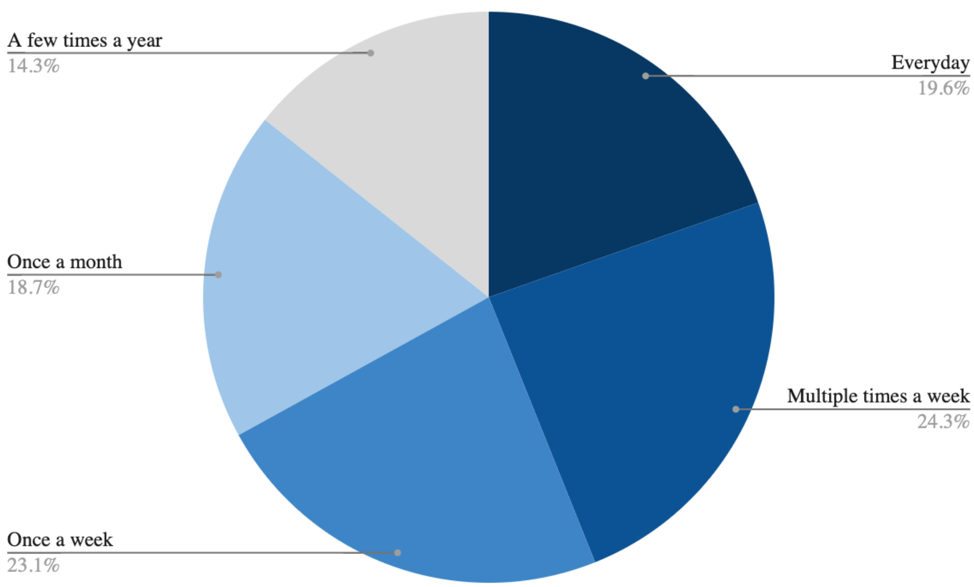
Through survey questions and in conversations with children, "time in nature" emerged as a prominent source for Galápagos environmental learning. Modes of interaction with this source were solo exploration and exploration with friends. Time in nature is viewed as a potent experiential source of LEK and general EE (Carrière et al., 2017; Gundersen et al., 2016; Louv, 2005). Some studies note a definite decline in this source of learning (Louv, 2005), pointedly encouraging children to spend more time in natural spaces, especially for solo exploration and with friends for the purpose of LEK leading to nature connection. Relatedly, studies that note an increase in adult-controlled time in nature as detrimental to the rich agency-filled environmental learning children can conduct on their own or with peers (Gundersen et al., 2016; Louv, 2005; Skår & and Krogh, 2009).

As visualized in Figure 21, pulling data from the survey, over two-thirds of child respondents (321 of the 337 surveyed) to the question, "How often do you do activities in nature in the Galápagos?"

stated that they spend time in nature at least once a week, with 24.3% of responding children spending time in nature a few times a week and 19.63% spending time in nature every day. Importantly, only 14.33% of responding children said that they only spent time in nature a few times a year, meaning that for most children, the source of time in nature is accessible and they interact with it frequently.

Figure 21

Galápagos children's perceptions of how frequently they do activities in local nature



Note: Data taken from survey question eight: "How frequently do you do activities in nature in Galápagos?" With non-responses removed, there were 321 useable responses

These modes of interaction may happen in forests or parks or nearby beaches and can be rich in experiential environmental learning, as supported by the literature (Carrière et al., 2017; Gundersen et al., 2016; Louv, 2005). In both port and highland schools, child participants noted that they find local natural spaces that they can readily explore and do so often, which contradicts literature from urbanized spaces and non-island spaces where access is more limited (Mohamad Muslim et al., 2017; Rigolon & Flohr, 2014).

The child interviewee from class GA6C, when asked if they remembered learning about the environment when they were younger, noted that, "hmm…I sometimes learned about the environment outside of my house because outside of my house, which is close by, we have a lot of plants." In this way, the child interacted with the source of time in nature through exploring a space around their home which was, to them, a clearly natural space with lots of vegetation.

Similarly, the child interviewee from class GB1A simply stated that he learned about the environment "when I'm on my own. On my own sometimes walking or with some friends and nothing more". Friends as co-explorers are noted as important for EE, but unstructured time with peers in natural spaces, especially without adults, is generally on the decline globally (Gundersen et al., 2016; Skår & and Krogh, 2009). The child from class GA1B, when asked how they learned about their local environment, said "I learn when I know how to do things, like I know how to go do things with my friends, we know how to go visit things, we know how to go to the beach" highlighting that agency as young children gives them access to and even permission to have interact with time in nature as a source of environmental learning. The benefit of this source to increase child agency in general and as facilitators of their own learning about the environment is supported and encouraged by the literature (Carrière et al., 2017; Gundersen et al., 2016; Louv, 2005).

Children sometimes noted that access to solo or friend exploration was easy for them because of access to local sites. For example, the child interviewee from class GA7A, a port school, when asked if they liked to spend time in nature, said yes, and then when asked where, noted "um...at my house, because I live in —----." The redacted village is one in the highland area, not in the port city. The child went on to note that they liked the highlands better than the port "because there I live with nature, with dogs, and with my family." For this child, the highland villages, in the scalesia ecological zone, were explicitly natural spaces for them to explore. The child from highland class GA2A, who had moved to Galápagos within the last year, and who confessed that they didn't know many animal names yet, noted that they learned the few species names that they did know and saw the animals "when we go out with my friends on excursions/trips." This emphasizes the accessibility of building environmental knowledge.

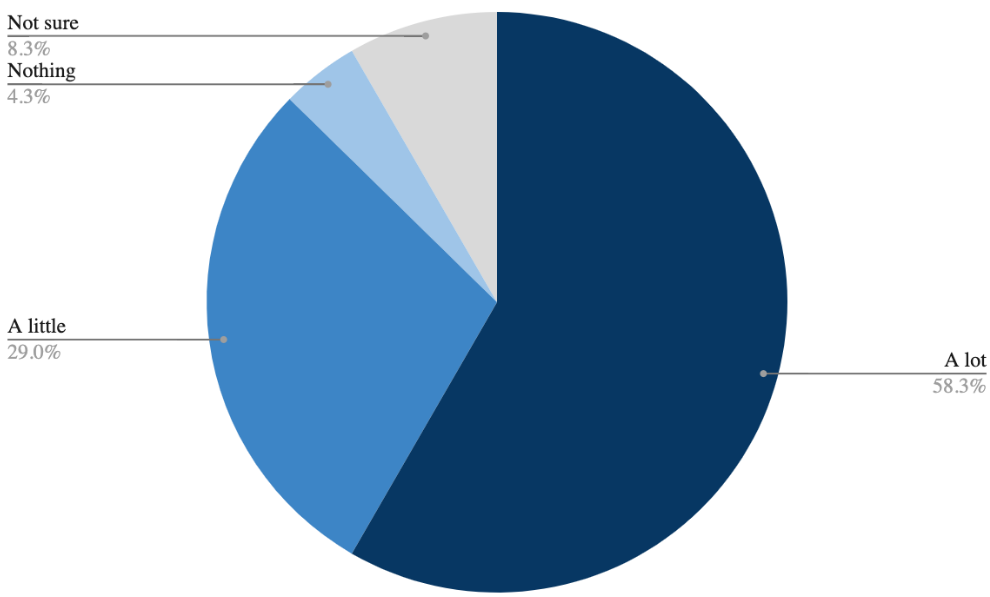
6.3 Family + (Instruction, Observation, Activities)

Another source from which children learn about the local Galápagos environment was family, with three modes of interaction: direct instruction, observation of family member behaviour, and participation in family-facilitated activities. Family, especially parents or caregivers, are noted in the literature as a potentially effective source of LEK (Bulnes, 2013; Jaun-Holderegger et al., 2021; McCarter et al., 2014; Setalaphruk & Price, 2007). Especially for the transmission of IEK, family and other adult community members are essential conduits and sources for that knowledge (McCarter et al., 2014; McCarter & Gavin, 2011; Sumarwati et al., 2020) though for LEK, sometimes parents and family are less abundant sources of that knowledge (Evans et al., 1996; Istead & Shapiro, 2014) which is contradicted by frequent evidence to the contrary in Galápagos.

As mentioned at the start of the chapter children deem parents as one of the foremost sources for environmental learning about Galápagos. In more detail, a later survey question asked children how much they learn from their parents about the Galápagos environment, (results in Figure 22). 58% stated that they learned a lot from their parents and 29% stated that they learned a little bit from parents.

Figure 22

Galápagos children's perceptions about how much they learn from parents about environment



Note: Data taken from survey question nine: "How much do you learn from your parents about the Galápagos environment?" After non-responses were removed, there were 324 useable responses

In interviews, some children noted that they see their parents as holders of environmental knowledge due to their tenure living in Galápagos. Tenure in a place as proxy for higher LEK is reflected in literature, mostly around IEK (Okui et al., 2021; Setalaphruk & Price, 2007). The child I interviewed from class GA8A noted that their parents teach them about the environment and qualified the parents as a learning source by stating that "they've lived here for more years than I have". This introduces an important tangential note that there should be a distinction between age of family members and years lived in Galápagos. Because many current residents are recent immigrants from mainland Ecuador or internationally, older generations may not necessarily be richer sources for local environmental learning, which contradicts the above literature.

The first mode of interaction with family was direct instruction, which is noted in the literature (Bulnes, 2013; Kola-Olusanya, 2005). This was noted particularly for early-years learning for children; and based on family member occupation - family teach or taught children about the environment because they had specific knowledge via their occupation. Children specified that parents were some of the first people to teach them about the Galápagos environment, which is reflected in some literature, especially for children learning IEK (Adom, 2022; Gallois et al., 2017; Kola-Olusanya, 2005) One interview question asked children who taught them about the environment when they were younger, and as a response, many children noted that their parents or other family taught them. The child interviewee from class GA1B noted that "my parents, they taught before I started going to school;" GA2A noted "yes, my parents;" and the interviewee from class GB1A confirmed that his parents taught him when he was younger, stating that "my mom, my dad and nobody else." Another child noted that his parents were who taught him about the environment when he was little, stating "from my parents because from [that age] they started teaching me what the environment was like."

Direct instruction was also a mode of interaction contemporarily with family members who had environmental occupations. While there is evidence that careers adults who work in environmentally-related jobs hold significant bodies of LEK, such as jobs in fishing, farming, or conservation (Ardoin & Heimlich, 2013; Berkström et al., 2019; Garavito-Bermúdez, 2020; Iniesta-Arandia et al., 2015; Pontón-Cevallos et al., 2022), and while we can then predict that adults with those careers and that LEK may then transfer it to children, this particular phenomenon is not documented in the literature. The phenomenon in Galápagos reflect the unique concentration of conservation and environmentally oriented careers in Galápagos. The interviewee from GA6A, when asked how they learned about their environment, said "because my dad was...what's it called...uh he works on a boat and what's it called and there he saw a lot of touristy things" referencing ecological tourist sites in Galápagos that the father then directly shared information about. Similarly, the interviewee from GB3A shared that they think that they learned about the Galápagos environment because their dad had a specific job and shared information from that job: "honestly I learned this...when when my dad was a fisherman".

The second mode of interaction was observing family member behaviour. Observation of family as a way of learning LEK is well documented for children, especially within Indigenous communities (McCarter et al., 2014). The interviewee from GB3C, recounted:

> Let's see...I learn to take care of the environment when my mom goes to water the plants [...] I learn because my mom always doesn't contaminate the water, no no she doesn't open the faucet too much because afterwards we leave the faucet open. ...there is there is there is...the water runs out

While this represents an incomplete piece of knowledge, the interaction serves as a learning experience about nurturing plants and saving natural resources that may help the child to form more mature knowledge.

Finally, the third mode of interaction was participation in family-facilitated activities. Frequently, these activities were outings to natural spaces, or after school programs that a family member signs a child up for and takes them to, or even days when family members bring children along to their environmental job. Families as facilitators for EE is regularly seen in the literature, though more frequently for IEK transmission (Gundersen et al., 2016; Skår & and Krogh, 2009). Family helps children gain access to more Galápagos sites, that may be challenging to reach on their own. The interviewee from GA6A remembered that “hmm…my dad always took me to the beach and because of that I like the beach and I like to swim” exemplifying how this mode of interaction with family can lead to environmental learning by facilitating a child to have an impactful environmental learning experience.

Additionally, children sometimes participated in family-facilitated outings to a family member’s environmentally associated workplace. For example, the interviewee from GA5A, when asked how they learned about their environment, said “[from] my parents. Because my dad is a [national] park guard and sometimes he brings me to his work so that I can help him.” Finally, family can facilitate activities that lead to environmental learning by enrolling children in programs or encouraging them to participate in external activities. For example, the child interviewee from class GA1A explained that their mother signed them up for a National Park after-school program and then goes on to describe some of the environmental knowledge that they gained from that experience:

> my mom enrolled me in the National Park, there I learned about species, everything. I even learned that… what are they called, the mari- iguanas, the iguanas make eggs in the ground, and they lay eggs. But they leave them unburied, it leaves them like that, but it puts three and each one comes out. And from the sea turtles I learned that they make nests under the ground, but to make the ground harder they make it with pee and poop, and they make a mixture, and they put it there and the parts [flippers] that they have, they're like diggers.

In this way, parents and other family members effectively open the doors to considerable environmental learning by facilitating access to learning spaces even if they don't feel confident leading those learning experiences themselves.

6.4 Organizations + (Unplanned Encounters, In-School Presentations, Visits)

Local organisations were another explicitly mentioned source of LEK for children. Organisations as sources of informal environmental learning for children are referenced frequently in the literature (Jun, 2019; Lugg & and Slattery, 2003; Soykan et al., 2018; Yusof, 1999), although many studies note that these spaces are usually hard to access or have multiple barriers to entry (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013), which is contradicted on inhabited islands in Galápagos. Children identified three modes of interaction: unplanned encounters with organizational staff 'in the wild,' in-school presentations done by organizational staff, and planned visits to organisational sites. Unplanned encounters with staff are not represented in the literature, and the frequent studies noting inaccessibility and infrequency of visits to National Parks elsewhere (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013) would indicate that these frequent encounters in Galápagos are unique to the islands and the accessibility and closeness of parts of the National Park. In school presentations by National Park and other orgs are also not well documented in the literature, though studies do note the benefits of guest speakers across topics (Kong, 2018; Mazzatenta, 2008; Ward, 2011). Planned visits are most frequently mentioned as a way for children to engage with organisations, but again are tempered by challenge to access such spaces (Jun, 2019; Lugg & and Slattery, 2003; Ostergren et al., 2005; Soykan et al., 2018; Van Zyl et al., 2019; Weber & Sultana, 2013). Through these modes of interaction, children perceive organizations, especially the National Park, as authoritative holders of environmental knowledge and even environmental regulations, positioning these organizations as trusted and legitimate sources of learning.

The organisation that was most frequently cited was the Galápagos National Park, which reflects its ubiquitous nature. But in addition to the park, children also mentioned the Agencia de Bioseguridad Galápagos (ABG, the Agency of Biosecurity), which is an institution on the islands under the remit of the Ministry of the Environment in Ecuador, and which carries out programs for invasive species eradication, control, and education. Smaller organizations, such as Hacienda Tranquila, a non-profit located on San Cristobal, which provisions informal environmental learning, "socio-environmental improvement and educational initiatives" for residents and international visitors, was cited as leading workshops within schools and field trips with children in schools (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013). And on Santa Cruz, children explicitly mentioned the Charles Darwin Research Station, of the Charles Darwin Foundation, and the interpretation centre and exhibition hall at the research station. Even in the final quote in the previous section, we can see a sample of the actual knowledge a child gained from participating in a National Park program for children.

Examples of the first mode of interaction, unplanned encounters with staff, include children referencing times they witnessed park staff making observations of local species for research or monitoring areas of the park. These interactions were often 'in the wild' (not at designated park sites like the tortoise breeding centre, and thus not a planned encounter with park staff). This is not documented in the literature thus far. The Galápagos is unique in this case as the whole of the islands are national park, vs a separate space that is often far from human habitation, so the chances of these unplanned encounters in Galápagos are considerably higher than elsewhere, where access and barriers to local entry are high (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013). As example of these impromptu encounters, the interviewee from GA1A explained that they had been told by a parent to not litter and not throw trash in the ocean, and this initial learning was concretized through a memorable encounter that involved park staff:

> C - If you want, if you want, how do you say, it not to be polluted, collect the garbage, the garbage in the ocean, but then I learned later I realized that the ocean was polluted, and we saw a turtle entangled right here with little pallets [...] and then a National Park [person] came and helped it
>
> R - ahh right, in the National Park?
>
> C - uh huh and and I know I learned from that [experience] and then I was getting used to not throwing away [trash]

Similarly, the interviewee from class GA1B noted that they were able to learn something through an unplanned encounter with park guards who were monitoring sea turtle nests on a beach:

> C - sometimes there are some turtles there, because a turtle came there and laid eggs [...] and there are guards there collecting the eggs to take care of them
>
> R - Ah right, to protect them or something?
>
> C - ah to protect them they cover them up because they said because there is this one....there are rats the species is...how do you say...the species I don't remember but

While the knowledge the child gained from observing and talking with the National Park guards wasn't fully formed, it was nonetheless a memorable environmental learning experience.

Similarly, the interviewee from GB3A expressed their frustration with litter and local pollution and, in connection, described a challenging situation that resolved with an encounter with park staff:

> [...] they don't like people throwing things in the trash, so then they start throwing all the things in the trash, a few times a day I see thirteen bottles thrown away [...] like beer, Coca Cola, Sprite [...] I also see things like toys thrown in the street [...] I see how...like for example...it's like thrown away plastic and the other time I saw a I saw a baby turtle, and he was choking on something. Of course, you can't...uh um touch the turtles, but I had to help it because it was suffocating. [...] He was choking on a Coca Cola bottle cap. So, I...I helped him. The Park guards told me that it was okay to help, but I couldn't touch it [the turtle], but if I didn't touch it it would die.

This serious encounter was something the child passionately recounted and seemed frustrated with what they had witnessed as an environmental injustice towards a Galápagos animal. The Park staff were still viewed by the child as an environmental regulatory authority, despite the child's hope that in this instance they could break a rule to help an animal.

The second mode of interaction, in-school presentations, were noted frequently by children from various schools. Outside of Galápagos, these programmed meetings of informal and formal education are less common because of school funding and available partnerships, but such guest speakers are noted as valuable in the literature (Kong, 2018; Mazzatenta, 2008; Ward, 2011). The interviewee from GA6B remembered that the National Park had visited their school and done a presentation about introduced species, noting: "I think that last month the National Park did a puppet show for us [here in school] that demonstrated the harm that introduced species can cause." Two additional children at different schools and on both islands (class GA6C and class GB3B) remembered this same puppet show about invasive species. Another child from GA5A noted the value of presentations by both the National Park and the ABG: "sometimes…sometimes in school some people come from the ABG and from the National Park to do a program and from that I learn a lot."

Additionally, children from two San Cristobal schools mentioned in-school presentations by and planned visits (the third mode of interaction) to Hacienda Tranquila. Multiple students within each of the two classes remembered the director by name and noted that there had been "lots" (GB4A) of visits to and from Hacienda Tranquila and that the organisation's ranch had "lots of plants" (GB4A). Other planned visits included many to either National Park sites, such as local beach sites like Tortuga Bay or Playa de la Estación on Santa Cruz or Playa Punta Carola or Playa Mann on San Cristobal and the tortoise breeding centres on both Santa Cruz and San Cristóbal islands, which are either walking distance or a short drive. While visits to spaces like national parks are discussed in the literature as an effective source of LEK (Jun, 2019; Lugg & and Slattery, 2003; Soykan et al., 2018; Yusof, 1999). Galápagos represents a location where these visits can be much more frequent than elsewhere, as the national park is everywhere and easily accessible on home islands.

Planned visits with family were frequent as well. One child from GA5A explained in detail how the National Park tortoise breeding centre works based on a recent visit: "in the National Park they take care of the tortoises so that nobody kills them, and nothing happens to them [...] so that later, when they're bigger, they can let them go and they can live on their own." At the Charles Darwin Research Station [CDRS] on Santa Cruz, the public buildings of which sit just next to and around National Park buildings and the Tortoise Breeding Centre, children also had stories of informal but intentional learning through planned visits with family or classes. These stories and details of the station were shared when children answered the question "where do you learn about the environment."

Multiple children in one class focus group chimed in when one mentioned the Station Beach, which sits next to the Station + Park complex, noting: "the station [beach] is the beach that most people go to because there you have two institutions in the same place the [National] park and the station [CDRS] and everything is connected and you can see tortoises and everything there and that's why it's the most visited beach here" (GA6A) following by another child noting that the station was "like a museum" (GA6A). Children from focus group GA2A noted similar experiences, remembering that "in the Charles Darwin Station they teach about tortoises" followed by another child chiming in to say, "the museum that museum is where there's a…" [filled in by another child] "a whale shark [skeleton]". This gathered knowledge emphasizes the impact of planned visits.

As a final note about local organisations, staff or representatives are usually seen as authoritative figures in relation to environmental information. Children note that staff of the National Park and the ABG are enforcers of regulatory and definitive information about the local environment. This authority was also perceived for Hacienda Tranquila staff and those working in the Research Station, though less regarding rules and regulations for human interaction with the local environment and more about local ecological knowledge. The interviewee from GA8A explained that "when you go to the station there are the guides who tell you about the species that are in extinction, and they can tell you whether they are in extinction or if you can touch them." This view of organizations may continue to encourage children to see learning gained through them as legitimate and trustworthy.

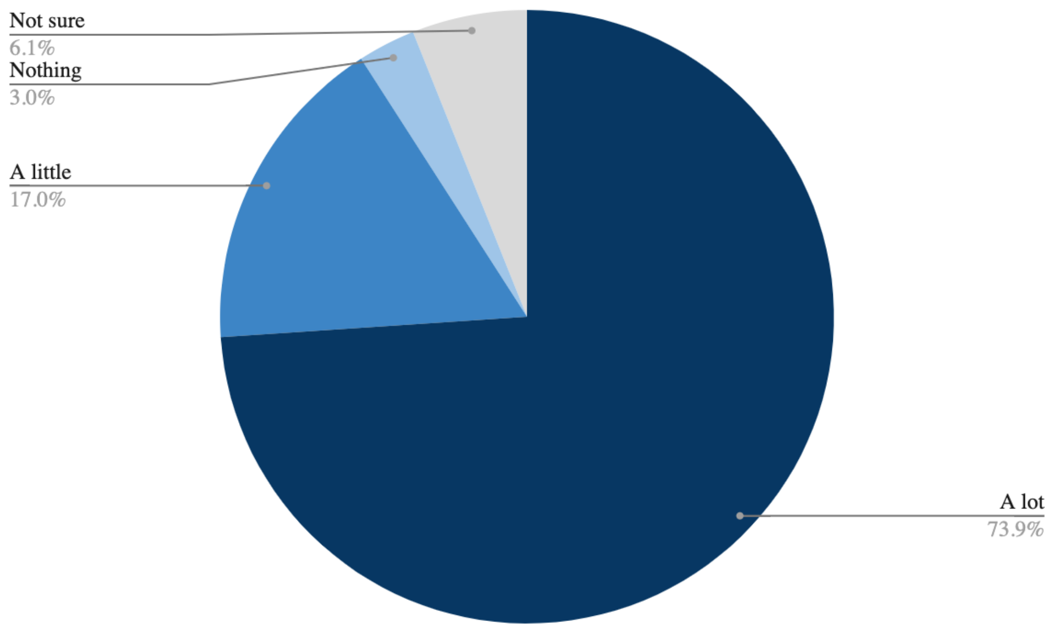
6.5 Schools + (Instruction, Outdoor Projects)

A final source of LEK is schools, with modes of interaction including receiving direct instruction and conducting outdoor projects. Schools in Galápagos seem an obvious place for LEK, as they are tasked with the formal education of the over 7,500 children in primary and secondary institutions. According to the survey, school the most frequently recognized source for Galápagos environmental learning. This is reflected in the literature, which notes schools as a common source for LEK (Eames et al., 2008; Stanisic, 2016; Sukma et al., 2020) though studies remind that schools alone are not sufficient for robust LEK, especially because of a potential lack of experiential EE (Amin et al., 2019; Appiah Takyi et al., 2023) and should be combined with other sources.

In the survey, 234 children (of the 327 responses) said that they learned about the Galápagos environment at school. Additionally, of children who responded to the question, "How much do you learn from your teachers in school about the Galápagos environment?" (Figure 23) 73.94% perceived that they learned "a lot" and 16.97% said they learned "a little" meaning that over 90% of child respondents perceive that they learn something about the Galápagos environment from teachers in school. This, together with reiterative verbal notes from children in interviews, clearly establish schools as a source for LEK. It is worth noting that when asked in interviews where children learned about the environment or who taught them about the environment, when mentioned, schools and teachers were often the first example, ahead of other sources mentioned. Sometimes school or teachers were the only source mentioned.

Figure 23

Galápagos children's perceptions of how much they learn from school about the environment



Note: Data from survey question 10 which asked: “How much do you learn from your teachers in school about the Galápagos environment?” After non-responses removed, there were 330 useable participant responses.

Many children in interviews noted that teachers were providers of direct instruction about the environment (GA1A, GA2A, GA3A, GA4A, GA5A, GA6B, GA6C, GA7B, GB1A, GB2A and GB4A). Most frequently, this mode of interaction occurred in science classes, though many children also confirmed that they received instruction in other classes about the environment, such as language class, history, and even their English classes.

The second mode of interaction with schools was conducting outdoor projects, often in school gardens. The use of outdoor space is noted as infrequent in the literature, with still a predominance of didactic or monologic teaching, but when outdoor space is used, school gardens are mentioned

(Erdoğan et al., 2008). The child from class GA8A, which was a highland school, remembered that the teacher in their science class made use of the naturally occurring native vegetation all throughout the campus: "sometimes in natural science class we have to do research on the plants [...] hmm like this one right here, it heals things [...] you eat it you have to wash it and you eat it." Other projects in Galápagos schools were often in the school garden or around school grounds which allowed children to engage with natural objects. Often, these projects centred on plants growing around school grounds, though they did not always include native or endemic Galápagos species. For example, some children noted that their natural science teachers would take them outside to the school gardens to plant things, though this was usually with introduced species and thus not an example of Galápagos LEK. In this way, while school gardens can be a productive learning space, if the goal is to increase LEK, schools may benefit from purposeful planting of or projects with native and endemic species.

Teachers in highland schools may have access to more plentiful native or endemic vegetation for outdoor learning projects (examples of highland schools in Figure 24 and port schools in Figure 25). However, it is not impossible for teachers in port schools to make use of the landscaped or garden areas. In fact, one port school child (GA1B) noted that their teacher took them outside of the classroom to teach them about a native plant growing around one of the buildings: "I have a memory from [school], I have this...in the past, my teacher took us outside here, there to see how to take care of the plants. For example, these plants, if you have seen them, if you remember? The ones that were in..." [child then pointed to the plant]. These anecdotes highlight detailed learning experiences that children about the local environment.

Figure 24

Highland schools, Santa Cruz and San Cristobal Islands (photos by author)

Figure 25

Port schools, Santa Cruz and San Cristobal Islands (photos by author)

6.6 Peers + (Knowledge snowballs, Correction, Confirmation)

Finally, children in Galápagos construct LEK with help from their peers, with modes of interaction including knowledge snowballs (a term used to describe events in the data in this study), corrections, and confirmation from peers. Literature mostly on Indigenous children note peers are noted as a valuable source of learning and knowledge especially LEK (Cruz García, 2006; Pretelli et al., 2022; Rogoff, 1981; Setalaphruk & Price, 2007). Distinct from previous subsections in this chapter, this source and modes of interaction were not always explicitly perceived by children, and instead were often ones that I perceived happening in real time within the focus groups. Some studies note the phenomenon of both correction by peers and supportive confirmation by peers to be common ways of interacting (Johnson, 2017; Morris, 2005; O'Donnell & Topping, 1998; Ogden, 2000; Rachmawati et al., 2018). In terms of knowledge snowballs, I chose to use the term because it helped to describe a notable phenomenon that happened in focus groups.

In survey question 13, which asked if there were any other people that children learned from about the Galápagos environment, only 16 children wrote in amigos, or friends, as a source of learning, but the prevalence of peer-to-peer learning that I observed in focus groups seems to suggest that learning from peers may be underrecognized by children themselves. Additionally, the prevalence of peer-to-peer learning through conversation and informal engagement that I observed in focus groups would suggest that other sites where children interact frequently, such as schools, would also have peer to peer learning present.

6.6.1 Knowledge snowballs

The term knowledge snowball is one that I have created to describe a specific phenomenon of that occurred during focus groups. There are existing terms that appear similar by name within the field of teaching and learning, such as the 'snowball method,' 'pyramid or snowball discussions,' and 'hexagonal thinking,' however, these terms represent strategies that teachers can employ to direct and guide a learning process from start to finish and not a child-led phenomenon that happens without guidance, direction, or instruction, which is what the term knowledge snowball speaks to. For example, the 'snowball method' happens when a teacher instructs students to use a piece of paper to write down ideas and thoughts on a topic and pass the paper sequentially around a small group circle until collective ideas are further developed (*The Snowball Method*, 2015). Pyramid or snowball discussions, is a structure for classroom discussions in which pairs of students develop ideas together and then join with other pairs, thus snowballing into larger groups for more complex discussions (Gonzalez, 2015). Hexagonal thinking involves instructing students to use hexagons with distinct data points or topics and connect them physically while developing ways of explaining those connections, which can differ from student to students (Potash, 2020).

The term knowledge snowball is used here to explain a phenomenon of knowledge sharing and informal peer to peer learning that is unintentional in nature, spontaneous in form, and may be un-perceived as a phenomenon by the children themselves. These snowballs develop and are driven by children in a group to share knowledge with others, and as such, were only observed during focus groups and not during surveys or interviews. During these focus groups, a topic, anecdote, or data point mentioned by one child served as the instigating piece of information upon which other children quickly piled, without prompting for additional answers or ideas by me as the adult, related points, facts, anecdotes, or supplementary knowledge that snowballed through popcorn like discussion snippets that were often highly emotive and unintentionally collaborative. It was as if children suddenly formed a team of experts all peppering in connected pieces of knowledge, built on previous points made by other children, with the result of building detailed maps of knowledge. An example of what a knowledge snowball is not, would be the pattern of me, as the researcher, asking children in a focus group a question such as “what is your favourite Galápagos animal?” and the stream of answers from all children that followed. This is not a snowball of related knowledge or detail, but individual answers to a single question.

The snowball is child-instigated, child-developed, and results in often comprehensive snowballs of knowledge about a single topic. Knowledge snowballs were not of a specific length and varied from a few children adding information to previous statements from other children to lengthy builds of additive knowledge. Many short knowledge snowballs may be created sequentially as knowledge addition shifted to a new topic from the mention of it by one child. It seems that the spontaneous creation of these snowballs was in part because the mention of a fact about a species or a topic could helpfully remind another child of something they knew about that species or topic. Knowledge snowballs are then a helpful learning experience for children because they allow reiterative recall of knowledge that they have, mitigating the chance of forgetting that knowledge and therefore not having it anymore, but also because when a snowball occurred, it allowed for pooling of information and thus children could cognitively add knowledge to their own contribution by hearing the additive and related contributions of other children which could result in more comprehensive, sticky webs of knowledge on a topic.

In Table 12 below are examples of knowledge snowballs with accompanying notes. 'R' stands for what I said in focus groups, and all 'C' comments are children's voices. The instigating point or start of a knowledge snowball is highlighted in each example. For some, I included a few lines prior to the start of the snowball for context and to help highlight how and where a snowball started. Knowledge snowballs were identified in 12 of the 18 focus group transcripts, with representation of this phenomenon across both islands and in both port and highland classrooms.

Table 12

Examples of knowledge snowballs taken from focus group transcripts, and accompanying notes

Knowledge Snowball from Focus Group Transcript	**Accompanying notes**
R – oh no. Ok, what can we do to protect the environment? C – ahhh C – don't touch the animals C – don't touch them, don't throw trash in the water or on the ground and don't introduce more species that aren't from here in Galápagos C – because the blackberry is introduced and it's… it hurts the	A branch off of the original topic, this snowball started to take off when one student mentioned introduced species while answering a question about how to protect the environment. This bridged to a specific

giant tortoises C – no that's not it the blackberry affects plants not animals C – it does hurt the birds too C – birds yes but it affects plants more C – nothing hurts the blackberry C – because it's it's dangerous, it's not that the birds know their trash. That's really really dangerous because the blackberry is an introduced species, and it also hurts other plants because it has spikes, and it grows too much for the plants here (GA6A)	introduced species, the blackberry, which was then picked up by other students who added their own knowledge about that species
R – and how many islands are there, approximately [in the Galápagos]? C – 12! C – 24 C – and Santa Cruz is the most populated…by people C – no Isabela is C – Isabela is the biggest C - …. Isabela has a lot of volcanoes…like five volcanoes C – four	This example had two successive knowledge snowballs, both of which were a departure from the question I had asked and took off in a different direction. One started with the mention of Isabela Island, which prompted sharing of knowledge about the volcanoes on that island. The

C – like four C – and there is where the pink iguana lives C – but close to the volcanoes that's why they didn't know…close to the volcanoes C – the pink colour is their blood C – the pink iguanas are there are less than 200 of the pink iguanas in the whole world and you can only find them on Isabela no other island C – and they were recently discovered… C – and because the pink iguanas are land iguanas they can't swim to other islands R – only in that one place C – that's why the population, their population can't expand across the islands (GA8A)	second initiation point was when one child mentioned that the pink iguana lives on the volcanoes on Isabela, which then fuelled knowledge sharing about the pink iguanas in another snowball.
C - the penguin, penguin! C – penguin C – it's from Galápagos! the penguins are from here! (all children shouted the last phrase at once)	This knowledge snowball started when, after I asked if children had memories or stories in nature they wanted to share, children

C – that green one is called the masked booby (fragment of previous conversation thread) C – they're the…the smallest variety in the world! R – the smallest in the world? I didn't know that. But where are they? On this island or a different island? C – innnnn…I think in Florea- C – we're in the Pacific Ocean right now C –Isabela Isabela Island I think is the only one [with penguins] C – AHH yea I saw one and I wanted to touch it, but my aunt was right there R – in Isabela or here? C – here R – here? C – there aren't any here C – there aren't any here C – just in your dreams (GA1A)	began recalling interesting animals they'd seen or liked. At this point, a child chimed in with "penguin" and this started a snowball of information about the Galápagos penguins. As the snowball slowed near the end, one child was corrected by others, and one offered a final consolatory light-hearted suggestion that he'd only seen a penguin in his dreams.
R – and what are some endemic species in Galápagos? C – iguana	In this example a snowball is initiated by the mention of

C – iguana C – the tortoise C – sea turtle C – sea lion! C – recently there are hardly any marine iguanas because some are going extinct C – yea they're going extinct C – the same with the vermilion flycatcher C – we have a bird here that doesn't fly C – the flightless cormorant! C – it feeds on fish C – on fish R – so the flightless cormorant is here in San Cristobal, or no? C – yes C – yes but it's going extinct because of humans C – I haven't seen it C – me neither C – me neither C – one time I saw it. In a photo but (all laugh)	iguanas by two children, which was added upon by other children with the detail on marine iguana status as endangered species. As a bridge, the mention of 'going extinct' within the marine iguana snowball seemed to remind another child about a different species going extinct, which was the vermilion flycatcher, which then served as the jump off for the final, longer snowball about the flightless cormorant. The flightless cormorant was one of the photos in question 18 of the survey. This is another reason why mixed method studies with children are beneficial, as this example shows that there are

C – there are more in Isabela C – the flightless cormorant doesn't fly because it's been a long time since it flew and so it doesn't fly C – they go bad the .... it doesn't have as many feathers anymore C – it doesn't have the strength (GB3A)	children who have considerable knowledge beyond just the name of a species asked about on the survey.

A snowball may seem, from an adult or teacher perspective, to veer off topic or to be chaotic and unproductive, but they were important in this study for understanding directions and depth of knowledge that children held and ended up being valuable learning examples for me as a researcher and for the other children in the groups. Further thoughts on the value of knowledge snowballs are shared in the discussion.

6.6.2 Correction and Confirmation

Focus groups were a highly effective space for observing peer to peer interactions in addition to noting individual children's knowledge and engagement with environmental topics. In addition to the phenomenon of knowledge snowballs, two modes of interaction emerged through thematic analysis of focus group transcripts: peer to peer correction of knowledge, and peer to peer confirmation of knowledge. Each of these modes of interaction were child-prompted and happened with unexpected frequency in 17 of the 18 focus groups, representing co-created discussions by children on both islands. It was both impressive and inspiring to experience the dynamism with which children engaged with the focus groups in general, often producing confident, collaborative, and complex discussions that were driven by child interests and ideas vs controlled by my guiding questions. I was interested in what children were willing to share about their Galápagos environment without being explicitly asked at every step, so focus groups, as well as interviews, allowed children the space and self-direction to do this.

Correction and confirmation were prominent ways that children engaged with each other throughout focus group discussions, and each had a specific impact on ecological knowledge for children in the group. Corrections are frequently noted in the literature (Johnson, 2017; Morris, 2005; O'Donnell & Topping, 1998; Rachmawati et al., 2018), with infrequent exploration of confirmations (Ogden, 2000). A correction was any time that a child disagreed with or provided corrective information in response to another child. For example, in the focus group with class GA1A, when one child said that there were two types of booby (bird) in Galápagos, another child immediately corrected them by noting that there was another (third) type. In GB3A, when one student said, "in May it's the coldest time," two children at once chimed in and corrected them by noting "in May and September," and "yea, May and September," compounding the correction. In the GA6B focus group, when asked how we could protect the environment, one student commented "drive vehicles" which perhaps was just a mistake as another student immediately corrected them and said, "*don't* drive vehicles." Another child, in the GB2A focus group, mistakenly said that cats were endemic species to Galápagos, which was quickly corrected by another child who said, "no no they're invasive." The speed and urgency with which children corrected each other when any misinformation was shared in these group settings indicated that there was an emotive drive behind the importance to be accurate, especially with information about their home.

Corrections are essential elements of constructing accurate LEK, as with any body of knowledge, but the frequency and willingness for peers to correct each other, versus waiting for an adult or other authority figure to correct children, is promising as it allows for efficient and collaborative knowledge preservation when it comes to LEK. This is referenced in the literature as a constructive peer engagement strategy and way of increasing peer-to-peer learning (Johnson, 2017; Morris, 2005; O'Donnell & Topping, 1998; Rachmawati et al., 2018). Children helping each other to refine and remember knowledge about their local environment then helps ensure that misinformation is not spread or acted upon, but there is a risk that correction can deter a child from feeling comfortable or safe engaging with that knowledge again if fear or shame is a result of the correction. Something that could be supplemented by adults or older children, could be the finesse and emotional awareness that children have when making these peer-to-peer corrections to avoid shaming or causing embarrassment or isolation for the corrected child.

A confirmation was any time a child agreed with or reiterated something that another child had said. This could be confirmation of a fact about a species or other LEK, or could even be confirmation of an experience, when one child noted that they felt, did, or had seen the same thing. Confirmation of knowledge between peers had a net positive effect and often was a part of knowledge snowballs, as it seemed to encourage children to provide more information, and potentially imbued children with confidence. While not frequent in the literature, one study did not confirm interactions while peer-to-peer learning occurred (Ogden, 2000). Many confirmations came in the form of a child simply saying 'yes' after a child had shared a piece of knowledge or story and those simple agreements drove the conversation forward, and I argue, serve a greater purpose of concretizing knowledge for the initial child, who has gotten positive confirmation that what they shared was accurate. Other confirmations agreed and then added information, building on what the first child said, like the 'yes, and' classic improv game. For example, in GA6B focus group, one child noted that a favourite Galápagos species was the sea lion, and another child said "yes, and also the penguin." In the same group, when asked "what are some plants or trees of Galápagos?" one child said, "there's a ton of them!" and another followed echoing "a ton." In the GA1A focus group, when one student noted that the manzanillo tree was poisonous, four other children chimed in to agree, and some added that it was the only poisonous tree in Galápagos.

These modes of interaction, and indeed peers as a source of knowledge for children in Galápagos was the only source + modes of interaction that were actively observed, reflecting my perceptions, whereas each of the other processes were only conveyed to me as a researcher through the perceptions and shared information from children. Reflecting on peer-to-peer LEK provides insight into effective means of knowledge sharing and creation especially when discussing topics like LEK which most of the children had passionate ownership of and thus lively interactions with their peers when discussing it.

6.7 Chapter Conclusion

Children in this study describe sources for learning about the local Galápagos environment and constructing LEK that pair with modes of interaction. Through analysis of survey responses, interview and focus group transcripts, and field notes, child responses and my own perceptions have highlighted five main sources of LEK: time in nature, family, organizations, schools, and peers. Modes of interaction with these sources are detailed again in Table 13 below:

Table 13

The sources from which children perceive learning about the environment and modes of interaction with those sources

Source	***Modes of Interaction***
Time in Nature	3. Conducting solo exploration 4. Conducting exploration together with friends
Family	4. Receiving direct instruction from family members 5. Observing family member behaviour 6. Participating in family-facilitated activities
Organizations	4. Engaging in unplanned encounters with organizational staff 5. Receiving instructive presentations from organizational staff in schools 6. Participating in planned visits to organizational centres and sites
Schools	3. Receiving direct instruction in classrooms from teachers or staff 4. Conducting outdoor projects at school

Peers	4. Knowledge snowballs 5. Correction 6. Confirmation

Ultimately, it is clear through these findings that a diversity of sources of LEK is necessary to construct robust LEK, which is supported by the literature (Amin et al., 2019; Pretelli et al., 2022; Takyi et al., 2023). This is reflected in studies that look both at LEK and Environmental Literacy (EL) more broadly, and that specifically, school curricula are not sufficient to alone produce robust LEK or EL (Amin et al., 2019; Takyi et al., 2023). This study highlights a specific combination of sources that seems to be highly effective to help children construct LEK.

7. Locations of Learning

7.1 Chapter Introduction

In this chapter, I explore how findings help to answer the third research question: where do children perceive that they learn about the environment? This question is closely related to the findings in the previous chapter, as locations often align with sources for learning about the environment. In this way, this chapter will describe the specific physical locations where children perceive that they learn about the environment and map those locations onto sources. As a reminder, sources were time solo exploration or with friends; family; organizations; schools; and peers. Locations mentioned are grouped into local nature-centric sites; local non-nature-centric sites; within school grounds; and at home. Each physical site was paired with at least one source of learning. The overlap in sources of learning within physical learning locations indicates a complex network of ecological learning that is well-developed, and which provides supportive and encouraging learning spaces for children.

7.2 Within school grounds

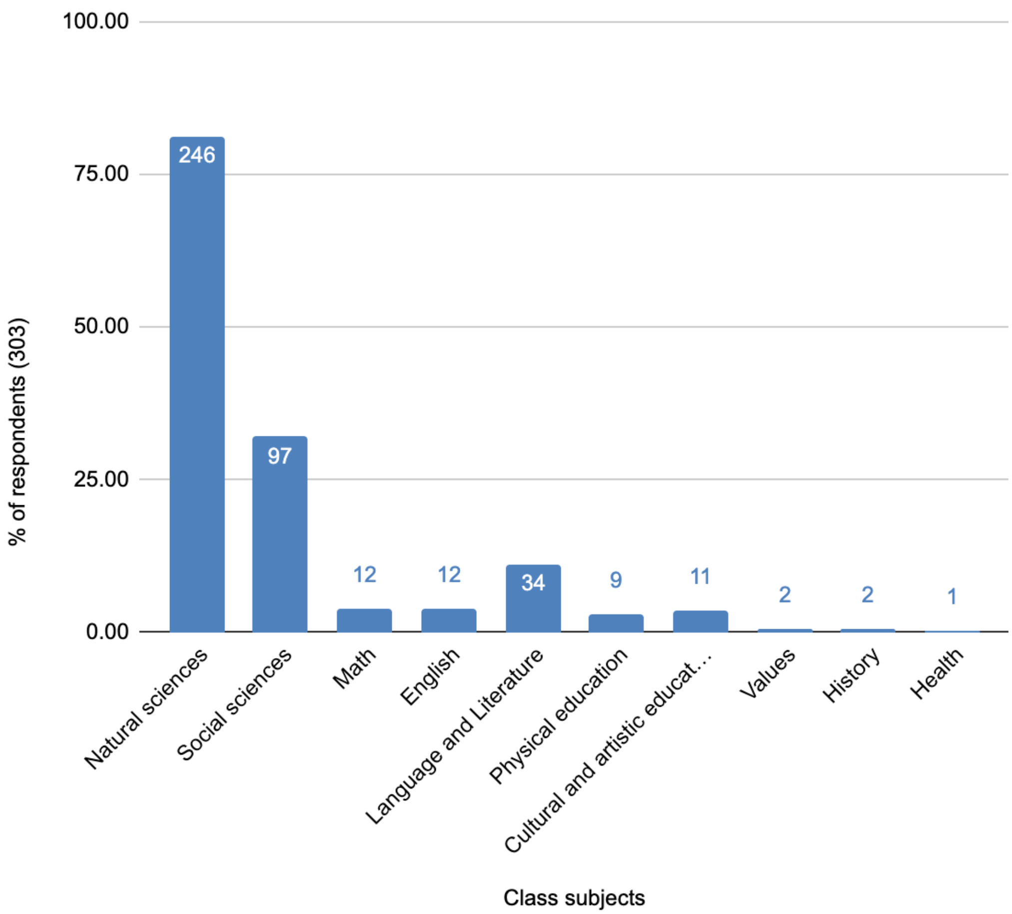
The most frequently mentioned physical site by children was school. Within schools, children referenced learning from both teachers and from representatives of the National Park, the ABG, or other local non-profits. In addition to learning in classrooms or other built spaces in schools, children referenced learning outside of the classroom on school trips, but this will be discussed in the 'local nature-centric sites' section of this chapter.

In-classroom learning is cited as a common, but often under-impactful location for LEK and EE because of a lack of experiential learning (Georgopoulos et al., 2011; James & Williams, 2017; Stanisic, 2016) or inclusion in the curricula (Eames et al., 2008; Stanisic, 2016; Sukma et al., 2020), the first of which aligns with findings here. For learning that took place within classrooms, there were mixed responses from children in the survey in which class subjects they learned from teachers about the Galápagos environment. This was determined by analysing question 11 on the survey which was a write-in question that asked children in which classes in school they learned about the environment. Figure 26 below shows both the percentage and total number of surveyed children who wrote in each of the class subjects. Most frequently, with 81% of children who responded to the question (303 children responded in some way out of 337 participants) noting it, children mentioned the subject of 'natural sciences' as the class in which they distinctly perceive learning about the Galápagos environment. This was confirmed within focus groups and interviews, with some children in interviews explicitly stating that they only learned about the environment in their natural science class (GA6B, GA8A, GB2A, GA6A). Slightly less frequently mentioned but still significant (32%) was the mention of 'social sciences' as a class in which children learned about the Galápagos environment. Science or natural sciences as the only class in which EE or LEK is taught is frequently cited in the literature (Stanisic, 2016; Sukma et al., 2020), with infrequent studies noting specialized curricula and training that supports EE and LEK within other school subjects (Eames et al., 2008).

Other subjects were less frequently mentioned but the range of responses is worth noting, as it seemed that children were frequently in disagreement about which classes contained environmental learning. Some class subjects did not match with the stated list of subject titles offered in Galápagos schools and Ecuadorian schools more broadly, perhaps indicating informal names for classes that were used by students such as 'dibujo' (drawing) instead of the listed subject name of 'Educación cultural y artística' (cultural and artistic education), or 'historia' (history) instead of 'ciencias sociales' (social sciences). For reference, listed subjects include natural sciences, social sciences, language and literature, foreign language (in Galápagos schools, this course is English language), math, physical education, and cultural and artistic education (*Educación General Básica Elemental – Ministerio de Educación*, n.d.).

Figure 26

School class subjects in which children perceive learning about the environment



Note: This data was pulled from survey question 11: In which of your classes in school do you learn about the environment? Out of 337 survey participants, there were 303 useable responses after removing non-responses

In interviews, children had varying answers, with many children noting different combinations of classes in which they perceived learning about the environment. For example, the interviewee from GA1B observed learning in "social sciences, natural sciences, and language" classes, while the interviewee from GA3A said, "sometimes in language and…in writing or in natural sciences". Still differently, the interviewee from GA4A noted that they learn about the environment in "Kichwa, in English, social sciences, and physical education" (Kichwa being a course offered only within the bilingual Kichwa and Spanish school). Contrasting all of the above, the interviewee from GA7A said they learn about the environment "in all the classes and subjects".

Examples of children disagreeing about some of the class subjects in which they believed that they learned about the Galápagos environment are below as quotes from the focus groups. Focus groups were especially helpful for illuminating these contested ideas, as they were the only data source in which children were in conversation with each other. Agreement when noting that they learned in the natural sciences classes was frequent. The fact that there was frequent disagreement indicates that the clarity of when knowledge is being shared that is LEK in a class may not always be clearly defined.

In focus group GA3A, children agreed across the board they learned about the environment in natural sciences, social sciences (often called social studies by children), and even in language and literature:

C – in science

C – science

C – and sometimes in language when it's like that

C – social [studies]

In focus group GA4A, children mostly agreed on the list of subjects in which they learned about the environment, but some uncertainty arose when asked if they then learned in every class subject. This mirrored the small number of children who wrote that they learned about the environment in math class in survey question 11:

C – science

C – [social] studies

C – social studies

C – and language

R – ah, so in all, all classes [you learn] about the environment?

C – but not in math?

C – yea

Focus group GA1B also disagreed about whether and what was learned in math relating to the environment, after noting that science was a definite subject in which LEK was present:

C – yea in science

C – in science

[...]

C – in math not about Galápagos

C – ah in math we learn about Galápagos

This may indicate an emerging area of lack of clarity or agreement on what learning about the environment includes, as the two children at the end of the quote both used the term Galápagos, and not specifically 'Galápagos environment.'

In focus group GA5A, children disagreed about a different subject, English. Science, again, was first mentioned and confirmed by other children:

C – natural sciences

C – yea

C – science

C – English

C – no not English

C – not English

In focus group GA7B, children called out differing quantities of LEK learned in different subjects. This may explain the contested nature of presence of LEK in subjects other than science, if quantity is low:

C – in science

C – natural sciences

C – science

C – social studies

[...]

R – and in other classes do you learn something about the environment? Like in language or other classes?

C – less

C – in English!

C – in English also

In the example above, English was not contested, which could indicate that some schools had covered environmental topics in English while others may not have.

One child noted in their response to survey question 11 that they learned about the environment in the contextualized Galápagos curriculum, explicitly referencing the then very newly applied (at the time) curriculum. While this didn't answer the question about specific class subjects, it was notable that a child knew that there was a new curriculum. In the curriculum, there are standards and goals that explicitly include elements of local Galápagos ecological knowledge and local Galápagos environmental sustainability listed for the following class subjects: natural sciences, social sciences, and English as a foreign language, though the encouragement of the curriculum to apply themes transversally seems to result in the presence of ecological learning happening in other classes (*Currículo Contextualizado para Galápagos*, n.d.).

7.3 Local Nature- and Non-Nature-Centric Sites

Children also perceived learning about their local Galápagos environment in situ, noting many local areas where they interact with the Galápagos environment and in which learning through observation, experience, or direct knowledge transfer, happens. Nature-centric and non-nature-centric sites are frequently noted as locations of learning for EE and LEK in the literature (Jun, 2019; Lugg & and Slattery, 2003; Soykan et al., 2018; Yusof, 1999), but studies often note fewer of these sites available to urban vs rural children (Mohamad Muslim et al., 2017; Rigolon & Flohr, 2014). Because of the intimate space of each of the populated islands, children describe having access to many local sites, including transition zones such as along the docks in port towns where wildlife often interact frequently with humans, or in protected but visitable areas such as local beaches, the lava tunnels in the highlands of some islands, the highland forested areas, or in areas of developed protection, such as the tortoise breeding centres. Frequent accessibility to these sites seems to be unique to Galápagos (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013). These locations can be sorted into nature-centric sites, in which humans are visitors, and non-nature-centric sites, which humans inhabit but where nature is still present.

Local nature-centric sites were often spaces where children gave examples of experiential and observational learning. These sites were also the spaces about which stories were told to children, thus serving as both first-hand and second-hand sites of learning for children. Nature-centric sites were often paired with multiple sources of learning, such as family or school trips, or solo exploration. For example, children in focus group GA6C below noted multiple examples of seeing direct sightings of local wildlife around local nature-centric sites, especially around beaches, which contributed to their knowledge about species beyond species names, but they also mentioned stories that were told to them from others who had experienced learning directly. These stories themselves also served as learning for children:

C – I saw a sea lion being born

C – once when he went to the park it was night and he was looking at the sea and suddenly some manta rays came out from under the bridge

C – I have seen golden manta rays!

C – I told my dad

C – I have seen a flamingo!

R – here in Santa Cruz?

C – yes yes

C – yes

C – in the Garrapatero

C – the Garrapatero

Other children explicitly connected learning with solo exploration. For example, a child in focus group GA6A said “I learn in the ocean because sometimes I swim there.” Schools were also a source of learning that brought children to local nature-centric sites. For example, children in focus group GB2A collectively described a visit to a local beach within the port town, the Loberia, where lots of sea lions can be spotted, (Figure 27). This mirrors literature on the impact of school-led fieldtrips to nature-centric sites for the development of LEK through experiential learning (Gambino et al., 2009; Hayes Hursh et al., 2024; Kola-Olusanya, 2005):

C – and we went to the beach with her with all the guys and we saw the Loberia

C – the Loberia

C – to the beach

C – the Loberia

C – we saw like lots of fish and also big fish

C – and we saw sea turtles

Figure 27

La Loberia, San Cristóbal Island (photo by author)

On other occasions, a blend of both organizations and schools as the source of learning facilitated visits to nature-centric sites, such as the notes from children in both focus groups GB4A and GB3C who collectively recalled trips to Hacienda Tranquila, a local environmental education non-profit which has a site near the highlands of San Cristobal. Other times, visits to nature-centric sites were facilitated by organizations such as the National Park or Charles Darwin Research Station as the host of the physical locations for visits, and family members who helped children access these sites. In focus group GA8A, children noted combinations of sources and physical sites where learning occurred, calling out the Charles Darwin Research Station, the National Park, the ocean, and connecting the value of learning from a parent who is a guide during trips:

C – from my parents and the Charles Darwin Foundation

C – in the [Charles Darwin] foundation and in the national park, in the Galápagos Islands and in the ocean

C – I learn from my father who is a guide and from all the trips I have to different foundations and protected areas of Galápagos

Non-nature-centric sites, such as the 'Malecón,' or boardwalk, in port towns, (Figure 28) which is an area of transition from purely urban human zones (where wildlife also lives) to marine environments edging on the protected marine reserve, were often cited as spaces where children had experiential ecological learning. Galápagos presents a unique situation in which native and endemic wildlife occupies all areas including human zones. For example, in focus group GA2A, children noted:

C – I like I see when we go down to the boardwalk I see, almost at night, I see turtles coming up to breathe. Sea turtles

C – yes and tons of sharks come

C – oh right, when you go to the boardwalk, I see a lot of sharks

C – yes because there is a light a red light

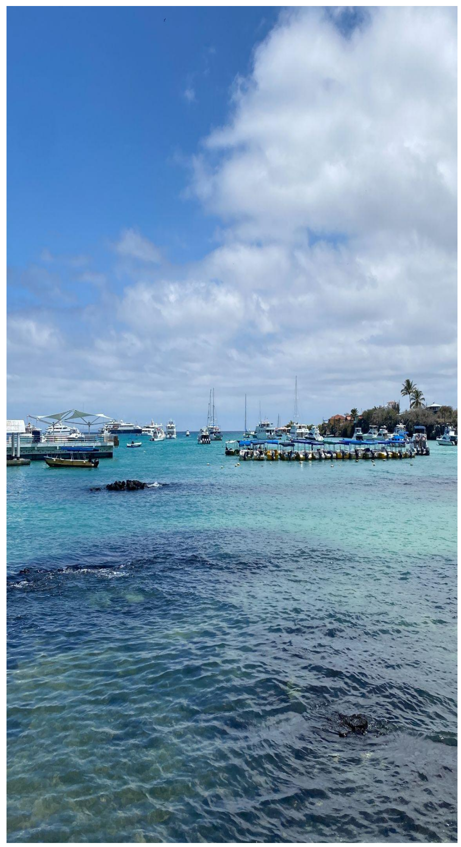
C - they come

C – I saw a manta ray one day and there is also a tortoise, a giant tortoise

Figure 28

The Malecón, Santa Cruz Island (photos by author)


SANTA CRUZ
GALAPAGOS



School also facilitated trips to these non-nature-centric sites as noted by children in focus group GB3C who recalled a visit to the boardwalk with their teacher that involved a dramatic scene involving sea lions and park staff:

> C – one day the teacher took us to the boardwalk! A sea lion had…something related to fishing and the people from the [national] park jumped over it and picked up the baby sea lions
>
> C – he died

Despite being spaces in the transition between non-human natural sites and humanized or urbanized built areas, places like the Malecón on each island seemed to play host to many opportunities to construct LEK, as they provided highly accessible space built for human occupation and involving high rates of incidental ecological observations. Literature does support coastal zones, or 'blue spaces' as typically good learning spaces, (Speldewinde, 2024) but in Galápagos, local wildlife, because it hasn't evolved a fear and aversion to humans, is more present, leading to higher frequency of interaction and experiential learning. An example of local wildlife on the main pier of the Malecón is pictured in Figure 29 below.

Figure 29

Sea lion, Santa Cruz Island (photo by author)

There was a substantial variety in the broader list of local sites that children shared as being their favourites or ones that they have at least visited once. Most often, these sites were nearby, meaning that they were sites located on the child's home island, but that restriction did not limit the breadth of distinct locations recognized by children. For example, children in focus group GA1B noted a string of locations that were their favourites in Galápagos, starting with mentions of two of the highland villages on Santa Cruz (Bellavista and Santa Rosa (Figure 30)):

C – Bellavista!

C – Santa Rosa!

C – because in the highlands it's like a place the zone with the most plants

C – Santa Rosa!

C – Tortuga Bay!

C – Santa Rosa

C – the whole island

C – Santa Rosa

C – Isabela…because I wasn't born here

C – Las Grietas

C – oooh Las Grietas are really pretty

Figure 30

Santa Rosa, Santa Cruz Island (photo by author)

For context, Tortuga Bay (Figure 31) is a protected area and one of the largest beaches on Santa Cruz Island, a long but accessible walk from the port town. It's a site often frequented by locals and tourists alike and is often a site for wildlife encounters with both flora and fauna.

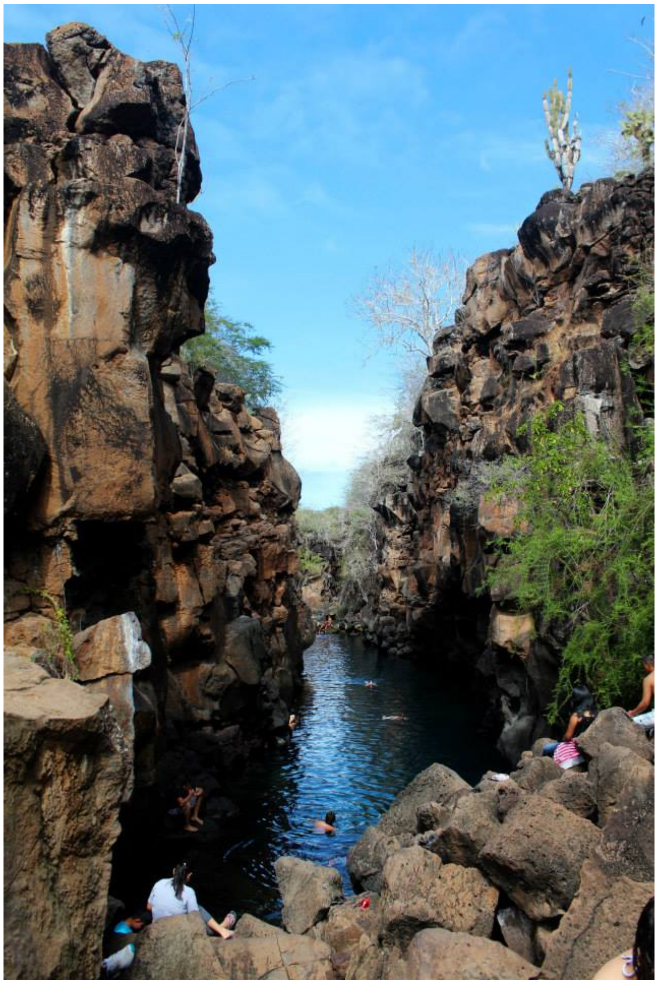
Figure 31

Path to and beach of Tortuga Bay, Santa Cruz Island (photos by author)

Las Grietas, which means 'The Cracks' is a naturally-formed salt-water swimming hole with deep clear water between two tall lava rock cliffs and is a short water taxi + walk away from Puerto Ayora, the port town on Santa Cruz (Figure 32).

Figure 32

Las Grietas, Santa Cruz Island (photo by author)



Children in focus group GA6A echoed the sites mentioned above and added the Station Bay, the beach next to the Charles Darwin Research Station, and the National Park buildings, a short and accessible walk from Puerto Ayora:

C – Tortuga Bay

C – mine is Tortuga Bay and the Station Beach and…

C – I like Las Grietas and Tortuga Bay

In focus group GA6B, children added other local areas including nature-centric sites in the highlands as well as along the coast. Children frequently added information or repeated locations, highlighting the commonality of experiences. One child did mention a beach on San Cristobal, which was followed by a note from another child that they've only ever been on Santa Cruz. This nods to a trend in accessibility in which most children hadn't visited other Galápagos islands:

C – the beach

C – the beach on [San] Cristobal

C – I've only stayed on this island

C – I have been to Tortuga Bay which is a beach umm the Garrapatero which is also a nice beach

C – That I went to with my family

C – it's a really big beach

[…]

C – the Gemelos

C - the tunnels

C – yea there are a ton

C – The Laguna de las Ninfas

C – the Gemelos

C – the tunnels

C – the magic tunnels

C – no no

C – Pelican Bay

The Garrapatero is about a 15-minute drive from Puerto Ayora or a 10-minute drive from Bellavista in the highlands. The Gemelos (Figure 33), meaning the 'twins,' are a pair of large lava tunnel sinkholes in the highlands. The tunnels (Figure 34) that a few children mentioned refer to multiple entry sites for networks of lava tunnels on Santa Cruz Island, accessible in the highlands. Laguna las Ninfas (Figure 35) is a small body of saltwater, separated from the ocean just inland from the docks on Santa Cruz. Pelican Bay (Figure 36) is just off of the main street in Puerto Ayora.

Figure 33

Los Gemelos, Santa Cruz Island (photos by author)

Figure 34

A lava tunnel on Santa Cruz Island (photos by author)

Figure 35

Laguna las Ninfas, Santa Cruz Island (photo by author)

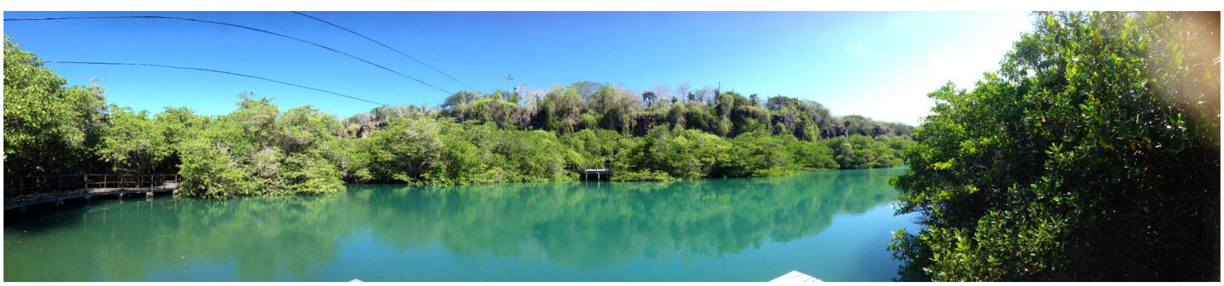


Figure 36

Pelican Bay, Puerto Ayora, Santa Cruz Island (photos by author)

Children in focus group GA6C echoed previous sites and added, and 'the beach' as favourite places in Galápagos, and children in focus group GA7A echoed much of the same and added the Malecón and the Media Luna, a half-moon shaped hill on the island that is a popular hiking spot, and Santa Cruz Island as a whole.

C – The Malec...

C – I like the Garrapatero beach more

C – The Malecón

C – The Media Luna

C – the Media Luuuuna!

C – Santa Cruz

C – the beaches

C – the highlands, Los Gemelos

On San Cristobal Island, children in focus groups also shared mostly home-island locations. For example, in focus group GB1A, children again cited the inhabited highland area, in this case called El Progreso, as a favourite location (Figure 37). They also cited local beaches as favourite places, such as Punta Carola (Figure 38), a vista point and beach just to the north of the port town. They also cited El Junco (Figure 39), the freshwater lake in the highlands of the island, as a favourite spot.

C – The Progreso!

C – me me me! El Junco!

C – um the beach

R – which one?

C – umm the Carola [Punta Carola Beach]

C – my house

C – the beach

C – El Progreso!

C – I like to go to the beach

C – El Progreso!

Figure 37

El Progreso, San Cristóbal Island (photo by author)

Figure 38

Punta Carola, San Cristóbal Island (photos by author)

Figure 39

Researcher at El Junco, San Cristóbal Island (photo by author)

In GB3C, children cited similar locations, adding to the list of local beaches, and adding the Galapaguera (Figure 40), the tortoise breeding centre based on San Cristobal. Puerto Chino (Figure 41), a beach frequently noted by children in this group, is on the southeast side of the island, just past the Galapaguera, about a 30-minute drive from the port.

C – The Galapaguera and Puerto Chino!

C – Puerto Chino

C – Puerto Chino

C – Puerto Chino

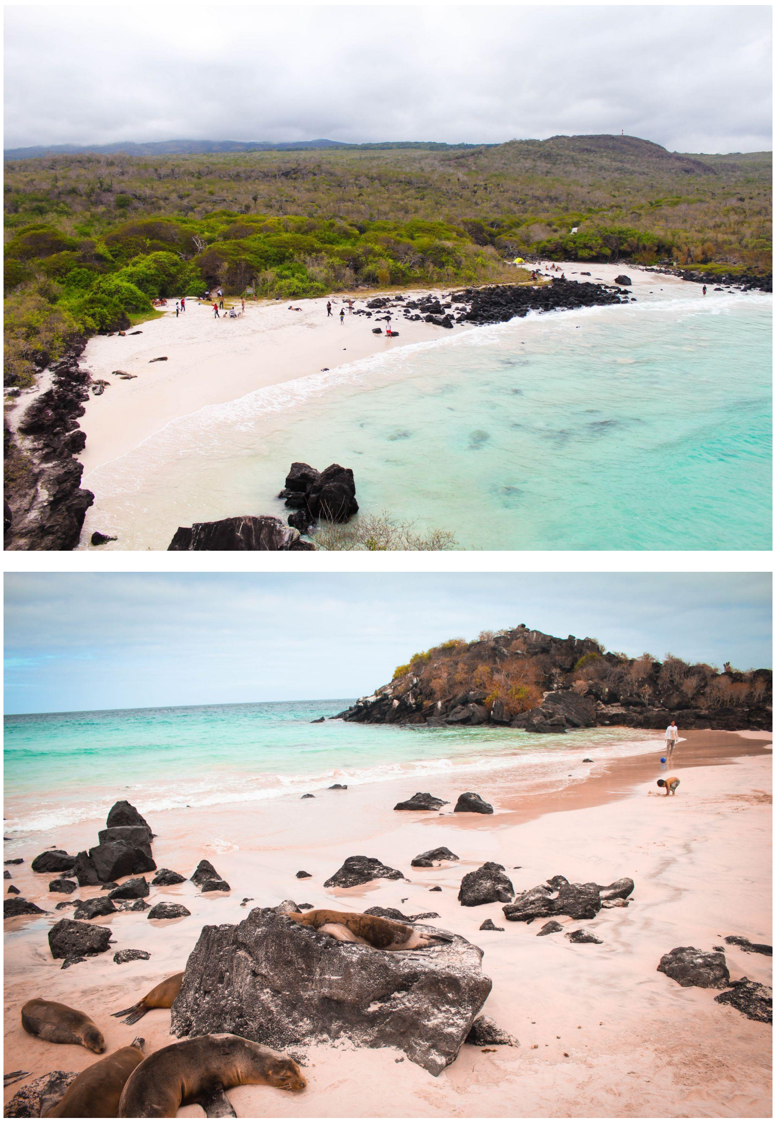
C – I like the beaches here

Figure 40

Tortoises in the Galapaguera, San Cristóbal Island (photo by author)

Figure 41

Puerto Chino, San Cristóbal Island (photos by author)



7.4 At Home

Often paired with the learning source of family members, 'at home' was a location for learning frequently mentioned by children in focus groups and interviews. This is mirrored in the literature

(Kola-Olusanya, 2005), though depends on family member's own LEK, which can be varied in other studies (Evans et al., 1996; Istead & Shapiro, 2014; Legault & Pelletier, 2000). In general, children seemed to be good at recognizing that learning happens not only in formal education settings like school, but in informal spaces. The frequency of learning happening within the home, often with family members, indicates that adults that they live with have substantial LEK that they can share with children through stories or data points about local species and geography. Children in focus group GB3B, when noting that they learned at home, clarified that they learned from their parents:

C – at home

R – from your parents?

C – yea

C – yea

The location of home also encompassed less-frequently mentioned sources of learning such as TV, websites, and social media sites. Children in focus groups GB1A noted that they learn both from the show "Animal Planet" and "in my house!" indicating that home provided access to other sources of learning.

7.5 Chapter Conclusion

Because of the intimate nature of human Galápagos communities, physical locations for learning LEK were easily sorted into a small range of location types. The short list of these types of locations, however, do not indicate lack of depth or frequency of learning for children, and in fact may indicate the opposite. Many physical locations paired with at least one source of learning indicate a complex map in which children gained LEK, emphasizing the effectiveness of collaborative learning experiences involving multiple sources, modes of interaction, and physical locations, which the literature notes is optimal (Amin et al., 2019; Pretelli et al., 2022; Takyi et al., 2023).

Children most frequently recognized learning happening within school grounds, most often in specific classes in which clearly stated LEK topics were included in coursework. Other subjects in school were sometimes contested within focus groups and between focus groups. Local nature-centric and non-nature-centric sites were frequently mentioned and represented a diversity of physical locations, and these sites were frequently connected with sources of learning such as solo exploration, schools, family, and organizations. There was a short-list of most-frequently-mentioned local sites, such as the Charles Darwin Research Station for Santa Cruz children, local beaches on both islands, and human-centric transition areas such as the Malecón on both islands. The volume of these accessible sites for both urban and rural children, and all income levels, is distinct from the literature (Mohamad Muslim et al., 2017; Rigolon & Flohr, 2014). Interactions at both nature and non-nature centric sites with wildlife were often unplanned, unstructured, and involved free-roaming wildlife and thus presented novel experiences with each visit. Distinct from some literature (Ostergren et al., 2005; Van Zyl et al., 2019; Weber & Sultana, 2013) local National Park sites on inhabited islands in Galápagos are highly accessible, and require no payment, passes, or gated entries, making these sites easier to frequent for locals, including children.

A plethora of other sites, local to each respective island, were mentioned by children in focus groups and interviews, indicating a wide range of local experiential environmental education and LEK acquisition through visitation of protected areas in both highlands and along the coasts. Home was another notable location for learning, often paired with the learning source of family but also paired with distinctly provisioned learning within a home, such as TV or other media. While not all children noted the home as a location of learning LEK, it was mentioned frequently enough to indicate that informal learning, that which happens outside of the formal education system has potential to be significantly supported by family members in a home environment even without family-organized trips to local sites.

8. Local Ecological Content by Location

8.1 Chapter Introduction

In this chapter, I explore findings for the fourth research question: what content do children describe learning about their Galápagos environment? While describing content that children learn, I also note locations and sources for each type of content. Looking at how correlations between content, location, and sources of learning fortify and encourage LEK for children will serve as an example to both Galápagos and international schools and organizations. Content was often connected with multiple locations and multiple sources, leading to a complex and reinforced network of LEK for children. The types of content explored in this chapter include local species content, local geography and climate content, and local human impact content. Each type of content was connected to some or all of three types of location: local sites, schools, and the home, engaging with often multiple sources of learning in each location.

8.2 Local Species Content

Species content that children noted learning encompassed species names, behaviour, location, classification, and status. These content buckets mirror the knowledges outlined in the chapter five. This content was most frequently connected with schools as a location for species name knowledge, with local sites and the home serving as abundant locations for species knowledge more generally.

8.2.1 In Schools

Within school grounds, children most-often described learning about species names and some content about classification of species as endemic or native vs invasive or introduced. Content around species behaviour and location was mentioned by children but less frequently. This content was provided by two sources within the location of schools: organizational representatives visiting to conduct programs within schools for children, and teachers in class-time lessons. For example, in focus group GA7B, children noted that they learned a lot about plants and native species in natural science and social studies classes, which aligns with curriculum goals and learning objectives per subject, and the frequency of science as the singular or one class with EE noted in the literature (Stanisic, 2016; Sukma et al., 2020). This was echoed by the interviewees from GB2A and GB3B who said they learned local animal names in classes. The interviewee from GA3A noted that they learn some plant names in classes as well. Children also noted that there was species names content in English classes in the form of learning translations from Spanish to English names of local species. There was some contention amongst children about species name learning in English, with some clarifying that they'd only covered English names of local animal species vs those of plants, also echoing a trend in the literature of lack of plant content in school curricula (Amprazis & Papadopoulou, 2018; Schussler et al., 2010):

C – a lot about plants

C – about native species

R – and in other classes do you learn anything about the environment? Perhaps in language or other classes?

C – less

C – in English!

C – in English also

R – in English - there are themes about the environment in English?

C – uh huh we write the animals in English

C – the plants

C – no

C – no

C – no

R – just the animals?

C – yes

C – about the names in English yea

One child in GA7B above, also noted that they learn 'less' about the local environment in classes other than natural sciences and social studies. This recognition of amount of content was echoed by children in focus group GA1B when asked what they learn from the organizational programs that take place in schools (by the National Park and others). While one child noted that they learned about iguanas from one of the in-school visits, another noted that they didn't think they learned very much from these visits:

C – ehhhhh

C – a little

C – about iguanas

Beyond species names, some children noted learning other things about local nature or flora and fauna, sometimes through games or experiential lessons led by teachers within school grounds. When asked what they learn about the environment in classes, the interviewee from GA4A notes "mhmm we play some games" or "we go to see nature" or "we go to see the plants."

Children in focus group GA4A also noted that they learned about local species in classes from teachers, mentioning lesson content about fish and tortoises, names of local animals, and specifically mentioned learning about sharks and food source and behavioural content about them.

C – yea about the fish and those things

C – yea about tortoises

C – the languages that we speak here

[...]

C – names of animals

C – the sharks

[…]

C – it's…it's the cleaner of the sea

C – it eats everything!

Similarly, in focus group GA1B, children recognized local species content in classrooms while adding that they learned about the first human inhabitants of Galápagos, a departure from strictly defined LEK to one of social and cultural context and history of Galápagos:

C – about the plants, animals

C – in social studies we learn about the environment the things the first settlers

C – like Isabela

C – culture!

This was specifically noted as being learned in social studies class, which then raises the question, are children combining both environmental and sociocultural content under the umbrella of "environmental learning" and if so, perhaps we should question their statements that they are learning about the environment in classes other than natural sciences, where they clearly state ecological themes. Alternately, this blending of sociocultural and ecological themes could reflect an overall difference in the perceptions that Galápagos children have about their home: that they may perceive the human communities as inherently a part of the local environment.

Finally, in focus group GB3A, below, when asked what they learned in classes about the environment, children at first said 'a lot' and responded positively when I asked if there was content about names of plants and animals. However, two children noted that their teacher didn't tell them much about plants in school. The noted lack of content on plants vs more on animals mirrors the levels of species knowledge in favour of animals.

C – really a lot

C – um like

R – like names of plants and animals?

C – yea!

C – we learn a lot here in school [...]

C – the teacher doesn't say a lot of plants

Focus groups were a space where I asked children directly about what they might be learning in schools about the local environment, but inadvertently, some children provided answers to that question on the survey as well. Within the open question "In which of your classes in school do you learn about the environment?" in the survey, most children wrote in the names of different class subjects. Some children, however, may have misinterpreted the question and wrote in detail about content they learned. This accidental data echoes what I've included from focus groups above, with three children describing learning about plants and animals in classes, and one noting learning that "the manzanillo plant is poisonous." One response specifically noted general ecological content: "in natural sciences about like how plants reproduce, animals, their environments."

Relatedly, conversations with children sometimes illustrated examples of general ecological content vs local. For example, in interview GB3C, the participant noted that they learned about the environment in classes and when asked what they learned, said “yea I learn um…like…like how plants grow,” or the interviewee from GA1B who pointed to a group of shrubs growing next to a school building while we walked through their school yard to note “before, my teacher brought us here outside, there to see how to take care of the plants”. In the interview at GA8A, the child also noted that projects happened in science class involving research about plants but didn’t specify if they were about native Galápagos species or species growing in school gardens, which usually are introduced: “sometimes in natural sciences we have to do research about plants.” The interviewee from GA5A said something similar, noting that in natural sciences class their teacher takes them out to the class garden to work with plants which they enjoy.

8.2.2 In Local Sites

Local sites served as locations with abundant content around local species. While informal and often involving spontaneous experiential interactions with the environment, as echoed by the literature (Gambino et al., 2009; Hayes Hursh et al., 2024; Kola-Olusanya, 2005), children noted rich examples of complex species behaviour. These spaces often offered simultaneous observations about multiple species that children could see interacting, growing, or moving through local sites. This type of content, shared through stories that children would tell about visits to local sites, often showed elements of broader ecosystem content that children were learning through experience and observation, often via solo exploration or exploration with friends or family.

Children in focus group GA3A noted species content, including local plant species content, from direct experiences in local nature-centric sites. While these instances were isolated and relatively short, they provided additional content with which to engage in observation and experiential learning:

C – one time I went on a picnic with my dad!

R – ah I love picnics, was it in the highlands or where?

C – in the park close to trees and vegetation

[...]

C – one time I went to the plaza, I went fishing with my uncle and we went to jump into the sea to swim and there were little sharks.

Examples of species content, particularly around location and interactions with other species were abundant in focus groups. For example, children in focus group GA6C, on Santa Cruz, shared stories of visiting the National Park tortoise breeding centre:

C – one day I went to see the tortoises and…the tortoises were in a little house when they went to eat

C – I was in the national park, and we went to see some baby tortoises

C – ah yea!

C – yea

C – yea when we go to the beach

[...]

C – my dad took me to the park especially because… and I was going to see the tortoises

Children in focus groups GA2A, below, also mentioned species content from local sites, particularly the local National Park sites and the Charles Darwin Research Station (on Santa Cruz Island). Multiple children spoke at once about visits to these sites and added information about the type of content available to them about local species like tortoises, or even about less-experientially-available local species like the whale shark. Volume of content was also noted by the first child who referenced learning more outside in these local sites because there was 'more' outside.

> C – we learn more outside because there is more outside, for example in the Galápagos National Park, they explain to us some things that they teach us
>
> C – ah yea!
>
> C – like at the Charles Darwin Station they explain how tortoises…
>
> C – the museum the little museum where there's a…
>
> C – yea also
>
> C – the whale shark
>
> C – oh yea right!
>
> C – the whale shark

At the same location, the local Santa Cruz complex that includes the Charles Darwin Research Station, the National Park tortoise breeding centre, and entrance to the Station Beach, children in focus group GA6A described detailed content about species growth and reproduction, citing educational content about tortoises:

C – the Station is the beach that is the best for people because there at the Station there are two institutions, the Park and the Station and everything is connected and you can see the tortoises and everything like that, that is the most visited beach here.

C – it's like a museum

C – and also there's an area with giant tortoises, the "Route of the Tortoises"

C – ah yea

C – snakes!

C – we can even see the tiny ones [tortoises] to the big ones

C – snakes!

C – but they don't have venom

C – in my house I see the bones of the…

C – Also the other day we went to see a new-born - that they control like the sex of the tortoise due to the temperature

C – I knew that…and when the sea turtles [mixing double-application of 'tortuga' in Spanish] lay their eggs on land, they [park rangers] go and look for them and set the temperature so they come out…. Or they come out males

Other local sites where environmental learning content was explicitly noted by children included local beaches, out on the ocean, and local parks or green spaces in the highlands. The content learned in these locations was based on observations of wildlife. Some of this content was learned directly, while some was transferred to them via stories from family or friends who visited these sites.

In both types, children gained location and behavioural content about local species. In focus group GA6C, for example, two children shared stories from their family members who had observed local species content at local sites and told stories about that content to these children - even exemplifying in the first story the density of wildlife as learning content:

> C – one day my cousins are… and a shark appears on one side, a pregnant shark, and on the other side a stingray appears, and in front of it was an iguana!
>
> C – one time my sister went to the Garrapatero, and she says, and she is going to play, and she says, "mommy mommy I touched the shark…."
>
> C – really?

Similarly, a child in focus group GA4A who noted that they learned about the biodiversity of Galápagos from tourists who visited other islands in the archipelago, which are often prohibitively expensive and difficult to access for local Galapagueños and especially for children: "from the tourists who go out for a trip, so they teach us the importance of the biodiversity of the Galápagos."

Much of the species content at local sites was learned through observation and thus frequently included LEK of species location, behaviour, and appearance. The readily available content at local sites offered extensive and easy experiential learning for children and both complemented and expanded on content provisioned through schools which often emphasized species names and species contextual content like location. Being able to apply content learned through schools to frequent engagement with experiential learning on species content at local sites is potentially a potent pairing and seems to support children's' recall and memory of impactful site experiences.

8.2.3 In Homes

The home space offered three perceived sources for learning: family members, solo exploration in nature, and media, such as books or TV that children accessed while at home. As explored in chapter six, many children noted that family members worked in environmentally focused jobs. This contact with environmental work through family at home was one source of species content for children. For example, interviewee from GB3A noted that their family at home taught them about the environment "like for example I learn that species are introduced," and also "that plants also have life," the last comment a pivotal realization that some children struggle with when learning about local living species. Introduced species was also mentioned as content learned at home by the interviewee from GA5A who said that their family "also believe that I need to learn more about the species because it could be that I confuse them with other species that aren't from here, aren't the ones that they're protecting." Family at home also were providers of species content even if they didn't work environmentally centred jobs, indicating that species knowledge is pervasive within Galápagos communities. For example, one child in focus group GA7B said "I have a cousin who's also a tourist and they teach me how to talk about the species" of Galápagos.

Additionally, some children noted that they learned about the environment experientially at home because of immediately available ecological space at or around their house. For example, the interviewee in GA6C noted "ummm…I sometimes learned about the environment outside my house because outside my house, which is nearby, we have lots of plants and trees, all of that. I have the acacia, the em…and some plants, I don't remember what the name is…the sunflower." This quote includes plant species that are not native or endemic to Galápagos, but it serves as an example that potentially could be mirrored by other children who do live amongst more native species.

Finally, some children noted that they learned species content at home through other sources such as books and media. For example, the interviewee from GA6C said that they learned about the environment from books outside of school, and the interviewee from GB3C said "I watch videos about the environment" at home.

8.3 Geography, Geology and Climate Content

LEK that centred on local geography, geology, and climate was mentioned less frequently by children in interviews and focus groups, and when a location was mentioned in connection with this content, it was only ever schools and local sites, not in homes. This could reflect a general low level of earth sciences knowledge through schools and the general populace (Dolphin & Benoit, 2016). This does not mean that geographical and climate content isn't actively being shared or learned in homes but may reflect that this type of LEK is less frequent in general. From conversations in interviews and focus groups, awareness of geographical knowledge, particularly place names for local sites and other islands, seems to be learned experientially, as children pick up names for places that they visit or hear about. Beyond geography, geology and climate content was light.

8.3.1 In Schools

The only geographical or climate content that children mentioned learning in schools was about the geological origin and foundation of the islands as shown in the excerpt from focus group

GA1B below when children talked about what they learned through direct instruction from teachers in class:

C – the history of like how the Galápagos Islands were created

C – that Galápagos is an underwater volcano!

C – the strait of…how it formed

While the second child's comment represents incomplete knowledge - that the Galápagos are formed by underwater volcanoes but the islands themselves are the land masses resulting from volcanic activity - there was still a small snowball of knowledge constructed by these three children in the focus group, which is promising for learning and retaining what seemed to be exciting information to them. This also is distinct from the literature as children displayed an overall good grasp of knowledge around island formation and underwater volcanoes specifically (Vasconcelos & Paz, 2023).

8.3.2 In Local Sites

Children described learning about geography at local sites either through informal exploration or organisationally run programs. However, as stated above, the mention of geographical content was infrequent, and there was no mention of learning any climatic content in local sites. For example, children in focus group GA3A talked about how frequently they spent time in nature around the islands and within this time spent in nature-based sites, children could easily reference place name knowledge and other pieces of geographical knowledge such as distance and direction:

C – I always go every day

C – I only went a few times a week

C – on vacation

C – the other is that I went to Playa Roja, but we walked because it's like… an hour

C – it's like Tortuga Bay but farther away

C – I also spend a lot of time in the countryside

R – every day?

C – yes

In focus group GA1B, children mentioned that they had done programs, provisioned by organisations, during which they learned content that included information about how the islands were created (geological):

C – ehhhhh

C – a little

C – about iguanas

C – about how the islands were created

C – what were the first animals or what were the ones that people brought

Overall, the infrequency and paucity of local geographical, geological, and climatic content in connection with any location or source does mirror the amount of child-held knowledge on these topics. The geographical content that was mentioned was usually around place names or distance, and geology content covered the basics of volcanic activity around the islands. This could indicate a lack of content being shared with or provided to children about these topics.

8.4 Human Impact Content

Human impact content included pro-environmental values and pro-environmental behaviours or avoiding negative environmental behaviours. Children perceived that this content was provisioned predominantly within schools by teachers or organizational visitors, and within homes from family members or from other content accessible to children while at home like books or media. Less frequently mentioned but still present was the perception that sometimes this content was gained within local sites from observations of stated rules or from interactions with organizational staff or family members.

It is helpful to note a distinction here between types of pro-environmental behaviour content that children referenced. PEBs don't necessarily connote positive actions or positively worded guidance and can include guidance on what not to do which, by not doing, is pro-environmental. There was a trend, though, in the frequency of negatively worded PEBs vs a low frequency of positively worded PEBs, which could be an area to strengthen. As noted in the literature, PEBs can be both avoidance of negative action and engagement with positive action (Liu & Green, 2024), though studies exploring the impact of pushing more avoidant actions vs engagements with positive ones is not apparent.

8.4.1 In Schools

Within the physical location of schools, children perceived learning pro-environmental values, such as the need or requirement to protect or take care of the local environment, in addition to learning how to do that. Additionally, and unique to this location, children perceived learning about larger pro-environmental behaviours such as content around sustainable resource use and renewable energy. Schools are frequently noted as sources for learning about PEBs, though as the literature reminds, usually these PEBs are superficial and limited to easy actions like recycling, waste disposal, and energy saving (Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Salazar et al., 2024; So & Chow, 2019).

Mention of sustainable practices and use of resources reflects some of the content within the Contextualized Curriculum in Galápagos, which has specific curricular themes such as “Sustainable Island Economy” and within that theme, areas of content knowledge such as “Identify the different types of production that alter the socio-natural balance of the Galápagos Islands and generate alternative proposals for responsible consumption in your locality” (Ministerio de Educación & Universidad de Las Américas, 2020, p. 77). Another major curricular theme, “Interdependence and harmony in nature” includes many areas of content knowledge that also support learning about human impact by exploring natural resources such as sun and wind as sources for renewable energy. While these curricular goals do not explicitly include content about how those resources can be used locally in Galápagos, there are many examples of solar panels and small wind farms that children were aware of and presumably that teachers might use as examples within lessons on these topics. Related to sustainability, one child noted in the survey that they learned about "sustainable fishing and the renewable environment" in classes. In focus group GA7B, two children also mentioned that in classes they learn "about renewable energy".

Content about rules of engagement between humans and the local environment were the most frequently mentioned human impact content. Content covering these environmental values and rules of engagement with the local environment was reflected in both interviews and focus groups and even in a few written responses within the survey. For example, a child in the survey wrote that in class they learned "about caring for the environment," another noted that they learned "that we have to respect the rules of the environment and take care of the animals." The interviewee from GA7A and a child in focus group GA2A confirmed that in classes they learn that they should 'take care' of the local environment. A child in focus group GA4A also noted this, stating "we learn that we have to take care of the environment and respect it" while another child in the same group noted that they learned "to take care of the tortoises."

In addition to this general content and value, there were many references from children in other groups and interviews about learning *how* and *why* they should take care of or protect the local environment, indicating a focus on values and pro-environmental values content within classes. Sometimes, the how was mentioned generally, without detail as to the actual *how* in terms of behaviours or actions. For example, in interview GB1A, the child noted that in classes "…I learn how to take care of the ecosystem," and the interviewee from GA3A said they learn "um, how to take care of the environment" and "how to take care of the animals." In focus group GB2A, children similarly noted that they learned:

C - to care for plants

C - the plants

C - the water and things

This was reiterated by a child in focus group GA7A who said that they learned "how to take care of the environment."

The specifics for *how* and the detail on *why* children should take care of the environment were shared by children such as those in focus group GA2A who listed the negative environmental behaviours they were taught to not do in classes, with the last child mentioning a pro-environmental behaviour:

C – in school they teach us to not throw trash in nature

C – and not on the beaches

C – don't throw trash in the ocean

C – and he [the teacher] taught us more about the flora and fauna and how to recycle and take care of the environment. If we find an animal, we have to call for help or try to help….the animal

Children in focus group GA7A also mentioned negative-environmental behaviours that they were taught in classes to avoid and mentioned that they also learned the *why* behind the *how*:

C – that we shouldn't fish

C – we shouldn't catch fish that are 17 centimetres because they're…

C – we shouldn't catch the big fish

C – so that in the future there will be more species

In focus group GA4A, children also mentioned negative environmental behaviours and overall harm to the environment caused by humans that they learned about in class, and also noted the reason or the *why* for the avoidance of particular negative environmental behaviours:

C – people cause disasters by throwing garbage into the water and then the animals come and eat it, one day I saw….

C – gasoline fuel also harms the water

C – when we throw garbage in the trash…

C – and the fish in the ocean think it's food and they eat it

C – and the turtles…the plastic bags!

Finally, a child in the survey also detailed a *why* when they said that they learned that "we must not pollute, or the species will disappear."

In classes, children perceived that three major content areas were covered and connected: 1) that residents of Galápagos should take care of the environment (value content), 2) how they should take care of the environment (pro-environmental behaviours to engage with and negative environmental behaviours to avoid), and 3) practically why the first two content sections were important (examples of impact on local species and environment). The inclusion of all three areas of content in classrooms seemed to make an impact on children, not only sharing and instilling environmental values but giving them the tools with which to practice those values.

8.4.2 In Local Sites

Human impact content at local sites was experientially perceived by children, often through solo exploration or exploration with friends. Observation and experience of impacts such as pollution, at local sites is noted in the literature (Aguilar-Gomez et al., 2025; Canosa et al., 2021; Choi & Woo, 1999; Duran, 2021; Praet et al., 2023). Much of this content centred on observing visible immediate negative results of human activity – effectively, the real-world application of learning about the negative-environmental behaviours content provided in both schools and at home.

For example, children in focus group GA7B described observing visible negative human impacts around the docks and the Malecon and further repercussions on local wildlife because of the human activity:

C – on the dock also you can see a lot of trash at night e

C – uh huh and gasoline

C – the gasoline looks like a galactic colour and, the bad thing, I found two fish and two....

C – I found a fish...it was dead

Similarly, the interviewee from GB3A described the litter that they observed around town: "a few times a day I see thirteen bottles lying around [...] I also see things like toys lying on the street, for example [...] I see how...like for example...it's like thrown away plastic." Observations of trash or litter around the islands was frequent and often accompanied by frustration and disgust from children in focus groups and interviews. For example, the interviewee from GA1A described the pollution that they observed while going around local Galápagos spaces such as the beach:

> mmm, ehhh, as they say…contaminated, with a lot of garbage here. in other places and here too, like when they go to the beach, they see garbage and they collect, they collect it in…the bins, in the four bins, they are used in recycling, non-recyclable, reduce, and a red one called…but I don't remember."

The lack of mention of other types of human impact content learned at local sites does not necessarily indicate a lack of it in general, but perhaps it is more indicative that pollution is a topic that is very emotive and top of mind for children in Galápagos. Their observations of pollution are ones they react strongly to and thus remember.

8.4.3 In Homes

Children most frequently perceived that their homes were spaces where human impact content centred around environmental values and pro-environmental behaviours. The most frequent source within the home was family. This is often reflected in literature (Bandura, 1982; Liu & Green, 2024), though other studies note that often non-Indigenous parents who don't hold bodies of LEK and associated PEBs, don't pass this on (Evans et al., 1996; Istead & Shapiro, 2014; Legault & Pelletier, 2000; Straub & Leahy, 2017). This is where Galápagos families may differ, as it seemed from children's frequency of learning these topics at home, that many families shared PEBs and knowledge of human impact. When children in interviews were asked if their family at home shared pro-environmental values, particularly the shared belief that one should take care of or protect the local Galápagos environment, 10 of the 18 interviewees confirmed yes. Of these 10, some explicitly described this sharing of values content from family within the home, such as the interviewee from GA1B who noted that “they teach me that I should take care [of the environment],” or the interviewee from GB3A who noted “I learn that I always have to take care of the species” from family at home.

Again, similar to human impact content learned through schools, when talking about the pro-environmental behaviours learned at home, the *how* to take care of the environment, children listed many negative-environmental behaviours to avoid, and listed fewer positive-environmental behaviours with which to engage.

Some children only mentioned these behaviours, the *how* to care, without the *why*, such as the interviewee from GB2A who said they learned at home “don’t throw trash,” or the interviewee from GB3C who noted “I learn to take care of the environment when my mom takes care of the plants…I learn because my mom never pollutes the water”. Similarly, the interviewee from GA1A noted that their grandparents taught them what to do and what not to do for the environment, and why: “ahhh don't throw garbage, take care of the animals, don't pollute […] if they threw garbage, they knew they were doing something wrong with it…with the environment of Galápagos”. The interviewee from GB3A also noted a negative-environmental behaviour to avoid paired with a reason for avoiding that behaviour when they described learning at home: “never hurt the plants, plants also have life.”

The prevalence of references to negative-environmental behaviours vs pro-environmental behaviours reflects the wording of many formalized rules in Galápagos regarding the environment, policed by the National Park and other residents, such as do not get within two meters or touch local fauna, don't cut down or burn native plant or tree species, etc. While it's significant and important to teach these rules to children growing up in Galápagos, it reflects a trend noted in chapter five that while children shared enthusiasm for pro-environmental behaviours, the list of example behaviours they shared was often short and repetitive, which mirrors other literature on superficiality of PEBs taught to children (Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Salazar et al., 2024; So & Chow, 2019).

8.5 Chapter Conclusion

Similar to the chapter five, the LEK content that children reference or describe in connection with locations and sources of learning is heavily biased towards species content as the largest bucket and human impact content as the second largest. Species content is most frequently mapped onto schools as a location and teachers as a source of that knowledge. Trailing behind, geographical, geological, and climate content, which are important within environmental education and essential for conceptualizing space, place, and environmental change are significantly less frequently covered.

9. Discussion and Conclusions

9.1 Chapter Introduction

In this study, I explored four research questions: 1) What is the state of Local Ecological Knowledge of children living in the Galápagos Islands? 2) How do children describe the processes through which they learn about their Galápagos environment? 3) Where do children perceive that they learn about the environment? 4) What content do children describe learning about their Galápagos environment? Findings illuminated that Galápagos children have robust levels of LEK, learn from a complex network of sources, learn predominantly through experience and shared stories, learn in many and varied spaces, and learn and learn content that is often unique to place and source.

Children in the Galápagos Islands were tremendously generous in sharing not only their time, but their ideas, emotions, and stories, for this study. The volume of data that they generated led to detailed findings for each of the research questions and raised so many more. In this chapter, I explore cross-cutting themes that emerged through findings and in relation to the literature. Five discussion topics are covered: 1) explanation and exploration of rapidly and readily constructed LEK; 2) the connection between emotion and experience; 3) the concept of ecocentrism and environmental ethics as displayed by children; 4) support for the concept of child centric and childism theories and practice; and 5) discussion of go-along interviews as a methodological contribution to knowledge. Additionally, I cover the limitations of this study, to reflect my positionality statement and remind researchers and readers of the importance of reflexivity and contextualization. I also share both implications and inspiration for further research in hopes of highlighting children, Galápagos communities, and any human + environment interaction points as partners for deeper exploration and action.

9.2 Rapidly and Readily Constructing LEK

The findings show that children in Galápagos exhibit substantial and robust LEK which they construct predominantly through experiential informal and non-formal education sources such as direct contact with local wildlife, solo and accompanied explorations and visits to local natural spaces, and observations of space and people. Through the findings of this research, I propose, and will explore through this section, four points: 1) that rapidly and readily constructing LEK has occurred with Galápagos children, as one might expect in a bounded ecoregion with both external and internal desire for urgent environmental connection, despite the fact that 2) human habitation on the islands is recently established. I then introduce point 3) what children's LEK consists of, before describing 4) how and why children in Galápagos have rapidly and readily constructed such robust LEK.

9.2.1 LEK despite the odds

In this first point, I propose that Galápagos children have rapidly and readily constructed robust LEK, despite recency of human habitation in Galápagos. Galápagos is a unique case study for island and protected area LEK because of the recency of human habitation and local population growth. The lack of people Indigenous to Galápagos means that there is not a body of cultivated IEK specifically about Galápagos, but there is a possibility of LEK. Contrary to trends of degradation of LEK globally, especially trends noting less LEK held by younger generations due to both lack of desire for this knowledge and lack of access to it through experiential learning and infrequency of access to nature-rich sites (Ianni et al., 2015; Okui et al., 2021; Souto & Ticktin, 2012), children in the Galápagos exemplify that despite only having lived in the Galápagos for under 11 years, and despite many of them having only one to three generations of family history in Galápagos, they are able to rapidly and readily construct robust experience and shared-stories based LEK. This ability is important not only as it indicates that LEK can be constructed as high-quality and large quantity in a short period of time, but also that bodies of knowledge about local environments are possible to build without long-term historical presence.

What the findings of this study support is that populations who are non-Indigenous or who have otherwise not been physically present in a specific environment for generations can still develop rich bodies of LEK which increase connection to and protection of nature, key factors in local conservation efforts and environmentally sustainable management. This proposition is not to detract from the deep importance of IEK and its distinct facets as a long-evolved body of knowledge held by marginalized groups of people, and IEK should not be treated as less than LEK, quite the opposite. In fact, the contribution of the small but growing group of migrant indigenous Salasaka community members in Galápagos has yet to be explored as a potential for continuing rapidly and readily constructed LEK. The second point does, though, offer hope for the establishment of bodies of ecological knowledge that mimic some of the deeply valuable and essential qualities of IEK, especially those that encourage sustained connection to nature and reflect the often ecocentric worldview of bodies of IEK. This ability of Galápagos children is a model to learn from and could very well be replicated and encouraged in other regions, whether those be similar non-Indigenous Island communities or non-Indigenous communities living in or around protected areas or at-risk environments.

9.2.2 Composition of Children's LEK

In terms of the composition of LEK of Galápagos children, children shared both a tremendous volume of LEK and complexity of LEK, both contributing to the robustness and the rapidly and readily constructing LEK theory. Their LEK included comprehensive species knowledge, in addition to nascent knowledge of geography, geology, and climate, and knowledge of human impact within and on local ecosystems. As a starting point, children's ability to name and know considerably more about local animals vs about local plants was consistent with the literature (Díez et al., 2018; Jaun-Holderegger et al., 2021, 2022; Remmele & Lindemann-Matthies, 2018). Some Galápagos children were even aware of the fact that they did not know as much about plants. The occasional trend of the highland (rural) Galápagos children were able to more frequently and accurately name plant species than children living in port towns was also consistent with the literature (Eyssartier et al., 2017).

Where LEK began to depart from other studies was in the composition of species knowledge within animal species, and the characteristics of plants. For example, literature on children's animal species knowledge and naming notes that mammals are the most well-known and named group, followed by birds (Huxham et al., 2006; Jaun-Holderegger et al., 2021; Torres-Merchán et al., 2018). The Galápagos is a unique environment in that there are very few, six species groups to be exact, native mammals (*Biodiversity*, n.d.; *Galápagos Wildlife - Mammals*, n.d.). Most of these are marine mammals, with only the Galápagos rice rat and native bat species as the two terrestrial examples. The lack of native mammals is mirrored on other island systems that are physically significantly isolated from mainland landmasses. Because most native and endemic animal species are not mammals, children's animal species knowledge is more heavily weighted towards reptiles, birds, amphibians, and other vertebrates.

Despite a lack of native mammal species, however, children still held robust and lengthy lists of animal species names and knowledge, indicating that perhaps contrary to the literature (Huxham et al., 2006; Kellert & Kellert, 1997) the species knowledge of children relies less on the suppositions that children have an affinity to mammals because they themselves are mammals, but more on the actual makeup of the local fauna. It also indicates that children can still like and know about animals which are in entirely different vertebrate category from them, which could point more towards local attitudes towards native animals, experiential availability of many non-mammal animals, and conservation ethics constructed by children and shared within the communities in which they live.

Consistent with the literature (Genovart et al., 2013), children were able to name more of the visibly flagship species, though the reasons for this differed from the literature, as interaction frequency with flagship species, not just their charismatic nature, influenced Galápagos children's knowledge about these species (Genovart et al. 2013; Díez et al., 2018). This may be due both to direct experience with them, such as daily encounters in port towns with sea lions and marine iguanas, or frequent encounters with giant tortoises in the highlands and at breeding centres in port towns, and due to presence of those species in local culture including murals, signs, logos, clothing, and in school discussions. There is a noticeable gap in ability to name less visible species such as the flightless cormorant, which is not present in most accessible spaces on the islands. This again highlights the importance of experiential learning through interactions with flora and fauna.

Although children were not able to name as many plant species, the reasons for knowing local and native plant species names are distinct in Galápagos from other studies. Unlike IEK around plant names which often centres on plant uses including medicinal properties, edible parts, or other useful elements (Hunn, 2002; Wyndham, 2010), native flora in Galápagos (and native fauna) cannot be used, as it is strictly protected. Because of this, native plant knowledge is about recognizing species for their protection and to purposefully avoid damaging or using them. Even when a native plant does have edible elements, like the Galápagos tomato, children did not frequently recognize or name it accurately which could be because they are not allowed to eat it as it is an endemic species. Echoing the literature (Hunn, 2002; Jaun-Holderegger et al., 2022; Wyndham, 2010), children would often list flowering or edible plants when asked about favourite local plants or examples of local plants, but these would often be introduced species such as orange trees, papaya, strawberries, blackberries, sunflowers, etc. When I clarified my questions and asked for native or endemic plants, ability to name or recognize them decreased.

Beyond species names, ability to categorize animals as native, endemic, introduced, or invasive, was highly accurate and robust, contrasting studies that avoid this topic entirely due to lack of knowledge, or show frequent confusion and inaccurate knowledge about categorization of local fauna (Panisi et al., 2022; Proença & Dal-Farra, 2022). Additionally, children held substantial and frequently accurate knowledge of local species status, such as endangered or extinct, which contradicts literature (de Azevedo et al., 2012; Gomes et al., 2019; Rigoberto et al., 2021; Sosa et al., 2021; Stazione, 2025).

These additional segments of LEK indicate more complex, accurate, and robust LEK overall for children in Galápagos vs other highly biodiverse or protected areas. Galápagos children illustrate that these additional segments of LEK are ones that children can understand and excel in and yet they are infrequently used as a metric for children's LEK and conservation knowledge.

Local species knowledge overall abounded, despite the contradiction of strict no-use and no-touch regulations which put a very real boundary between local children and the flora and fauna of their local environment. This indicates that such regulations, for the sake of conservation and native ecosystem protection, does not hinder local children's ability to develop deep connections to nature in their local environments. It could even point to such regulations and regulatory boundaries as encouraging specific affinity, when paired with the frequent experiential learning children in Galápagos do enjoy, towards local native species because of the ingrained ideas that they deserve to be protected and that it is children's responsibility to help to protect them, thus encouraging nascent stewardship of local species. The boundaries in place in Galápagos between local human populations and native flora and fauna seem to direct children's attention to and understanding of local species and children interpret these rules as supporting evidence that flora and fauna have inherent value instead of value only for humans (the latter of which is a concept deeply ingrained in many sustainability programs (Devall & Sessions, 1985; Washington et al., 2017). This aligns with, and perhaps encourages the apparent development of children's ecocentrism in Galápagos, which sees local species as deserving of conservation and survival separate from their usefulness, directly or indirectly, to humans.

Additional LEK beyond species knowledge centred on geography, geology, climate, and human impact on the environment. Elements of these abiotic ecological knowledge segments were not particularly robust for Galápagos children, which was reflected in the literature (Dolphin & Benoit, 2016; Gersmehl & Gersmehl, 2007; Henriques, 2002), but the nearby-ness of geography knowledge, in the form of place names and knowledge of nature centric sites about their home island in the archipelago, may signify nascent knowledge that corresponds to children's age and that will grow with exposure and ability to conceptualize larger geographies as they get older, a concept supported by the literature (Cin, 1999; Gersmehl & Gersmehl, 2007). A similar phenomenon seemed to occur in geological and climatic knowledge, in which knowledge may reflect age and experiential exposure more than a lack of interest or valuing of that knowledge.

Human impact knowledge was robust and substantial, and often accompanied by strong pro-environmental emotions and emotive anecdotes. This knowledge, must like the species LEK, was predominantly formed through direct experience and observation and child-initiated application of their pro-environmental values. Because of frequent interaction with local flora and fauna in both nature centric and non-nature centric sites on the islands, children had abundant opportunities to see the direct and immediate impacts humans have on their local environment. This immediacy, as opposed to values being taught from adults to children through examples of the non-immediately visible and often indirect consequences of human activity on global environments, resonated deeply with local children. This phenomenon is supported by literature that note the impact of direct observation of human impact (Canosa et al., 2021; Praet et al., 2023).

While children in the Galápagos did have fluency when describing some Galápagos specific ways of protecting their home environment, and while the actual PEBs listed were often collectively agreed upon across focus groups and interviews, they were noticeably limited. Recycling and not throwing trash were the most frequently cited PEBs, which is supported by the literature (Lee & Manfredi, 2021; Raisya & Djuwita, 2018; Salazar et al., 2024; So & Chow, 2019). There were a small range of locally relevant PEBs such as not touching or harming wildlife, not cutting down native trees, not spilling gasoline etc. However, both the focus on the negatives (what *not* to do vs what *to* do), and the lack of larger or more substantial PEBs indicated a gap in local child knowledge. Children in this study had not developed or been supported with the detail and tools to build an expansive repertoire and understanding of more complex PEBs. This is not a failing of willingness to engage in PEB by children, as children were enthusiastic about the PEBs they did know about and engage with, but instead a notable gap that could be more deeply and comprehensively supported by adult actors or older adolescents. Local sources of learning, such as non-formal programs through organizations, informal learning from family members, and formal school-based content, have an opportunity to supply ideas and information about PEBs beyond superficial basics.

9.2.3 How and why Children have Robust LEK

In the case of Galápagos as a bounded ecoregion, the nature of the ecological and human systems on the islands provides children with a high frequency of access to direct experience and observation in addition to human-shared knowledge through programmed or impromptu interactions. As a result of this rapidly and readily constructed LEK, the children of Galápagos counter the noted trend in degradation of both IEK and LEK in research globally (Aswani et al., 2018; McCarter et al., 2014; Reyes-García et al., 2007) and instead provide a case study of younger generation growth of LEK which is promising for sustainability and conservation work.

The question is, how and why are children in Galápagos capable of rapidly and readily constructing LEK and why do they construct it? One of the definitions of LEK provided by da Silva Costa et al. (2023) describes LEK as built through interactions with and observations of a local environment that is often shared through generations. This definition was borrowed from Berkes (1999) who was discussing IEK, not LEK, but the findings show that Galápagos children who participated in this study, while not Indigenous to the islands, did exemplify the sourcing and construction of their own LEK in the ways described in this IEK definition. Bodies of IEK are rich with detailed observations and based on deep local experience over time, and despite their age and lack of indigeneity to Galápagos, these children engage readily with a sense of expedited and adopted vigour for learning about and developing a strong attachment to and protection of their local island ecosystems. This is echoed in literature such as Guest's (2002) research with coastal communities in Ecuador during which contemporary LEK was developed and could be acquired quickly due to integration into environmentally dependent economies, vs the longevity and time-dependence of generational and historically transmitted IEK. This was further supported by Reyes-García et al. (2007). The Galápagos does fit this model generally, as the recently established human population has formalized a now highly regulated set of communities per the Galápagos Special Law and subsequent reiteration and expansion of regulatory policies encouraging conservation-oriented local behaviour.

However, while a few children did mention the connection between conservation of Galápagos and the preservation of the local eco-tourism industry, most children in this study did not cite economic drivers as the reasons for their LEK, environmental empathy, or pro-environmental behaviours, neither does this match their displayed environmental ethos. So, while entry into a highly productive slice of the market economy (eco-tourism), may be a direct factor in construction of LEK for local adults who directly engage in and often depend on this economy, it does not seem to be a direct factor for most children. Indirectly, the focus on ecotourism and the number of local jobs that require LEK for adults (from working in the National Park, to running boat tours, to teaching, etc) does seem to indirectly provide sources of LEK for children, as the findings show that children cited family members, especially family who worked as National Park guards or guides, or family who worked in invasive species control and fishing or boat tours, as sources of information about their environment. The phenomenon of family working in environmentally related jobs sharing environmental content with children at home is not apparent, there is literature that notes that adults with these jobs do have significant LEK (Ardoin & Heimlich, 2013; Berkström et al., 2019; Garavito-Bermúdez, 2020; Iniesta-Arandia et al., 2015; Pontón-Cevallos et al., 2022), and so if family to child communication is good, we can presume that the phenomenon does occur elsewhere. Particular to Galápagos is the volume of local adult family members who work in environmentally related jobs, so this phenomenon occurs more frequently.

The regional and national focus on Galápagos as a National Park and site of considerable domestic and international tourism is complemented, or compounded, by the international attention and focus that the islands, and their residents, receive from UN organizations, international non-profits, and even documentaries. This compounded focus, in addition to local love of the islands, has created a human community that is centrally focused on the local environment. Which, in turn, has created a space in which children grow up surrounded by words, signs, campaigns, murals, sculptures, talking points, and other direct and indirect experiences that impress upon them the special-ness and importance of the flora and fauna of their home.

These surroundings make up part of the necessary complex network of sources of learning which children use to construct such robust LEK; however, these adult-created influences alone do not automatically produce children who are conservation minded and who value construction of LEK and experiences in nature. They must be paired with child agency to take in these adult-provided ingredients, in addition to rich experiential learning and observation of local ecosystems and human impact on them, for children to cultivate a self-sustaining and truly personal-value-driven environmental ethos. The essential component of experiential learning within an environment is supported by the literature which reminds that higher frequency of contact with and experience in nature leads to greater LEK, connection to nature, and PEBs (Aziz et al., 2022; Corraliza et al., 2013; Genovart et al., 2013; Jaun-Holderegger et al., 2022). In this study, children individually and collectively express strong pro-environmental emotions such as environmental passion and environmental empathy (Lambert, 2024), and pro-environmental values, which are elements of their displayed ecocentric worldviews and all important components to develop EL especially for elementary aged children (Bostad & Hessen, 2019; Hidayati et al., 2017; McKnight, 2010) While some of the practicalities of pro-environmental values were communicated from adults to children, the resonance of these values and reasons for believing in them stemmed from an internal child-built and sustained ethos. Other ingredients for these emotions and values were readily available to children in Galápagos in the form of frequency of interaction with local flora and fauna, frequent and easy access to local sites for experiential environmental learning, and frequent interaction with peers as a source of additive, confirmatory, and corrective learning and value sharing about the local environment. What seems to be clear through this research, is that children must be given agency to parse ingredients and from them, construct robust LEK and sustained environmental values and behaviours.

The structure of and access to the environment in which children live in Galápagos seems to also play a role in rapid and robust LEK construction. Having access experientially to so many local nature-centric and non-nature-centric sites and, each with an abundance of local species, increases the material that children process and use to construct such LEK. Further promoting this access, local fauna has evolved with a noticeable lack of mammalian and terrestrial predation (Durham, 2021) coupled with very recent introduction of humans to the islands which has produced local animals that are not afraid of humans and thus on the whole do not avoid human presence, increasing the instance of interaction between human and animal and ensuring close proximity to animals for local children. This is not to say that human populations elsewhere, where this animal response is not common, cannot construct robust LEK, but it highlights the importance of interactions with environmental components, animals included, for the purpose of high-frequency experiential environmental learning which increases the construction of connection to nature and pro-environmental values. Access to and experience of an environment is deeply important and essential for children to construct LEK and the necessary components of emotional connection to nature to lead to behaviour change and stewardship of that space. General frequency of interaction with local fauna and access to local sites has only been mirrored in two studies with children living in or alongside similarly highly biodiverse protected areas in Brazil and Greece (Martinis et al., 2018; Pío-León et al., 2017).

As a note, while children in Galápagos did frequent many local National Park sites, these were predominantly on their home island or on other inhabited islands. This reflects challenges in access to the rest of the archipelago for residents and the often-significant barriers to entry for much of the national park not on inhabited islands. If children in Galápagos are already constructing such considerable LEK and building strong positive emotional connections to their local environments, rapidly and readily constructing LEK and corresponding EL components would most likely exponentially increase if the literal scope of their learning spaces expanded.

Overall, this study has shown that rapidly and readily constructing robust LEK is possible despite residents not being Indigenous to the Galápagos, and despite recent permanent human habitation. The findings also illuminated the complex composition of children's robust LEK and indicated how and why they rapidly and readily constructed robust LEK. It seems that the bounded ecoregion of Galápagos, the high incidence of human-wildlife interactions, frequent and easy access to nature-centric sites, and conservation attention on and within the islands, and children's capacity for heightened ecocentric moral reasoning, has all helped with rapidly and readily constructing LEK. This study does not seek to undermine the importance of IEK from other Ecuadorian and global communities. The idea here is to highlight the way that Galápagos children and the very recent generations of human residents, have managed to emulate some of the depth and connection that is inherent in bodies of IEK.

9.3 Emotion and Experience in the Environment

Knowledge, including LEK, does not exist in a vacuum. When discussing LEK, the literature supports attention to emotional components of knowledge such as ecological empathy, eco-emotions, and other emotional responses to experience that shape and shift importance and recall of knowledge built through them. In this way, this study departs from a historical Western separation of knowledge (reason) from feeling (emotion), noted in the views of Plato and Descartes as an example (Michelson, 1998). These views still in many ways permeate approaches to mind vs or over body, referenced by feminist writers as the 'abstract masculinity', or, a "detachment from whatever ties the knower to a contextualised human life: emotions, loyalties and interests, memories, responsibilities to others" (Michelson, 1998, p. 218, referencing Bordo, 1986). Instead, the findings of this study affirm the idea that emotion and reason are intrinsically intertwined, and that emotion and experience are an essential pairing to construct knowledge (Felten et al., 2006; Graesser, 2020). This builds on ideas from foundation learning theorists Kolb and Dewey, who saw reflection, involving emotional responses and processing, as an essential ingredient in knowledge creation (Michelson, 1998; Kolb, 1984; Dewey, 1933, 1934). I agree with Felten (2006) and Graesser (2020) in the idea that emotion can take a central role in the construction and evolution of knowledge. The children in Galápagos who participated in this study and shared their knowledge did so while also sharing emotion - the two were hand in hand. Findings showed strong emotional responses to the discovery and construction of LEK through direct experiences in the local environment, and even the presence and use of emotion to convey knowledge and the importance of that knowledge gained through shared stories. Such pro-environmental emotions are supported by literature which notes that children, especially around the age of these Galápagos children, have increased moral reasoning and ecocentrism which often fuel pro-environmental emotion (Kahn & Kellert, 2002; Krettenauer, 2017).

Galápagos children exemplified that emotion has a communicating function: through shared experience and shared emotion, children individually and collectively communicated the importance they feel is essential to assign to local environmental problems or to the excitement of learning about their local environment. This emotion-led communication is supported by the literature (Clayton & Ogunbode, 2023). While focus has been paid to mitigating and managing the growing negative doom and eco-anxiety related to climate change and human-perpetuated environmental degradation, it may be more important to focus on the other side of the coin: the power of ecological empathy and passion, as supported by some studies (Junot et al., 2017; Lambert, 2024; Wang & Li, 2024). These powerfully positive motivating emotions in childhood include both emotion towards components of the environment (excitement and love of animals, plants, and natural spaces), and emotion about the protection of and change in behaviour towards the greater environment and ecosystems. As noted in the literature, there is an increase in eco-centric thought and moral reasoning and awareness of social (including environmental) issues, in mid-childhood (Krettenauer, 2017; Liu & Green, 2024), but some studies note a deterioration of it in later adolescence (Krettenauer, 2017). This is not to say that large-scale and deeply impactful (and ongoing) environmental movements and change have not been fuelled by adolescent passion for environmental protection and change, as noted in earlier chapters regarding youth-led environmental movements in recent decades (Neckel & Hasenfratz, 2021). But perhaps those movements would be even more well-fuelled if adult actors taught, non-formally, informally, and formally, children to harness that nascent passion and ecocentrism instead of perhaps instilling adult-centric views and beliefs which tend to lean more anthropocentrically.

Akin to emotion, experience is a rich foundation for knowledge construction. Children who participated in this study affirmed literature that notes that experience is not only an essential element to learning (Dewey, 1938; Kolb, 1984; Miettinen, 2000), but that direct environmental experience, or time in their local environment and natural spaces, was the most impactful, memorable, and effective type of learning for them (Gallois et al., 2017; Setalaphruk & Price, 2007). Children frequently communicated their LEK through verbal stories based on direct experiences in the Galápagos environment, and these stories of experience were forged in and remembered through the glue of emotion. For children in Galápagos in this study, emotion was an active construction tool for knowledge in addition to being a fuel for ideas about and decisions to protect the local Galápagos environment. The LEK shared during focus groups and interviews especially was coded with emotion which seemed to increase retention of that knowledge through detailed recall. Galápagos children painted a clear example of how direct experience in nature leads to emotion which in turn leads to the construction of 'sticky' and powerful knowledge which then supports the development of environmental values and attitudes, which support commitment to and choice of PEB. The children who shared their time for this study overwhelmingly asserted that a separation of emotion from knowledge is unfounded, and that including emotion in the experiencing of the environment and allowing and encouraging that emotion to drive concrete knowledge construction through reflection (Felten et al., 2006) leads to clear and powerful retention of that knowledge.

This study, and the children participating in it, show the importance and essentialism of emotion in environmental education and literacy work, and any related fields. If conservation or sustainability programs hope to both help children develop LEK and to choose pro-environmental behaviours, they must address the often overlooked but integral component of emotion. If environmental emotions are not tended to or encouraged equally with knowledge sharing, our hope of new generations taking on the mantle of environmental stewardship and protection will die on the vine. We can posit that the success in Galápagos, with so many young people invested in their local environment and willing to be stewards of that environment, is because this emotion is present. So, listening to and encouraging children's positive and powerful emotions about their environment is deeply important.

9.4 Ecocentrism - Galápagos Children's Worldview

Experience and emotion coevolve with and help children to construct robust LEK for Galápagos. The essentialism of pro-environmental emotions to the construction of LEK and other EL elements such as values and behaviour, are supported by the literature (Millar & Millar, 1996; Reis & Roth, 2009). This overwhelming sense of pro-environmentalism is connected to another main finding of this study which was that children in this study overwhelmingly displayed an ecocentric ethic when discussing environmental knowledge, human impact, reason for protecting the local environment, and actions for sustainability. As described in the literature review, an ecocentric philosophy, ethic, or view means centring the right of survival and to sustained existence of the ecosphere above the perception that humans as a singular species deserve prioritization at the expense of ecosystems, non-human species, and natural spaces (Foster, 2022; Kidner, 2014; Rowe, 1994). I propose that the development of LEK through experience and constructed with positive and powerful pro-environmental emotions, not only lead to stewardship and pro-environmental behaviours, but also encourage children to cultivate and grow what may be an inherent ecocentrism of childhood not always taught by adults.

As described in the literature review, many Indigenous philosophies, especially around local environments, teach and include ecocentric values, beliefs, and practices, but are also based on sustainability and conservation for the purpose of human survival, proving that to ensure human survival, it is not inherently necessary to adopt an anthropocentric philosophy (Kidner, 2014; Rowe, 1994). Similarly, research with children on environmental beliefs and behaviours echo the findings of this research that children, especially around ages 9-10, display more ecocentric values than older children or adults (Krettenauer, 2017; Liu & Green, 2024). This study further supports this proposition, that children are disposed to be ecocentric, and that they can cultivate and nurture their own ecocentrism through environmental experience, LEK, and emotion, because of the apparent ability of Galápagos children to display ecocentrism in spite of the more anthropocentric values taught through the school curriculum.

This study not only confirms an intrinsic affinity for ecocentrism in children, but it also questions the ethics around adult-led experiences and contexts, such as homes and schools and organizational programs, which may impose a worldview that is contrary to that intrinsic child ecocentrism. This study raises the question: if children are intrinsically more ecocentric than adults, when, how, and why does this shift in worldviews occur, and, given that the Galápagos and indeed many other global locations are focused on conservation and climate change mitigation, should we not defer to children's ecocentrism as the guiding light, instead of relying on default adult anthropocentrism? If we do the former, perhaps that apparent shift to anthropocentrism will lessen in future generations.

The above is not to say that all adults in Galápagos, or anywhere, are anthropocentric or incapable of holding ecocentric views. Adults are indeed capable of holding ecocentric worldviews, as is evidenced by the literature written by adults which espouses ecocentric values (Kidner, 2014; Rowe, 1994; Washington et al., 2017). Additionally, Galápagos children do reference adults who have shared knowledge that contribute to children's ecocentrism. These adults were often noted to be park guards, other organizational staff members from non-profits or local governmental orgs, and adult family members (noting a substantial overlap in adult family members who also worked in the park, as teachers, or in other environmentally related jobs). These adults, and often the spaces that adult generations in Galápagos have built and continued supporting, mirror the ecocentrism that children display. For example, program content from the National Park, signage throughout National Park sites, tortoise breeding centre signage and content, even multi-age painters of local murals, mosaics, or sculptures can be interpreted to be ecocentric and thus add support to children's ecocentrism. Teachers, as well hold the power to interpret and make decisions about examples and projects used in classrooms which may depart from the anthropocentric tilt of the written curriculum.

9.5 Centring Children

The 337 fifth graders on Santa Cruz and San Cristobal islands who both had permission to and were willing to take part in the survey for this study generously shared their perceptions and ideas about their home ecology and the volunteer interviewees and focus group participants gave even more of their time, energy, and commitment to discussing what they think and what they know about their islands. This study has shown the importance of seeing children as the experts in the room on their own LEK and that their voices are heard as legitimate community members and individuals who will shape the future of the islands. The centring of child voices, recognition of them as complete human beings, and inclusion of them in research is supported in the literature (Quennerstedt & Quennerstedt, 2014; Sudarsan et al., 2022). As discussed in the theoretical framework and philosophical underpinnings of this research, centring children as agency-holding actors with legitimate knowledge and beliefs is both equitable and essential. This is especially important when investigating environmental topics, as children are inheriting the current and future global environment. The centring of children requires the questioning of research approaches, methods, outputs, and literature that assumes sameness between adults and children, and by so doing, ignores and misrepresents millions of experiences worldwide.

This study insists on frameworks like childism (Wall, 2022), as described in section 4.2.3, which works to not only centre child voices, but to actively recognize, reflect on, and dismantle adultism which often undermines, strips agency from, and does a disservice to children. Childism helped keep me honest and aware as a researcher, but also highlighted points of misalignment between some adults living in or working around Galápagos and the views of many children living in Galápagos. The contextualized curriculum currently being used in the Galápagos, like most school curricula worldwide, was adult-consulted and designed, with no listed input from the individuals who would receive the content and structure of the curriculum as students (Ministerio de Educación &

Universidad de Las Américas, 2020). This is particularly concerning when discussing both the UNCRC's stated rights of the child (*Convention on the Rights of the Child*, n.d.), and when discussing education for and about environmental realities and ongoing challenges. As stated in section 2.3.2, children are and will continue to be disproportionately affected by adult-human-caused climate change (Cutter-Mackenzie & Rousell, 2019; *The Climate Crisis Is a Child Rights Crisis*, 2021), and will inherit global environments further destroyed by other branches of the environmental polycrisis, which should give adults pause when considering the emotions, knowledge, and beliefs of children about what they want to focus on and learn about to best outfit them to deal with and mitigate those futures. What was noticeable through the stories and emotions children shared in this study, was the marked ecocentrism of their beliefs and behaviours regarding their local and broader environment, which contrasted with the implied anthropocentrism of the curriculum documents.

Beyond school curricula, centring children seemed to also allow children to more freely express and engage with their ideas, emotions, and beliefs in data collection. One example of this was the child-initiated and led co-learning and sharing space that I termed knowledge snowballs. As a reminder, this term was developed to best-fit the reality of children's engagement within focus groups, as a similar term did not yet exist in the literature. Knowledge snowballs are the unplanned construction of snowballs of knowledge that grow through an initiating comment or idea from one child that then reminds other children of their own knowledge, which they add in a cumulatively complex pile of information about a topic. Recognizing, and not deterring or shutting down these spontaneous and child-led knowledge snowballs was an equitable and deeply important way to centre children and to recognize peer-to-peer learning especially about a topic that unites children because of shared realities and experiences: LEK. Knowledge snowballs are at once a potentially useful phenomenon for adults to encourage or let happen to increase peer-with-peer learning, but also potentially a child-centric way to assess environmental knowledge such as LEK. Knowledge snowballs align with childism as they completely decentre the adult and allow children direction and agency within their knowledge sharing.

Additionally, snowballs were entirely child-led, and thus an ethical way that I could decentre myself as the adult in the group. In fact, I argue that by giving children the freedom to develop direction of a conversation, spontaneous branches of knowledge collection and formation appear that would not have been present in more formalized adult-directed learning spaces. Learning from peers is an important part of social, emotional, and cognitive development for children, in addition to an effective conduit for LEK (Cruz García, 2006; Setalaphruk & Price, 2007), and thus allowing these unstructured formations like knowledge snowballs to be created by children for children is a responsible and indeed integral part of education, especially when encouraging children to develop comprehensive and value-laden knowledge about their local environment. The camaraderie and collaborative additive nature of knowledge snowballs encourages the sharing of value and pride in ownership of environmental knowledge and thus, per the connection between values and actions, can increase place attachment to the location about which the environmental knowledge is, and increase pro-environmental behaviours for children.

While I did not collect data with adults in this study, it would be worth highlighting the rights of and beliefs of Galápagos children in any adult-led venture on the islands to ensure ethical future considerations. In this way, Galápagos children have encouraged me to interrogate the ideas of omission of children from educational programming like curriculum design, and the general omission and exclusion of children from environmental management spaces. Adults who work within environmental education, or on programs and projects intended to increase EL, especially for the purpose of informing about and mitigating branches of the environmental polycrisis locally and globally, should critically examine their own adultism and adult-centric positionalities and proactively include and listen to children, especially in the philosophical purposes for learning about and solving the polycrisis. This is echoed by the literature which supports and insists on inclusion of children especially within policies and projects of conservation (Adom, 2022). Perhaps it is time to de-centre the adult, as adult-led histories have led us all to the brink of irrevocable ecological destruction, which includes the destruction of humanity.

9.6 Go-Along Interviews as a Methodological Contribution

This thesis offers a contribution to methodological knowledge and practice through the illumination and testing of go-along interviews as a method both for gathering data within environmental social science research, particularly for studies hoping to learn from children about their LEK or other components of their EL. Additionally, this research builds on existing literature that encourages go-along interviews as a method that is child-led and child-centric and therefore aligns with the goal of mitigating adult researcher powder dynamics with child participants, and not removing agency from children in research contexts (Hart, 1979; McFadden et al., 2023; Green, 2012). The use of go-along interviews or other similar methods, such as child-led tours for younger years, works to mitigate the marginalization of children. This research also adds to a small body of literature (Veitch et al., 2020; Rooney, 2018) looking at the combination of the two elements above: a novel methodological approach for working with children in the field of environmental education and learning to experientially explore participant LEK, connection to nature, place attachment, environmental emotions, and attitudes.

Children who participated in this study were given the opportunity to volunteer for go-along interviews in each class, and consistently, this method of engagement for this topic was met with considerable excitement and enthusiasm in each classroom visit. While there were certainly children who were not as comfortable with 1-1 conversation, the go-along interview did provide an opportunity to connect with children who were willing to and able to verbalize more of their thoughts and to use their agency to guide the researcher through a microcosm of their local environment. Go-along interviews as a comfortable method for children to engage and discuss their local space is supported by other literature (Merewether, 2015). The often complex and in-depth conversations and physical pathways that followed in these go-along interviews echoed childhood researchers who have advocated for and used such methods for the purpose of retaining child agency. This study went beyond the scope of current research by applying a version of this method to environmental education data collection and specifically for data collection exploring children's held knowledge of their local environment.

The go-along interview used in this study not only allowed for freedom of movement and for children to feel as the expert of their own life and local environment (building on the idea of children as 'experts in their own lives' by Clark (2011, 2017)), teaching and leading me as we walked, but also allowed children real-time fodder for conversation related to our topic. The reference to and use of the surrounding space during a go-along interview is echoed by Evans and Jones (2011). The real-time references made by children, and the freedom of movement, both physically and conversationally, that this method allowed for, suggests that go-along interviews through local environments is an ethical and deeply productive way of more effectively understanding children's LEK beyond answers to survey questions. Children could, and often did, point to and use their surroundings, even referencing memories within and prompted by the environment focused path during interviews.

Go-along interviews presented children with opportunities to both show and tell their LEK. But beyond LEK, this method also presented children with a type of engagement through which to communicate, through body language and verbalization, the emotion that has helped to construct and retain that knowledge. In this way, the go-along interview is not only helpful for children to show their LEK, but to also demonstrate and share other components of EL, especially environmental dispositions or affectations.

9.7 Conclusions

9.7.1 Reflecting and Rethinking - Limitations

As a subjective researcher, many of the decisions I made in applying to this DPhil program at Oxford, accepting it, and seeing it through were driven by the compounded experiences of my own life, and of academic, corporate, and personal observations I had made of the world as I moved through it. Doctoral research was not something I undertook to show off what I knew how to do but was something I felt impassioned to explore with a community and in an environment that I love, and to develop my ability to evolve, learn, and reflect. Doctoral work is an exercise in formation of researcher identity and in confession of newfound awareness, understanding, and recognition of our own impact on and purpose in academia and the broader socioecological system. The above explanation serves to situate the decisions I made that did in fact limit my research. Prioritizing ability to support myself while balancing part time jobs, paying double (or triple) rent or temporary accommodation fees (both in Oxford and on Santa Cruz and San Cristobal Island), hundreds of pounds in printing costs locally while in Galápagos, flight, boat, and taxi charges, and of course sustenance, meant that I had to make critical choices about the length of time I was able to spend in the field, and on each island.

The limitation I most often play out differently in my mind is that of the actual research questions. I approached this research with a presupposition that knowledge would be the most impactful thing to focus on, thinking of knowledge, specifically LEK, as one of the more foundational building blocks for environmental education, attitudes, values, and behaviours. While I still believe knowledge to be essential to constructing and sustaining all these other components of EL, I discovered a magnificent volume of findings that had nothing to do with knowledge and everything to do with the stuff around it: those environmental attitudes, values, emotions, place attachment, and behaviours. I had assumed that knowledge would be the easy to gather data on with children, already contradicting what I imagined at the start to be my belief in child agency, individualism, and ability to engage with the world. I have since come to understand how much I missed, even lacking reflection on my own childhood which would have reminded me that emotions, beliefs, and values were huge drivers for me personally as a child. That lack of understanding and lack of true reflection on my view of children hindered the scope of the study from the very outset in terms of what questions I thought to ask.

The scope of the research questions for this study was limited to asking specifically about LEK instead of umbrella terms. Because of this narrowing, research questions on other distinct elements of umbrella terms like EL, such as environmental attitudes, values, or behaviours, were not explicitly covered. The narrowing was necessary for the practical limitations that a DPhil project imposes; however, the information that children shared led to findings and discussion points that indicated deep connections and relationships between components of EL. It was clear that knowledge does not exist, and perhaps should not be investigated, in a vacuum. Resource permitting, a more nuanced approach to research questions and to data collection instruments could have provided more depth to findings. Focusing just on LEK was, I believe, a large limitation to the study and while highlighting it as important to broader discussions on the environmental polycrisis and social change, it is artificial to separate it entirely from other elements of EL.

As this study included two qualitative data collection methods, gathering individual stories from individual children was central to the research. That being said, stories were only gathered from children living on two of the four inhabited islands, and, as these two islands are the two most populous islands, stories from children on Isabela and Floreana could have been considerably different from those shared on Santa Cruz and San Cristobal. For future qualitative-heavy studies with children in an already-small community, I would encourage researchers to find ways of including children from all four islands both for the ethics of inclusion and presenting opportunities to children to share their voices if they so desire, but also to gather what could have been additive or divergent views and ideas.

Additionally, while the mixed methods approach did provide breadth and complimentary data, the qualitative data collection instances were time-bound and single-touchpoint. A truly ethnographic study with children in Galápagos would be ethically rigorous as it would deeply centre child experiences and voices. As a final note on methods, the use of go-along interviews with children about their LEK beyond the physical limits of the school would be useful. As discovered during data collection, school grounds vary widely in terms of vegetation and general environmental elements, and thus when asking children about their LEK, it would have been useful and informative to have children lead walks through local sites to both provide visual and tactile fodder for conversation and to observe children outside of formal education spaces but still within the environment about which we were speaking.

Through findings from research questions one and four, it became clear that species names were a prominent topic of LEK for children in Galápagos. While names were frequently connected with more complex species knowledge, conversations with children, and even answers to survey questions, illuminated that a lack of, or even temporary lapse in (as in, failing to remember), species names does not necessarily indicate a lack of LEK. For all data collection instruments, the emphasis on asking children to name species may have overshadowed other more complex questions that could have been asked to allow children to share and demonstrate more substantial LEK.

This study would benefit from engaging more directly with Indigenous philosophies and the local migrant Indigenous community, especially for critically examining the anthropocentrism of many non-Indigenous political and social systems. While Indigenous groups living in Galápagos are small, it would be beneficial to engage both with more Ecuadorian Indigenous, Salasaka, scholarship and community narratives, as well as with Indigenous children and community members to investigate differences in LEK and environmentalism between Indigenous and non-Indigenous children.

9.7.2 Implications and Inspirations for Further Research

As humans, and all the ecosphere, brace for exponential worsening of all branches of the human-caused environmental polycrisis, with incredible losses to the ecosphere impacting all living things including (but not exclusive to) humans, highlighting case studies like the Galápagos to both applaud and learn from them is productive and hopeful. Highlighting children who exemplify not only the construction of robust LEK, which informs sustainable management and protection of local environments, but also broader environmental knowledge and the affective components of EL that are the generative power behind behaviour change, is deeply encouraging for an ecocentric turn in stewardship. The children who participated in this study are examples of an alternate trend in LEK that counters the degradation of such knowledge seen in other case studies (Gerl et al., 2021; Louv, 2005). More research with communities like these children who exhibit robust and increasing LEK and environmental affectations could provide more actionable paths to deepening and developing EL which is in line with global goals set out by the UN and many member states, in addition to being the goal of many individual communities fighting for change.

Research and work on educational programs and materials, such as curricula, may benefit from consulting with those who are subject to or receive those materials, in many cases, children. Through this research, it became clear that while some adult-designed and provisioned programs and knowledges matched the ethos and desires of children in Galápagos to learn about their local environment and engage with protecting it, others, such as the inferred ethos of the Galápagos contextualized curriculum were not entirely in line with child cultures. Curricula for formal education systems are not typically designed with child consultants on board or involved, but this should be questioned, as there was a noticeable gap between the concept of rights of the child, as put forth by the UN, and the ethos behind the content that is imposed on children by adult actors.

Further research that uses childism (Wall, 2022) as a guiding theory and which seeks to recognize and question normalized omission of children, especially on topics that impact them disproportionately more than the adults controlling those topics, such as environmental education and education for sustainability, could provide support for children's rights. Methods that centre and create spaces of comfort and ease for child communication are also something that the academy could do more of. Go-along interviews and focus groups, for example, while challenging for researchers in terms of ethics and management, presented spaces in which Galápagos children seemed to communicate in comfortable and natural-to-them ways which meant that their voices and experiences without insistence to conform to adult-shaped spaces.

Through this research, it became clear that children, if given access to spaces and environments, can construct their own LEK. Research and practice which asks children and listens when they discuss what knowledge is powerful and meaningful to them, how they learn, and what knowledge becomes sticky through the coevolution of affectation with that knowledge, would greatly benefit work on LEK as it provides actionable insights for the purpose of elevating and encouraging environmental behaviour change from a young age and with younger generations, set to inherit continually increasing environmental challenges. In research and in practice, experiential learning about and in the environment seems to produce this sticky knowledge and would benefit from increased academic and practical attention for children.

The Galápagos human and socio-ecological systems are under-researched. There is a clear gap in research in the social sciences and particularly around residents' interaction with and connection to the local environment. Filling this gap with locally consulted and thoughtfully designed research would allow for the increased involvement of residents in sustainability and conservation particularly around EE and environmental polycrisis education. Additionally, research with Galápagos communities about their engagement with the local environment would benefit the international community by sharing examples of excellence and evolution of EE and LEK. This is a specific note to audiences outside of Galápagos: while research on and about non-human spaces and species are vital for the construction of ecological knowledge for policy and people, research, and content in general, that omits local human populations from environmental contexts and conservation narratives perpetuates the Western-pushed separation of human vs or above nature, which does not serve sustainability measures. This omission is a choice and one that does a disservice to environmental work that asks humans to do more to take care of global environments. It would behove us as researchers, documentary filmmakers, teachers, non-profit leaders, policy makers, to recognize the detriment that removing humans from environmental issues and spaces causes, and attempt to work in opposite ways, especially listening to Indigenous voices who often highlight the necessity of human as part of nature for local environmental sustainability and global mitigation of the environmental polycrisis. As we all grapple with how and why to protect nature and ecosystems, having examples of how and why other human and child communities, like those in Galápagos, are doing this, is important. To complexify the findings of this study and address the above questions, including the element of place, and concepts of sense of place or place attachment especially when connected with LEK and in conversation with PEBs could produce rich insights for community conservation in an ecoregion like Galápagos (Ardoin, 2014; Ardoin et al., 2025).

Additionally, research conversations around the transfer of IEK held by Ecuadorian Indigenous communities the Galápagos could illuminate possibilities for informing and encouraging the development of LEK at migration points. Most scholarship on IEK looks at this knowledge in relation to the origin space of the community who holds it, but with global migration patterns and changing landscapes, more Indigenous communities or individuals are migrating and questions around what happens to the IEK when movement occurs, and how that IEK can encourage and inform the development of new bodies of LEK has not been studied. Additionally, research around how this transfer and transmission from family to children in Indigenous homes and schools happens when environments are newer to human residents would be helpful to understand how to translate and preserve IEK once movement happens. The comparison between LEK and IEK, especially in the case of Galápagos has not yet been investigated, and the potential to learn from established IEK, even as it originates and is held predominantly about other environments distinct from Galápagos, could help understand the rapidly and readily constructed LEK for children in Galápagos.

Finally, this research has prompted a reflection on and urgency to address further and new research questions. I believe that the structure of this study and the novel contributions to knowledge should be investigated further through comparative studies with children living on mainland Ecuador, particularly children in other protected areas of Ecuador or a comparison with children living in nonprotected areas of the country. This could provide more confirmatory evidence and child-centric stories around the construction of LEK. I also am curious to work with groups of children who are either non-Indigenous or migrant-Indigenous to a new local environment in countries that are top contributors to the environmental polycrisis to explore if rapidly and readily constructing LEK is possible with these child communities given different combinations of local factors. Relatedly, exploration of how experiential learning can lead to co-construction of pro-environmental emotions and LEK for other child communities and for other age groups of child communities would provide more actionable insights for adults working for and with those children and could provide further support for inclusion of children in adult-dominated conversations around environmental and educational policy. Lastly, questions around how best to work with children especially on topics of the environmental polycrisis and the stewardship of local and global environments arise: what stories, ideas, and worldviews are we missing as an adult populace from children in varying ecosystems around the world and can these stories, ideas, and worldviews provide needed impetus for environmental and educational policy, or novel contributions to ecosystem management and conservation?

9.7.3 Concluding Remarks

This study centred on children and the environment within the Galápagos Islands, and findings illuminated a case study of a both highly unique but universally relevant location and socio-ecological system. As a UNESCO Natural World Heritage Site, National Park, and Marine Reserve of Ecuador, the Galápagos exemplifies an environment that is recognized as one worth protecting due to high rates of endemism and incredible biodiversity of both flora and fauna. This recognition assists greatly in the development of recently established human communities who, overall, support conservation of their ecological home. While these environmental values and ethics are not ubiquitous throughout the four human-populated islands, it is the dominant philosophy of children who participated in this study.

Findings for each research question highlighted nuance, depth, and clarity of thought from children. In chapter five I explored answers to the first research question, what is the state of Local Ecological Knowledge of children living in the Galápagos Islands? This was an exploratory question, and to gain an understanding from children what their LEK consisted of, I drew from surveys, interviews, focus groups, and observational notes. The survey provided insights into accuracy of species knowledge through photo identification and ecological questions, while in interviews and focus groups, children exhibited substantial LEK through stories of experience, learned stories from others, and references to species location and description, species status and category, some geography and geology, and human impact on the local environment. While species knowledge was weightier for animals than for plants, children overall readily exhibited robust LEK that was nearly always paired with equally strong and foundational pro-environmental emotions. Out of all findings chapters, this first piece on LEK illustrates a richness of both depth and breadth of LEK. The volume, robustness, and complexity of LEK that children shared and that was discussed in this chapter is central to this study as it supports that children not Indigenous to Galápagos are capable of rapidly and readily constructing LEK.

In chapter six, I explored: How do children describe the sources from which they learn about their Galápagos environment? Findings illuminated that children learned from a complex network of sources, that were each engaged with through one or more modes of interaction. The five sources and their modes of interaction identified by children and the researcher were: 1) time in nature as a source, and solo exploration and exploration with friends as the modes of interaction; 2) family as a source and direct instruction, observation, and activities as the three modes of interaction; 3) organisations as a source, and unplanned encounters, in-school presentations, and visits to organisational sites as modes of interaction; 4) schools as a source and direct instruction and class projects as modes of interaction; and 5) peers as a source and knowledge snowballs, corrections, and confirmations as the modes of interaction. This chapter illuminated complex and diverse sources of LEK for children and highlighted an abundance of deeply impactful experiential learning occurring through many sources and modes of interaction that greatly increased LEK construction and retention, and coevolution of pro-environmental emotions. It also highlighted the importance of both solo and peer-to-peer learning as child-centric and agency-preserving ways of constructing LEK.

In chapter seven, I explored: Where do children perceive that they learn about the environment? This chapter illuminated physical locations where children perceived learning about their local environment, which most-frequently included: within school grounds, in local nature-centric and non-nature-centric sites, and in the home. In each type of location, children engaged with multiple sources of learning, illustrating an even more complex resource map for LEK construction. Children's frequency of interaction with a plethora of locations, including long lists of local sites where experiential learning occurred, communicated both ample opportunity for LEK construction, and strong pro-environmental emotions in response to observations and experiences. Child agency in accessing many of these sites was important for children's ability to and confidence with constructing their own LEK.

In chapter eight, I explored: What content do children describe learning about their Galápagos environment? This chapter explained both what content children perceived learning but also where that content came from and from what sources. Local species names and contextual knowledge was the most frequently mentioned type of LEK and was often associated with schools, local sites, or the home. Geography and climate knowledge was a smaller bucket of content and was only perceived to be associated with some schools and local sites and seemed to be content that was sometimes more challenging to grasp for this age group of children. LEK content about human impact on the environment was the second most frequently mentioned and was enthusiastically and accurately understood by children. Children perceived learning this type of LEK content in schools, at home, and at local sites through direct experiences and observations of immediate impacts of humans on local ecology.

9.7.3.1 Contribution to Knowledge

The stories shared by children in the Galápagos, coupled with the interpretation and interrogation of literature across disciplines supported the development of contributions of new knowledge to education, environmental education, and childhood studies. This research makes five distinct contributions to knowledge: 1) that rapidly and readily constructing LEK is temporally possible despite short-term human community presence and that rapidly and readily constructing LEK is effective through a combination of factors; 2) that emotion is intrinsically linked to and essential for LEK that leads to behaviour change and that co-construction of pro-environmental emotions with LEK is most effectively encouraged through experiential learning for children; 3) that children have ecocentric worldviews that are often distinct from adult worldviews; 4) that childism as a framework is particularly equitable and ethical for studies on environmental topics to centre children and that children engage openly about and conduct peer-to-peer earning of LEK through the phenomenon of knowledge snowballs, and 5) that go-along interviews are a novel and effective method of data collection with children on topics related to LEK and EL.

Firstly, this research highlights the rapidly and readily constructed and robust nature of LEK of young children living in a protected natural space and with this, I assert that temporally rapidly and readily constructed robust LEK is possible despite a lack of Indigeneity to Galápagos, long-term human habitation, or the presence of multi-generational environmental knowledge. This assertion looks to research with Indigenous communities who hold and cultivate IEK through centuries, often millennia, of local habitation and resource management (Aswani et al., 2018; Inglis, 1993; McMillen et al., 2016) as a reference for gauging robustness and complexity of the LEK of Galápagos children. It also provides an alternate narrative from literature noting a global decrease in youth LEK (Gerl et al., 2021; Ianni et al., 2015; Louv, 2005; Okui et al., 2021) and offers an example for how to allow and encourage children to construct their own LEK, especially in co-evolution with pro-environmental emotions. The key influences identified that support Galápagos children's robust and complex LEK, ecocentric values, and environmental emotions are the bounded ecoregion effect of the national and international conservation focus on Galápagos; the clear and strict regulations around human engagement with local ecosystems; the frequent and easy access to and interactions with local flora and fauna in varied ecosystems that produce rich experiential learning; and a complex network of sources of LEK that children interact with in varied ways and in varied locations. The effectiveness of this combination exposes a potential essential grouping of factors that can be encouraged and accomplished through local management of human systems that enable local children to rapidly and readily construct LEK.

Secondly, building on literature that conceptualizes knowledge as linked with emotion (Graesser, 2020; Michelson, 1998; Millar & Millar, 1996; Reis & Roth, 2009) this study confirms and specifically asserts that ecological knowledge cannot be divorced from environmental emotion, and that if EL is a stated goal of EE, emotion is an integral partner to LEK. Additionally, this research highlights that experience is an essential conduit for building complex and robust LEK and for co-evolving environmental emotions and ecocentric worldviews, which most Galápagos children exhibit. This essentialism of experiential environmental learning both for LEK and emotion cultivation, is conceptually noted in the literature, especially with children (Gambino et al., 2009; Gundersen et al., 2016; Michelson, 1998). Experiential learning, through solo exploration or exploration with child peers, or facilitated by local adults, was the most frequently recalled held knowledge for children which led to connections to behaviour change and emotional connection to their local environment. This study fills a gap in the exploration of how emotion within LEK is communicated and leveraged in the development of other EL components including behaviour change for children and how best to support, and not inhibit or discourage, the co-construction of emotion with LEK for children.

Thirdly, this study proposes that children have their own worldviews about the environment that may differ greatly from those of adults in their community. I found that children in Galápagos predominantly held ecocentric worldviews, which differed from the implied anthropocentric views of the adult-designed documents for the Galápagos Contextualized Curriculum. These ecocentric worldviews were intrinsically connected to the emotive knowledge that children held about their Galápagos environment and to the frequency of interaction with that environment and spurred children to share stories and beliefs in reasons for protecting and engaging in stewardship of their local environment. This finding mirrored literature that found that moral sensitivity and ecocentrism often peaks around age 10 (Kahn & Kellert, 2002; Krettenauer, 2017; Liu & Green, 2024) and that children are often more ecocentric that older individuals (Krettenauer, 2017) but goes beyond that literature by proposing that this worldview of children should be given more weight than that of adults because when dealing with subjects like environmental concerns that more heavily impact children, the ethical way forward is for adults to centre and listen to children's worldviews. This assertion is supported by the use and interpretation of the childism framework (Wall, 2022), which urges adults to recognize and mitigate their adultism, something that is infrequently applied to research and programming for EE and EL but should be a required element of any project claiming to be for the benefit of both the environment and future generations.

Fourthly, this study supports and furthers the application of childism as an ethical framework (Wall, 2022) that not only centres children but actively questions, recognizes, and deconstructs adultism. Centring children and ensuring that they are seen and heard as agency-holding complete individuals, instead of as incomplete and thus illegitimate knowledge holders, is supported by the literature, and indeed by the Rights of the Child convention (*Convention on the Rights of the Child*, n.d.; Quennerstedt & Quennerstedt, 2014; Sudarsan et al., 2022; Wall, 2022). This study focuses on seeing children as valid and worthy constructors of their own LEK through their own lived experiences and observations, and particularly sees children as sources of learning and LEK transmission to their peers. The latter point is supported by the finding that children effectively co-construct knowledge through a phenomenon I have termed knowledge snowballs, which are child-led, and child-initiated and thus centre child knowledge as distinct from and not-dependent-on adult actors.

Finally, this research builds on literature describing walking, or go-along interviews as a method for data collection and infrequently as a method for working with children (Green, 2012; Hart, 1979; McFadden et al., 2023) but evolves and applies this method to work with children both for the purpose of centring children and fulfilling goals of a childism framework, but also as a method for effectively collecting data about children's LEK and other EL components. This research shares novel findings that go-along interviews provide spaces of felt agency for child participants and allow for engagement with held LEK through the real-time prompting of the ecological spaces through which the go-along interview moves. Allowing children to lead the interview path and allowing children to interpret and use, as examples, the surrounding ecology centres children's experiences and seems to provide a type of communication that mitigates adult domination of conversation and narrative. It also provides a method that centres movement and informality, reducing the potential detrimental impact of formalized seated interview or interviews during which social norms could distract participants from more freely and comfortably engaging with interview topics. This not only centres and prioritises children, but gives space for neurodivergent individuals, echoed by two studies as equitable (Kinney, 2021; Marcotte et al., 2022). The considered use of go-along interviews with children and for the child-centred exploration of their constructed LEK and cultivated EL components is one I hope other researchers will engage with.

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Appendices

Appendix A: Scoping Review

1.2 Research Gap: Scoping Review of Galápagos Literature

Before designing and undertaking new research on Galápagos children' LEK, it was key to explore and understand the current array of literature on Environmental Education and LEK for residents of islands, particularly children, and determine if there is a gap in such scholarship. To do this, I mapped the field of research on the Galápagos by conducting a scoping review. Results of the scoping study revealed a significant gap in social sciences literature on Galápagos, and a further paucity of literature focusing on residents as research participants, especially in studies of education, environmental education, and children's perceptions and experiences living on the islands.

1.2.1 Methodology for the Scoping Study

According to Daudt et al. (2013), a scoping study is a type of literature review which aims to "map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research" (p. 8). Oftentimes, the purpose of mapping a field of research is to summarize "a range of evidence in order to convey the breadth and depth of a field" (Levac et al., 2010, p. 1). My main goal was to identify a gap that exists in the literature, and thus a scoping study was fitting. Arksey and O'Malley (2005) confirm as well that scoping studies are useful for "mapping fields of study where it is difficult to visualize the range of material that might be available" and identifying research gaps by "drawing conclusions from existing literature regarding the overall state of research activity" (p. 21).

For the resulting scoping study of Galápagos literature, I followed the framework outlined by Arksey and O'Malley (2005) with the below steps:

Stage 1: identifying the research question

Stage 2: identifying relevant studies

Stage 3: study selection

Stage 4: charting the data

Stage 5: collating, summarizing, and reporting the results (p. 22).

The research question for the scoping study was broad: what is the published academic literature on the Galápagos since 1850? The reasoning for the date chosen is explained below. I executed a structured search using the SOLO (Search Oxford Libraries Online) search engine and strict search terms. I chose to focus on peer reviewed articles, across all subject areas/fields, that contain the word "Galápagos" in the title to explore the question within a purely academic lens, as my concern is with a gap in academic literature on peer reviewed research. While SOLO is certainly not an exhaustive bank of academic and peer reviewed resources, for the use in this thesis, the selections in SOLO are used as a proxy for the broader, complete, volume of literature in existence. A more comprehensive review, using other data sources such as Google Scholar or other university repositories, would be beneficial for further scoping research. An initial search of all peer-reviewed articles published in any year and in any language yielded over 3,000 results. The first peer reviewed article about the Galápagos appeared in 1853; because of this, I determined that the start date for search criteria should be 1850.

Inclusion criteria for the search were: resource type is article; peer reviewed articles only; in any language; with the exact phrase “galapagos” in the title; including results without full text access; sorted by publication date oldest to newest. Exclusion criteria were: remove any duplicate articles; remove articles that contain the word “galapagos” but were not about the Galápagos Islands (for example, articles mentioning the concept of “being a Galapagos,” meaning an isolated phenomenon that progresses/evolves without input/contact with the outside world (Reisel, 2017; Ro et al., 2019), or articles about the biopharmaceutical company called Galapagos (Senior, 2019)); remove any articles that were deemed to be reviews of articles or books.

Once exclusions were made, I categorized all articles as Human or Non-Human to filter for research focusing on human-centric and social topics. This separation of human and non-human was not to perpetuate the often Western-pushed narrative of humans vs. nature, which will be discussed in future sections, but in an effort to highlight the separation present in the literature which I presumed excluded humans, especially local human communities in Galápagos, from the exploration of ecosystems. For the purpose of this review, Non-Human was meant to encompass research that focuses on ecology, biology, geology, and other subjects that exclude humans as subjects. The Human category encompassed any human-centric or human-inclusive topic such as waste management, tourism, or education (others below). Determinants for these categories included the title, the description or abstract of the article, and the subjects or keywords. When I was unable to determine the subject of a resource based on the information in the spreadsheet, I consulted the full text of the article.

Once all articles were categorized as Human or Non-Human, I then sub-categorized all of the Human articles into these salient themes: Tourism; Conservation; Education; Politics; Medical/Health;

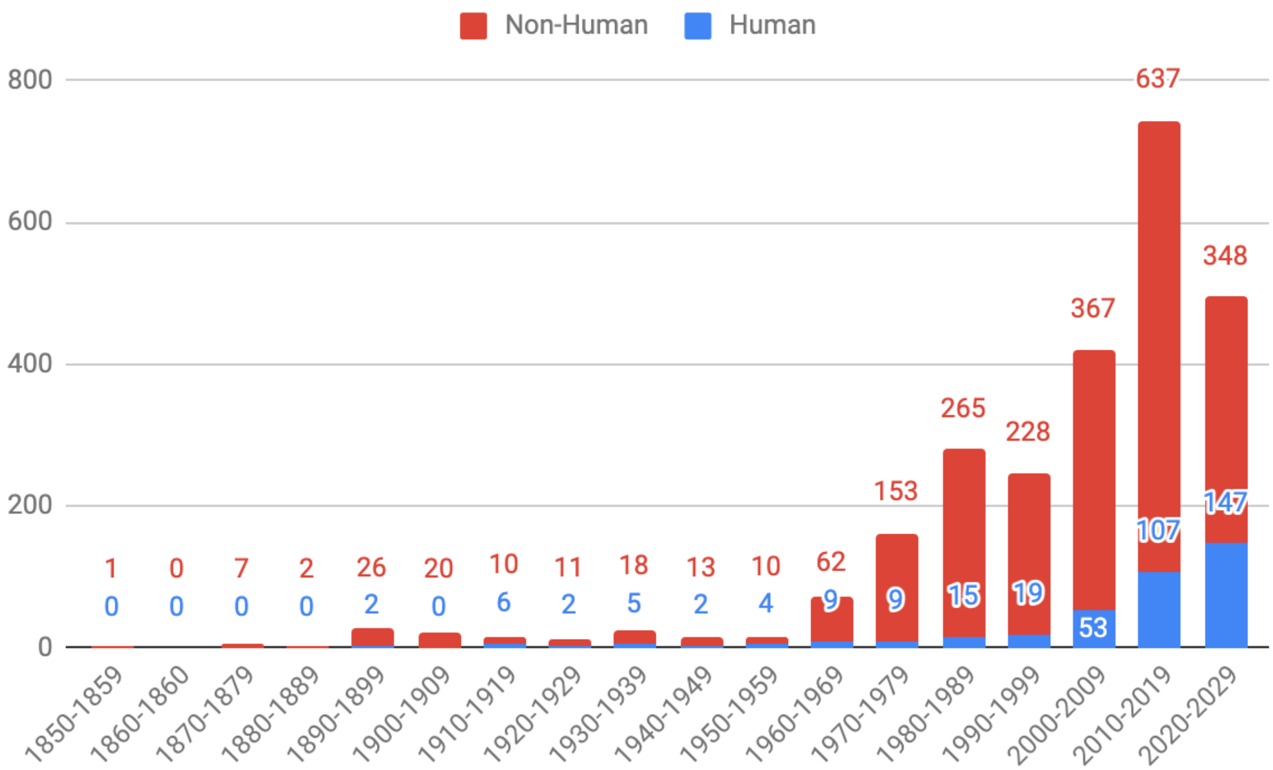
Fishing; Agriculture; Municipal Services; Human Impact; Energy; History; Culture; Food/food insecurity; LEK; Pollution; and Human Environment Conflict. These sub-categories were developed inductively based on themes that emerged while reading through the titles, description section, "subject" column of the spreadsheet, and abstracts of the articles.

1.2.2 Results of Scoping Review

After the data was cleaned and categorized, I was left with a total of 2,558 resources. Over the 175-year time frame, there was a trend in exponentially greater volumes of peer reviewed work produced into the 20th century and indication of this trend continuing into the 21st century. The first significant increase in peer reviewed work occurred in the 1960s, with the highest volume yet in 2010-2019 with 747 resources (Figure 42). If the pace and volume of articles produced in 2020-2029 continues, it will outpace all previous decades. While human-subject work is still in the minority of total Galápagos centric publications, the ratio of human to non-human literature is changing in this current decade, with over 30% of published work between 2020-2025 on human topics.

Figure 42

Volume and subject of Galápagos Peer Reviewed Resources Published Between 1850-2025



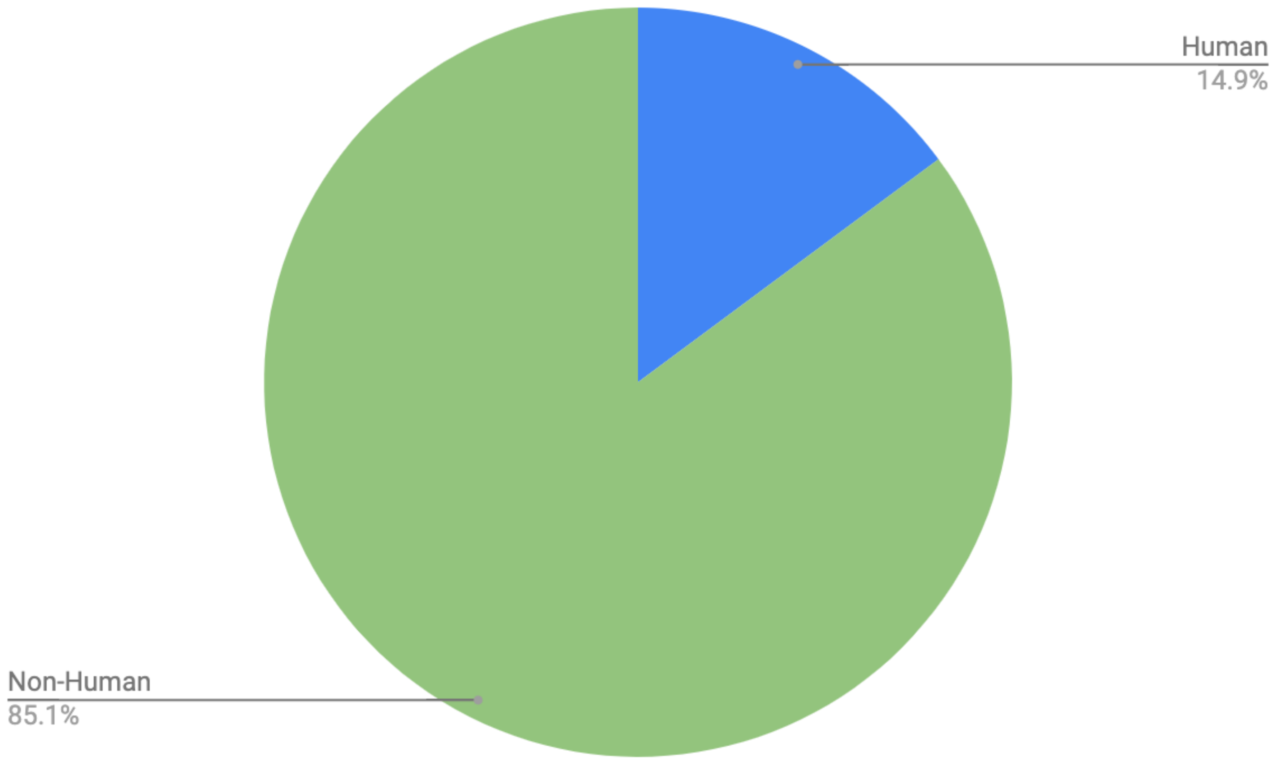
Note: Volume of peer reviewed resources published each decade (based on SOLO search results) starting in 1850, with distinction between those on Human and Non-Human subjects.

1.2.3 Human Literature Section

Human literature comprised only 14.9% (Figure 43) of the total 2,558 Galápagos peer reviewed resources. The three Human subcategories with the largest volume of resources were: Human Impact, History, and Tourism, with Politics and Conservation closely following (Figure 44 and Table 13). Education and LEK, my primary interest, lagged behind many categories.

Figure 43

Subject of Peer Reviewed Galápagos Literature 1850-2025



Note: Human and Non-Human research subject in 2,558 peer reviewed resources produced between 1850-2025

Table 13

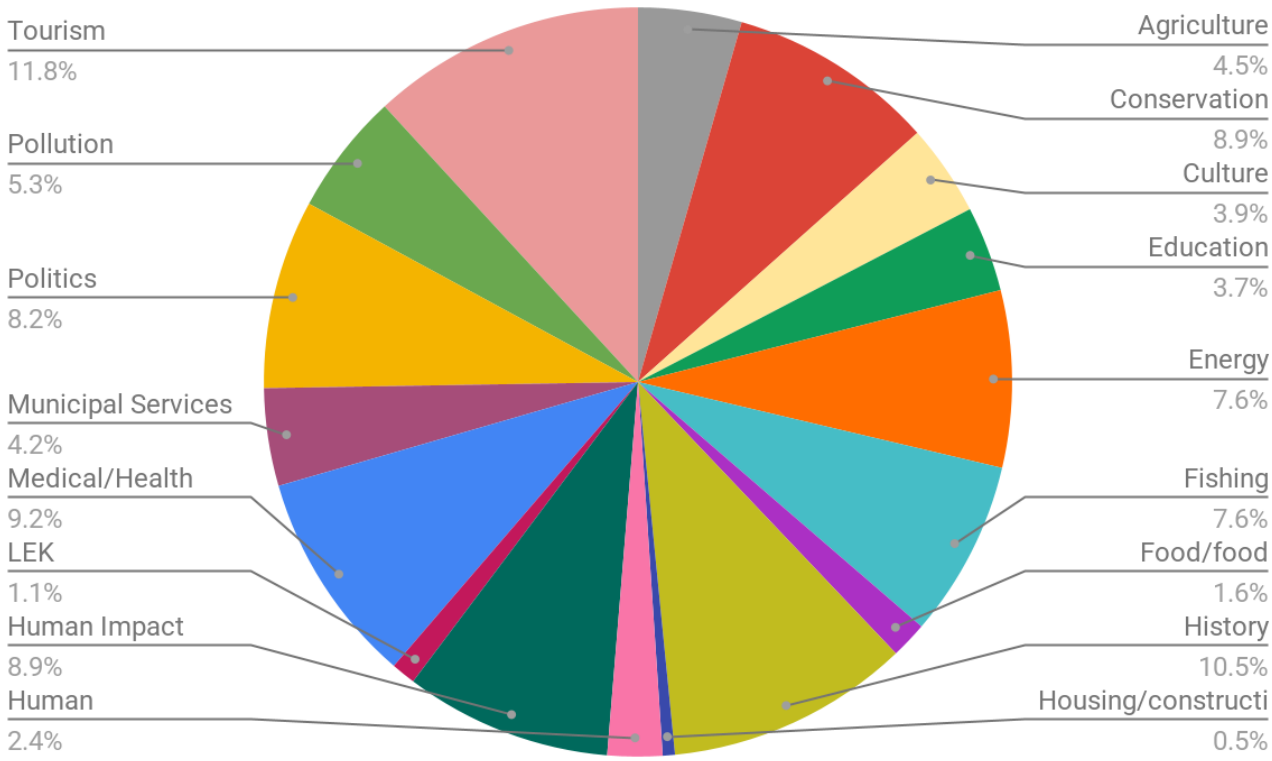
Frequency of human subcategories of scoping review resources

Human Subcategories	Frequency
Agriculture	17
Conservation	34
Culture	15
Education	14

Energy	29
Fishing	29
Food/food insecurity	6
History	40
Housing/construction	2
Human Environment Conflict	9
Human Impact	34
LEK	4
Medical/Health	35
Municipal Services	16
Politics	31
Pollution	20
Tourism	45

Figure 44

Subcategories of human topic resources as a percentage of total human resources

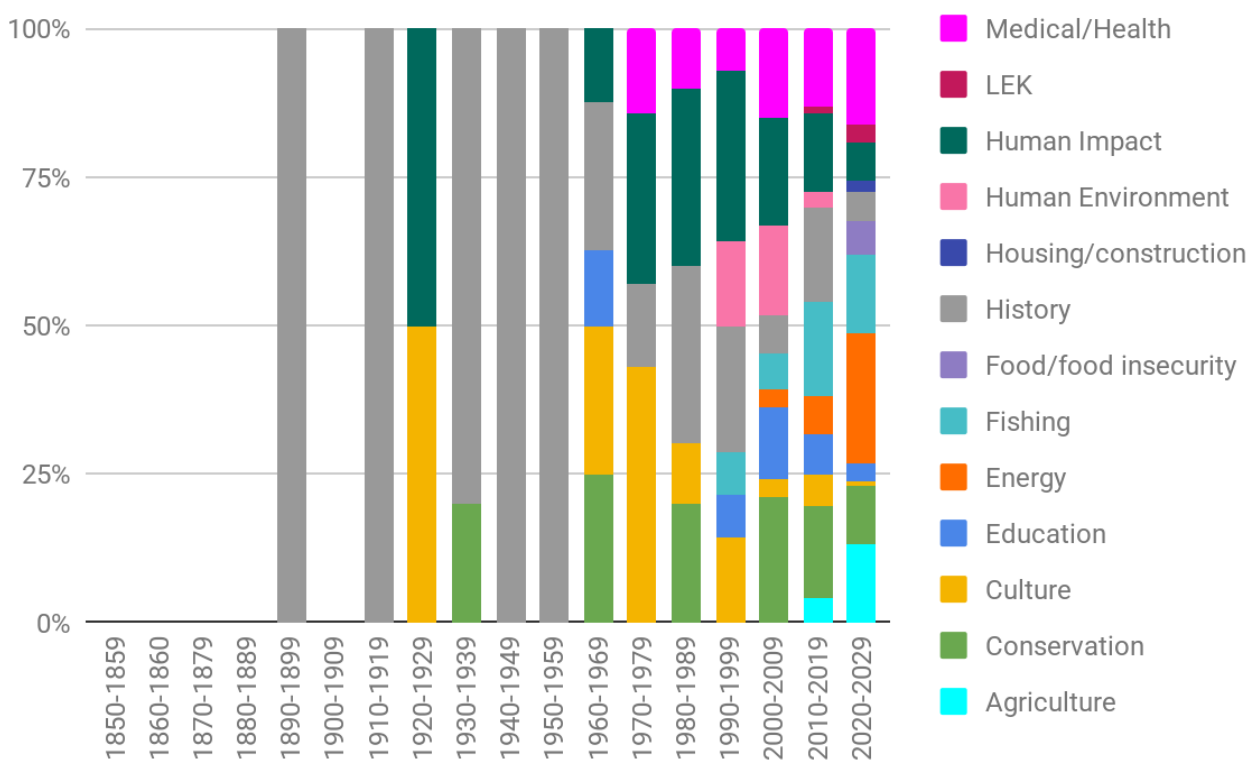


Note: Galápagos peer reviewed resources produced between 1850-2025 that centred on each of the inductively determined Human sub-categories.

Trends in Human sub-categories of research can be seen in Figure 45 below, with notable increase in the variance and number of Human sub-categories through the end of the 20th and into the 21st centuries. Human communities as centric to the overall narrative of Galápagos as a socioecological ecosystem is thus represented through the visual expansion in Human topics of research. For example, there has been a recent increase in attention paid academically to the use of or planning for renewable energy sources in Galápagos, and the COVID-19 pandemic prompted the publication of more medically associated studies with local communities. However, the persistently low volume of education-centric articles shows a clear gap in the research. Out of the 2,558 resources and out of the 380 Human articles, only 14 were in the education sub-category. This constitutes only 0.55% of the total literature produced on Galápagos. Furthermore, only six of the 14 education resources were directly about or for teachers, children, or the overall education system in the Galápagos Islands, representing only 0.18% of the total Galápagos literature. Other education articles covered programs for education systems outside of the Galápagos, typically detailing programs for learning about the Galápagos.

Figure 45

Galápagos literature Human subcategories by decade



Note: Breakdown of 100% of the Human literature per decade by the inductively chosen Human subcategories

The first education resource about the education system in Galápagos was produced in 1968 and details the appointment by the Ecuadorian Minister of Education of an official who would work towards developing educational programs around conservation education, alongside the work of the Charles Darwin Research Station - a physical set of buildings and an organization that has housed international and regional researchers since 1959 (*About Us*, 2024). The other resources cover the following: one describes a curriculum idea for children in the Galápagos that uses the book "El Misterioso Reloj de Darwin" to teach the concept of evolution using a work of fiction (Cuvi & Georgii, 2013); one assesses the views of teachers in the Galápagos on Darwin and evolution (Cotner et al., 2016); one covers an analysis of how COVID19 impacted teachers and teaching in the Galápagos with the replacement of in-person teaching with distance education (D. Román et al., 2024); one quantitatively explored the impact of COVID-19 on Galápagos student participation and families in regards to education (Carrick, 2023); and finally, one that highlights the marginalization of the Salasaka Indigenous community living in Galápagos and how to mitigate inequities in education for Indigenous students by using a bilingual-focused contextualized curriculum (Román et al., 2024). None of these studies centred on children, and all focused on adult experiences around education and engaged with adult participants. The few resources that dabbled in LEK, mirrored this trend, focused on exploring or leveraging the LEK of local fishermen, farmers, or other adult community members for the purposes of conservation programs or assessments (Cavole et al., 2020; Colloredo-Mansfeld et al., 2020; Lorden et al., 2012; Pontón-Cevallos et al., 2022).

While there is evidence of a recent slight increase in academic interest in the education system within the Galápagos, and on LEK of community members, there is clearly a dearth of scholarship on the education system in Galápagos, and especially within Environmental Education for children living on the islands. Furthermore, research within education, environmental education, or on topics related to LEK, have not thus far centred children as actual research participants or voices needing to be listened to. This gap in research is one that I plan to begin to fill with my proposed fieldwork.

Appendix B: Table of Participating Schools

School Code	Number of Grade 5 Classes	Class Codes	Number of Grade 5 children	Number of children Surveyed	Level of Schooling Provided	Island	Highland vs Port School
GA1	2	GA1A, GA1B	66	58	Básica	Santa Cruz	Port
GA2	1	GA2A	30	22	Básica	Santa Cruz	Highland
GA3	1	GA3A	9	5	Básica	Santa Cruz	Highland
GA4	1	GA4A	11	11	Básica	Santa Cruz	Port
GA5	1	GA5A	17	13	Básica	Santa Cruz	Port
GA6	3	GA6A, GA6B, GA6C	85	71	Básica y Colegio	Santa Cruz	Port
GA7	3	GA7A, GA7B, GA7C	79	31	Básica	Santa Cruz	Port
GA8	1	GA8A	12	9	Básica y Colegio	Santa Cruz	Highland
GB1	1	GB1A	27	23	Básica y Colegio	San Cristóbal	Port
GB2	1	GB2A	7	5	Básica	San Cristóbal	Highland
GB3	3	GB3A, GB3B, GB3C	57	50	Básica	San Cristóbal	Port
GB4	2	GB4A, GB4B	40	38	Básica y Colegio	San Cristóbal	Port
		Totals:	440	336			

Appendix C: Survey First Draft

Getting to know you questions:

1. How long have you lived in Galápagos?
    a. Less than a year
    b. One year
    c. Two years
    d. Three years
    e. Four or five years
    f. More than five years
    g. My whole life
2. How old are you?
    a. 8 years old
    b. 9 years old
    c. 10 years old
3. Circle the letter that indicates your gender
    a. Female
    b. Male
    c. Other
4. Please indicate the letter that identifies your racial or ethnic information
    a. Indigenous

   b. Non-Indigenous

5. How many Galápagos islands have you visited (including the one that you live on)?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
   f. More than 5

How and where do you learn about the Galápagos Environment:

6. Where do you learn things about your Galápagos environment?
   a. At home from my parents
   b. At school
   c. When I'm outside by myself
   d. At after school programs
   e. On trips around the islands

7. How often do you spend time outside in the Galápagos?
   a. A few times a year
   b. Once a month
   c. Once a week
   d. Multiple times a week

8. How much do you learn from your parents about the Galápagos environment?
    a. Nothing at all
    b. A little bit
    c. I'm not sure
    d. A lot

9. How much do you learn from your teachers at school about the Galápagos environment?
    a. Nothing at all
    b. A little bit
    c. I'm not sure
    d. A lot

10. In what subjects in school do you learn about the environment?
    a. ____

11. How much do you learn from other programs or people about the Galápagos environment?
    a. Nothing at all
    b. A little bit
    c. I'm not sure
    d. A lot

12. What are those other people and programs that you learn from?
    a. ____

13. If you do things to protect the Galápagos environment, what are they?

    a. ____

Galápagos Ecology Questions:

14. How were the Galápagos islands formed?

    a. ____

15. What is something that you're excited to tell me about the Galápagos environment?

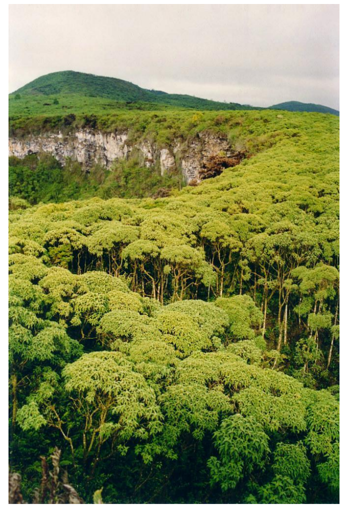
    a. ____

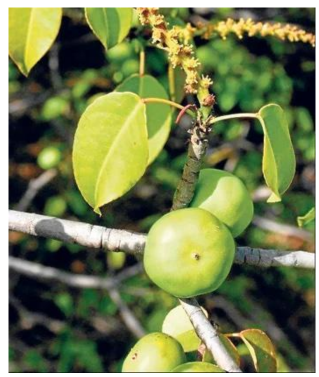
16. How many of the Galápagos animals below can you name in the pictures below?

 Animal name: ________________________	 Animal name: ________________________

 Animal name: ___________________________	 Animal name: ___________________________
 Animal name: ___________________________	 Animal name: ___________________________
 Animal name: ___________________________	 Animal name: ___________________________

17. How many of the Galápagos plants and trees can you name in the pictures below?

 Plant name: ______________________	 Plant name: ______________________
 Plant name: ______________________	 Plant name: ________________________

 Plant name: __________________________	 Plant name: __________________________
 Plant name: __________________________	 Plant name: __________________________

18. Can you tell me the names of any other wild animals in the Galápagos that aren't pictured above?

    a. ___________

    b. ___________

    c. ___________

    d. ___________

e. __________

19. Can you tell me the name of any other plants or trees in the Galápagos that aren't pictured above?

a. __________

b. __________

c. __________

d. __________

e. __________

20. How many other Galápagos islands can you name? Write as many as you know below:

a. ____

How do you feel about the environment in Galápagos? (circle one for each question)

21. I love the Galápagos environment	a) Completely agree	b) Sort of agree	c) Neutral/I don't know	d) Sort of disagree	e) Completely disagree

22. I hate the Galápagos environment	a) Completely agree	b) Sort of agree	c) Neutral/I don't know	d) Sort of disagree	e) Completely disagree
23. Protecting the Galápagos environment is important to me	a) Completely agree	b) Sort of agree	c) Neutral/I don't know	d) Sort of disagree	e) Completely disagree
24. I want to learn more about the Galápagos environment	a) Completely agree	b) Sort of agree	c) Neutral/I don't know	d) Sort of disagree	e) Completely disagree

Appendix D: Pilot Survey Instrument

Tus Pensamientos sobre tu Ambiente

Preguntas para conocerte mejor:

1. ¿Cuánto tiempo has vivido en las Galápagos?
    a. Toda mi vida
    b. Menos de un año
    c. Un año
    d. Dos años
    e. Tres años
    f. Cuatro o cinco años
    g. Más de cinco años

2. ¿Cuántos años tienes?
    a. 8 años
    b. 9 años
    c. 10 años

3. Cierra con un círculo la respuesta que indica tu género:
    a. Mujer

   b. Hombre

   c. Otro

4. ¿Cómo te identificas racial o étnicamente? (por ejemplo, afroecuatoriano)

   ____

5. ¿Cuales islas has visitado en Galápagos?

   ____

Cómo y dónde aprendes sobre el ambiente de las Galápagos:

6. ¿Dónde aprendes cosas sobre tu ambiente de las Galápagos? Cierra con un círculo todas las respuestas que se te aplican.
   a. De mis padres en la casa
   b. En la escuela
   c. Cuando estoy afuera a solas
   d. En programas después de la escuela
   e. Durante viajes en las islas

7. ¿Con qué frecuencia haces actividades en la naturaleza en las Galápagos? (por ejemplo: ir a la playa o caminar por los senderos)
   a. Unas veces al año

b. Una vez al mes

c. Una vez a la semana

d. Varias veces a la semana

8. ¿Cuánto aprendes de tus padres sobre el ambiente de las Galápagos?

    a. Nada

    b. Un poco

    c. No estoy seguro(a)

    d. Mucho

9. ¿ Cuánto aprendes de tus maestros en la escuela sobre el ambiente de las Galápagos?

    a. Nada

    b. Un poco

    c. No estoy seguro(a)

    d. Mucho

10. ¿En cuáles materias en la escuela aprendes sobre el ambiente?

    a. ____

11. ¿Cuánto aprendes de otros programas u otras personas (por ejemplo: el parque nacional o una organización local) sobre el ambiente de las Galápagos?

    a. Nada

b. Un poco

c. No estoy seguro(a)

d. Mucho

12. ¿Quiénes son esas otras personas de que has aprendido o cuáles son esos otros programas donde has aprendido sobre este tema?

    a. ____

13. Si haces cosas para proteger el ambiente de las Galápagos, ¿cuáles son?

    a. ____

Preguntas sobre la ecología de las Galápagos:

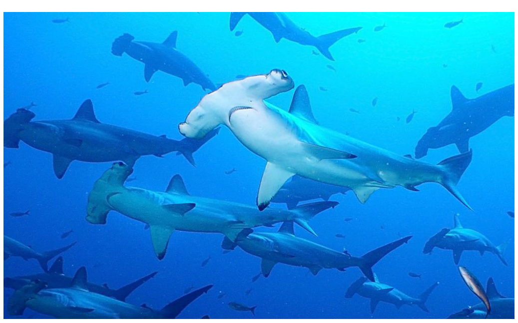
14. ¿Qué pasaría si el cactus opuntia se desapareciera de las islas?

    ____

15. ¿Qué es algo que estás emocionado(a) de contarme sobre el ambiente de las Galápagos?

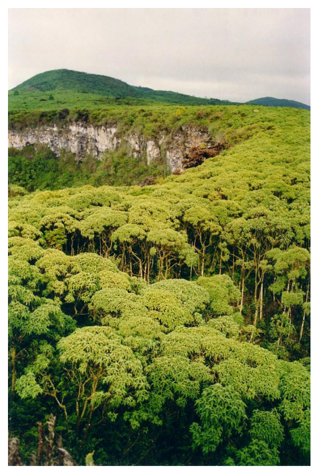
    ____

16. ¿Cuántos animales de las Galápagos puedes nombrar en las siguientes fotos?

<table>
<tr>
<td>
Nombre del animal: ____________________</td>
<td>
Nombre del animal: ____________________</td>
</tr>
<tr>
<td>
Nombre del animal: _____________________</td>
<td>
Nombre del animal: _____________________</td>
</tr>
<tr>
<td>
Nombre del animal: _____________________</td>
<td>
Nombre del animal: _____________________</td>
</tr>
</table>

 Nombre del animal: ____________________	 Nombre del animal: ____________________

17. ¿Cuántos árboles y plantas de las Galápagos puedes nombrar en las siguientes fotos?

 Nombre de la planta: ____________________	 Nombre de la planta: ____________________

 Nombre de la planta: ____________________	 Nombre de la planta: ____________________
 Nombre de la planta: ____________________	 Nombre de la planta: ____________________
 Nombre de la planta: ____________________	 Nombre de la planta: ____________________

18. ¿Me puedes decir los nombres de otros animales salvajes en las Galápagos que no están en las fotos de arriba?

    a. ___________
    b. ___________
    c. ___________
    d. ___________
    e. ___________

19. ¿Me puedes decir los nombres de otros árboles u otras plantas en las Galápagos que no están en las fotos de arriba?

    a. ___________
    b. ___________
    c. ___________
    d. ___________
    e. ___________

20. ¿Cuántas otras islas de las Galápagos puedes nombrar? Escribe todas las islas que conoces en la línea de abajo:

____

¿Cómo te sientes sobre el ambiente de las Galápagos? (Cierra con un círculo uno para cada pregunta)

21. Me encanta el ambiente de las Galápagos	a) Completamente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completamente en desacuerdo
22. Odio el ambiente de las Galápagos	a) Completamente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en descuerdo	e) Completamente en desacuerdo
23. Es importante para mí proteger el ambiente de las Galápagos	a) Completamente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completamente en desacuerdo
24. Quiero aprender más	a) Completamente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completamente en desacuerdo

sobre el

ambiente de las

Galápagos

Appendix E: Chart of Survey Modifications:

Object Type	**Pilot Survey Object**	**Notes from Pilot Observations**	**Notes from pre- and post-Pilot Reviewers**	**Modifications Made**	**Object Type**	**Final Survey Object**
Instrument title	Tus Pensamientos sobre tu Ambiente	- children asked what the survey was about even after reading the title	- not clear what the survey is asking about - not clear that survey is about Galápagos Environment	- used term for knowledge instead of thoughts (conocimiento vs pensamientos) - clarified that it's the Galápagos Environment that we're asking about	Instrument title	Tu Conocimiento sobre el Ambiente de Galápagos
		- children were unsure how to start the survey even after a verbal introduction - significant issue with children wanting to get the right answer vs leaving a question blank - observation of children looking concerned if they don't know an answer	- grammatical edits made by Spanish Native speaker reviewers on modifications listed	- included a written introduction to complement verbal instructions - included a reminder that it is okay to leave things blank and they should if they don't know - included a gentle reminder that we are just interested in their knowledge about Galápagos - try to emphasize that it's not a test	Introduction	Antes de empezar, recuerda que es importante que no ayudes a otros con las respuestas y que no copies las respuestas de tus compañeros. Este cuestionario no es una prueba o examen, solamente queremos saber lo que tu sabes sobre las Islas Galápagos! Si no sabes la respuesta de una pregunta, no la contestes. Solo

		- significant challenge with children wanting to help their friends, copy answers, or teachers wanting to help children		- included a reminder to not copy friends/help them or get help from teacher for answers		contesta a las preguntas que sabes. Empecemos. Cierra con un círculo una de las respuestas
Question Group 1 Description	Preguntas para conocerte mejor:	NA	NA	NA	Question Group 1 Description	Preguntas para conocerte mejor:
Question 1	¿Cuánto tiempo has vivido en las Galápagos? a. Toda mi vida b. Menos de un año c. Un año d. Dos años e. Tres años f. Cuatro o cinco años g. Más de cinco años	- several children confused why I included the term "las" - in everyday speech you just say "Galápagos" without an article	NA	- removed "las" in front of Galápagos on all questions	Question 1	¿Cuánto tiempo has vivido en Galápagos? a. Toda mi vida b. Menos de un año c. Un año d. Dos años e. Tres años f. Cuatro o cinco años g. Más de cinco años
Question 2	¿Cuántos años tienes? a. 8 años b. 9 años c. 10 años	- no child filled in the 8-year-old answer, one child was 11 years old	NA	- removed 8 years old, added 11 years old	Question 2	¿Cuántos años tienes? a. 9 años b. 10 años c. 11 años

Question 3	Cierra con un círculo la respuesta que indica tu género: a. Mujer b. Hombre c. Otro	- terminology was not age-appropriate (man, woman) - adding the term "other" on gender questions is not commonly done in Ecuador (vs the US or UK), so confused some children	- reviewers noted that the "other" option was not common so may be better left off	- changed terminology to say "boy" or "girl" instead of "man" or "woman" - removed the third gender option	Question 3	Encierra en un círculo una respuesta. Tu eres... a. Niña b. Niño
Question 4	¿Cómo te identificas racial o étnicamente? (por ejemplo, afroecuatoriano)	- significant confusion from many children - asking what race meant and confusion over figuring out what their own race was (asking if it meant where they're from in Ecuador, or what language they spoke etc)	- note from Roman that asking about race is still not common in Ecuador so children would need scaffolding to understand question	- added additional common race answers as examples to help children understand	Question 4	¿Cómo te identificas racial o étnicamente? (por ejemplo, Blanco, Negro, Mestizo, Indígena, Mulato, Montubio, otro)
Question 5	¿Cuales islas has visitado en Galápagos?	- children confused and asking if they should include the	NA	- clarified that they should include the island where they live	Question 5	¿Incluyendo la isla dónde vives, cuáles islas has visitado en

		island where they live - children confused what content they needed to include in the answer		- clarified that they should write the names of all of the islands they have visited		Galápagos? Escribe los nombres
		- confusion over what we meant by the question, some only read the first part and assumed they should put a number of how many islands. Also assumed children would know other names instead of asking them if they knew names - some children concerned if they couldn't remember them all	- originally this was question 20 on pilot survey. Proaño noted that it fit better for question flow near the other question about islands	- moved question 20 up into group 1 just below Question 5 - Clarified sentence by saying "do you know the names of other islands" instead of "how many other islands can you name" so that they understood it was asking *if* they knew any, and if so, what the names are - changed wording to "Escribe todos los que sabes!" to make it sound more fun or like a game and not a quiz	Question 6	¿Conoces los nombres de otras islas en Galápagos? ¡Escribe todos los que sabes!
Question Group 2 Description	Cómo y dónde aprendes sobre el ambiente de las	- confusion from some children over why it says "las"	NA	- clarified by stating "las Islas Galápagos"	Question Group 2 Description	Cómo y dónde aprendes sobre el ambiente de las Islas

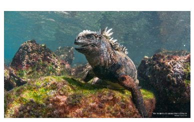
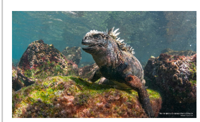
	Galápagos:	Galápagos				Galápagos:
Question 6	¿Dónde aprendes cosas sobre tu ambiente de las Galápagos? Cierra con un círculo todas las respuestas que se te aplican. a. De mis padres en la casa b. En la escuela c. Cuando estoy afuera a solas d. En programas después de la escuela e. Durante viajes en las islas	- Noted that we didn't provide an option for learning form their friends - Many children asking if they could fill in more than one answer - Many children asking what the question meant - they were unclear what the question was asking	NA	- Added an answer option for learning from friends - Verbally reminded children that they should circle as many as applied, in addition to showing them the text - Clarified the point of the question in a second sentence before the answers	Question 7	¿Dónde aprendes cosas sobre el ambiente de las Galápagos? Cierra con un círculo todas las respuestas donde te ayudan a aprender sobre el ambiente de Galápagos. a. De mis padres en casa b. En la escuela c. Cuando estoy afuera a solas d. A través de mis amigos/amigas e. En programas después de la escuela f. Durante viajes a las islas
Question 7	¿Con qué frecuencia haces actividades en la naturaleza en las Galápagos? (por ejemplo: ir a la playa o	- children asked if they should only circle one answer after previous question that	NA	- added clarification that for this question, they should only circle one answer - added answer option for	Question 8	¿Con qué frecuencia haces actividades en la naturaleza en las Galápagos? (por ejemplo: ir a la playa

	caminar por los senderos) a. Unas veces al año b. Una vez al mes c. Una vez a la semana d. Varias veces a la semana	allowed multiple answers - Some children said that they explored outside everyday - some children asked for clarity for what kind of activities we meant		activities done outside "every day" - added clarification by describing walking through forest in the National Park as an example		o caminar por los senderos del Parque Nacional) Cierra con un círculo una de las respuestas a. Unas veces al año b. Una vez al mes c. Una vez a la semana d. Varias veces a la semana e. Todos los días
Question 8	¿Cuánto aprendes de tus padres sobre el ambiente de las Galápagos? a. Nada b. Un poco c. No estoy seguro(a) d. Mucho	- children confused about "las" in front of Galápagos	- Proaño noted that the sequence of answers would make more sense if the "mucho" came sequentially after "un poco"	- switched answers to flow sequentially from: nothing, a little, a lot, not sure - removed article "las" from in front of Galápagos	Question 9	¿Cuánto aprendes de tus padres sobre el ambiente de Galápagos? a. Nada b. Un poco c. Mucho d. No estoy seguro(a)
Question 9	¿ Cuánto aprendes de tus maestros en la escuela sobre el ambiente de las Galápagos? a. Nada b. Un poco	- children confused about "las" in front of Galápagos	- Proaño noted that the sequence of answers would make more sense if the "mucho" came sequentially after "un poco"	- switched answers to flow sequentially from: nothing, a little, a lot, not sure - removed article "las" from in front of Galápagos	Question 10	¿Cuánto aprendes de tus maestros en la escuela sobre el ambiente de Galápagos? a. Nada b. Un poco

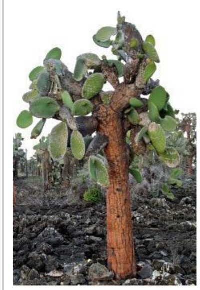
	c. No estoy seguro(a) d. Mucho					c. Mucho d. No estoy seguro(a)
Question 10	¿En cuáles materias en la escuela aprendes sobre el ambiente?	- some children confused what we meant by materias - some children confused what they should write as an answer	NA	- changed wording to "in which of your classes in school" using the term "clases" versus "materias" - provided examples of names of classes	Question 11	¿En cuáles de tus clases en la escuela aprendes sobre el ambiente? (por ejemplo: en ciencias naturales, en lengua, en sociales, u otras)
Question 11	¿Cuánto aprendes de otros programas u otras personas (por ejemplo: el parque nacional o una organización local) sobre el ambiente de las Galápagos? a. Nada b. Un poco c. No estoy seguro(a) d. Mucho	- children confused about "las" in front of Galápagos	- Proaño noted that the sequence of answers would make more sense if the "mucho" came sequentially after "un poco"	- switched answers to flow sequentially from: nothing, a little, a lot, not sure - removed article "las" from in front of Galápagos	Question 12	¿Cuánto aprendes de otros programas u otras personas (por ejemplo: el Parque Nacional o una organización local) sobre el ambiente de Galápagos? a. Nada b. Un poco c. Mucho d. No estoy seguro(a)

Question 12	¿Quiénes son esas otras personas de que has aprendido o cuáles son esos otros programas donde has aprendido sobre este tema?	- some concern from children that they had to put down names of people or had to answer because of the wording "who are the other people that have taught you about the environment" - confusion from children about who they should name - children missing that there were two parts of the question (what other people AND what other programs)	NA	- changed wording of question to "are there other people/programs" - so that children understood that they didn't have to answer if there weren't - added examples of people to the first question - separated the two parts of the question	Question 13	¿Hay otras personas en tu vida (por ejemplo: tus abuelos, tus amigos, guías en un centro de interpretación) de las que has aprendido? o ¿hay otros programas donde has aprendido sobre el ambiente?
Question 13	Si haces cosas para proteger el ambiente de las Galápagos, ¿cuáles son?	- confusion from children about what the question was asking	NA	- changed wording of question to state: what do you do? instead of "what are the things [that you do]"	Question 14	Si tu haces cosas para proteger el ambiente de Galápagos, ¿Qué haces?
Question	Preguntas sobre la	- confusion from	NA	- removed "las"	Question	Preguntas sobre la

Group 3 Description	ecología de las Galápagos:	some children over why it says "las" Galápagos			Group 3 Description	ecología de Galápagos:
		NA	- Mejia raised this topic as what she has observed locally as a gap in knowledge for children	- create new question, with assistance from Mejia	Question 15	En tus palabras ¿Cómo defines la palabra ambiente?
Question 14	¿Qué pasaría si el cactus opuntia se desapareciera de las islas?	NA	- grammatical note	- change to "se desapareciera" (reflexive)	Question 16	¿Qué pasaría si el cactus opuntia desapareciera de las islas?
Question 15	¿Qué es algo que estás emocionado(a) de contarme sobre el ambiente de las Galápagos?	- children confused about the wording of the question, weren't sure what they should write	NA	- change to "tell me something interesting or special" so that it was clearer that we wanted a fact or story	Question 17	Cuéntame algo interesante o especial que sabes sobre Galápagos:
Question 16	¿Cuántos animales de las Galápagos puedes nombrar en las siguientes fotos?	- children confused what they needed to do - requires more explanation - children thought they had to fill in every question even if they didn't know the answer, wording	NA	- Added more explanation to the question - asking "what are the names of the animals in the photos? Look at the photo and write the name of the animal that you see" - in all caps, clarify that if	Question 18	¿Cuáles son los nombres de los animales que aparecen en las fotos abajo? Mirando la foto, por favor escribe el nombre del animal que ves. RECUERDA: SI

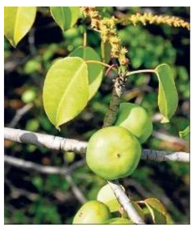
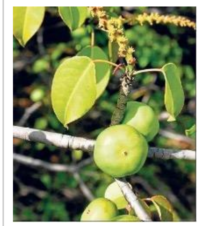
		was competitive or like a quiz		they do not know the answer, to not answer the question		NO SABES EL NOMBRE, NO LA CONTESTES
Question 16a		NA	NA	NA	Question 18a	
Question 16b		NA	NA	NA	Question 18b	
Question 16c		NA	NA	NA	Question 18c	
Question 16d		NA	NA	NA	Question 18d	
Question 16e		NA	NA	NA	Question 18e	

Question 16f		NA	NA	NA	Question 18f	
Question 16g		NA	NA	NA	Question 18g	
Question 16h		NA	NA	NA	Question 18h	
		NA	- originally, this was question 18 in the pilot survey, after both the animal and plant identification image questions. Proaño noted that it flowed better to come directly after animal identification images.	- shifted up to question 19 in final survey, following animal identification images	Question 19	¿Podrías escribir que otros animales de Galápagos recuerdas pero que no estaban en las fotos?

Question 17	¿Cuántos árboles y plantas de las Galápagos puedes nombrar en las siguientes fotos?	- children confused what they needed to do - requires more explanation - children thought they had to fill in every question even if they didn't know the answer, wording was competitive or like a quiz	NA	- Added more explanation to the question - asking "what are the names of the trees or plants in the photos? Look at the photo and write the name of the tree or plant that you see" - in all caps, clarifed that if they do not know the answer, to not answer the question	Question 20	¿Cuáles son los nombres de los árboles o plantas que aparecen en las fotos el la siguiente pagina? Mirando la foto, por favor escribe el nombre del árbol o de la planta que ves. RECUERDA: SI NO SABES EL NOMBRE, NO LA CONTESTES
Question 17a		NA	NA	NA	Question 20a	
Question 17b		- many children in pilot asked what this was (asking for help from researcher, friends, or teacher)	NA	- did a new image search and found an image that more clearly showed the Scalesia trees (not just the treetops)	Question 20b	

Question 17c		NA	NA	NA	Question 20c	
Question 17d		- many children in pilot asked what this was (asking for help from researcher, friends, or teacher) or wrote the wrong plant name	NA	- did a new image search and found an image that more clearly showed the entire mangrove plant and that showed mangroves in an environment that may be more familiar to children (on the beach vs Galápagos mangroves in inlets/away from the sand)	Question 20d	
Question 17e		- many children in pilot asked what this was (asking for help from researcher, friends, or teacher) or wrote the wrong plant name or wrote "tree without leaves" or just "tree"	NA	- did a new image search that was more up-close to show the bark colour and volcanic rocks around palo santo trees	Question 20e	

Question 17f		- Mejia noted that there are two species of passionfruit on the islands: one is native, and one is non-native (neither are endemic), so either to check this photo to ensure it was in fact the native species, or, to avoid confusion, choose a different native/endemic plant that does not have a non-native variety also on the islands	NA	- swapped the passionfruit flower photo for a photo of muyuyo, a native plant that grows commonly around Galápagos towns and midlands. Partially chosen based on researcher's visual observation of plants around towns in weeks leading up to pilot administration	Question 20f	
Question 17g		- significant confusion from children about what this pant was - many children in pilot mistook this for tomatoes - reviewers	NA	- removed image and swapped it for a photo of Darwin's Cotton, an endemic plant that grows commonly in the lowlands and around towns, with recognizable flowers and cottony	Question 20g	

		confirmed that coffee is not native so recommended swapping for a native or endemic species		tufts. Partially chosen based on researcher's visual observation of plants around towns in weeks leading up to pilot administration		
Question 17h		NA	NA	NA	Question 20h	
Question 18	¿Me puedes decir los nombres de otros animales salvajes en las Galápagos que no están en las fotos de arriba? a. ___________ b. ___________ c. ___________ d. ___________ e. ___________	- children in pilot confused and thought they had to list exactly five animals (no more, no fewer)	- Proaño noted that this question was more suitable directly after the animal identification question - grammatical note that conditional and imperfect tenses would make more sense	- moved question to directly after animal identification photos - Removed five lines and made it a blank text field so that children could write as many or as few species names as they could - changed wording to ask children if they could name any additional species that weren't in the photos		

Question 19	¿Me puedes decir los nombres de otros árboles u otras plantas en las Galápagos que no están en las fotos de arriba? a. ___________ b. ___________ c. ___________ d. ___________ e. ___________	- children in pilot confused and thought they had to list exactly five plants (no more, no fewer)	- Proaño noted that this question was more suitable directly after the tree and plant identification question - grammatical note that conditional and imperfect tenses would make more sense	- moved question to directly after plant identification photos - Removed five lines and made it a blank text field so that children could write as many or as few species names as they could - changed wording to ask children if they could name any additional species that weren't in the photos	Question 21	¿Podrías escribir que otras plantas propias de Galápagos recuerdas pero que no estaban en las fotos?
Question 20	¿Cuántas otras islas de las Galápagos puedes nombrar? Escribe todas las islas que conoces en la línea de abajo:	NA	- Proaño noted that this question was similar to a question in Group 1 and should be moved so that question topic flowed more logically	- shifted to question 6 in final survey, following question about which islands children had visited		
Question Group 4 Description	¿Cómo te sientes sobre el ambiente de las Galápagos? (Cierra con un círculo uno	- still some confusion noted in pilot about how to answer these	NA	- clarified second sentence here to "circle one option for each question"	Question Group 4 Description	¿Cómo te sientes sobre el ambiente de las Galápagos? Cierre con un círculo una

	para cada pregunta)	questions/what the questions were				opción para cada pregunta)
Question 21	Me encanta el ambiente de las Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo	NA	NA	NA	Question 22	Me encanta el ambiente de Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo
Question 22	Odio el ambiente de las Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en descuerdo e) Completamente en desacuerdo	NA	NA	NA	Question 23	Odio el ambiente de Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en descuerdo e) Completamente en desacuerdo
Question 23	Es importante para mí proteger el ambiente de las Galápagos	NA	NA	NA	Question 24	Es importante para mí proteger el ambiente de Galápagos

	a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo					a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo
Question 24	Quiero aprender más sobre el ambiente de las Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo	NA	NA	NA	Question 25	Quiero aprender más sobre el ambiente de Galápagos a) Completamente de acuerdo b) Algo de acuerdo c)Neutral/No sé d) Algo en desacuerdo e) Completamente en desacuerdo

Appendix F: Final Survey Instrument

Tu Conocimiento sobre el Ambiente de Galápagos

Antes de empezar, recuerda que es importante que no ayudes a otros con las respuestas y que no copies las respuestas de tus compañeros. Este cuestionario no es una prueba o examen, solamente queremos saber lo que tu sabes sobre las Islas Galápagos!

Si no sabes la respuesta de una pregunta, no la contestes. Solo contesta a las preguntas que sabes.

Empecemos. Cierra con un círculo una de las respuestas

Preguntas para conocerte mejor:

1. ¿Cuánto tiempo has vivido en Galápagos?
    a. Toda mi vida
    b. Menos de un año
    c. Un año
    d. Dos años
    e. Tres años
    f. Cuatro o cinco años
    g. Más de cinco años

2. ¿Cuántos años tienes?
    a. 9 años
    b. 10 años

c. 11 años

3. Encierra en un círculo una respuesta. Tu eres…
   a. Niña
   b. Niño

4. ¿Cómo te identificas racial o étnicamente? (por ejemplo, Blanco, Negro, Mestizo, Indígena, Mulato, Montubio, otro)

____

5. ¿Incluyendo la isla dónde vives, cuáles islas has visitado en Galápagos? Escribe los nombres

____

6. ¿Conoces los nombres de otras islas en Galápagos? ¡Escribe todos los que sabes!

____

Cómo y dónde aprendes sobre el ambiente de las Islas Galápagos:

7. ¿Dónde aprendes cosas sobre el ambiente de las Galápagos? Cierra con un círculo todas las respuestas donde te ayudan a aprender sobre el ambiente de Galápagos.
   a. De mis padres en casa
   b. En la escuela

c. Cuando estoy afuera a solas

d. A través de mis amigos/amigas

e. En programas después de la escuela

f. Durante viajes a las islas

8. ¿Con qué frecuencia haces actividades en la naturaleza en las Galápagos? (por ejemplo: ir a la playa o caminar por los senderos del Parque Nacional) Cierra con un círculo una de las respuestas

a. Unas veces al año

b. Una vez al mes

c. Una vez a la semana

d. Varias veces a la semana

e. Todos los días

9. ¿Cuánto aprendes de tus padres sobre el ambiente de Galápagos?

a. Nada

b. Un poco

c. Mucho

d. No estoy seguro(a)

10. ¿Cuánto aprendes de tus maestros en la escuela sobre el ambiente de Galápagos?

a. Nada

b. Un poco

c. Mucho

d. No estoy seguro(a)

11. ¿En cuáles de tus clases en la escuela aprendes sobre el ambiente? (por ejemplo: en ciencias naturales, en lengua, en sociales, u otras)

____

12. ¿Cuánto aprendes de otros programas u otras personas (por ejemplo: el Parque Nacional o una organización local) sobre el ambiente de Galápagos?
    a. Nada
    b. Un poco
    c. Mucho
    d. No estoy seguro(a)

13. ¿Hay otras personas en tu vida (por ejemplo: tus abuelos, tus amigos, guías en un centro de interpretación) de las que has aprendido? o ¿hay otros programas donde has aprendido sobre el ambiente?

____

14. Si tu haces cosas para proteger el ambiente de Galápagos, ¿Qué haces?

____

Preguntas sobre la ecología de Galápagos:

15. En tus palabras ¿Cómo defines la palabra ambiente?

____

16. ¿Qué pasaría si el cactus opuntia desapareciera de las islas?

____

17. Cuéntame algo interesante o especial que sabes sobre Galápagos:

____

18. ¿Cuáles son los nombres de los animales que aparecen en las fotos abajo? Mirando la foto, por favor escribe el nombre del animal que ves.

RECUERDA: SI NO SABES EL NOMBRE, NO LA CONTESTES

 a. Nombre del animal: ____________________	 b. Nombre del animal: ____________________
 c. Nombre del animal: ____________________	 d. Nombre del animal: ____________________
 e. Nombre del animal: ____________________	 f. Nombre del animal: _____________________

 g. Nombre del animal: ____________________	 h. Nombre del animal: ____________________

19. ¿Podrías escribir que otros animales de Galápagos recuerdas pero que no estaban en las fotos?

____

20. ¿Cuáles son los nombres de los árboles o plantas que aparecen en las fotos el la siguiente pagina?

    Mirando la foto, por favor escribe el nombre del árbol o de la planta que ves.

RECUERDA: SI NO SABES EL NOMBRE, NO LA CONTESTES

 a. Nombre de la planta: ___________________	

	b. Nombre de la planta: ____________________
 c. Nombre de la planta: ____________________	 d. Nombre de la planta: ____________________

 e. Nombre de la planta: ___________________	 f. Nombre de la planta: ____________________
 g. Nombre de la planta: ___________________	 h. Nombre de la planta: ___________________

21. ¿Podrías escribir que otras plantas propias de Galápagos recuerdas pero que no estaban en las fotos?

____

¿Cómo te sientes sobre el ambiente de las Galápagos? Cierre con un círculo una opción para cada pregunta)

22. Me encanta el ambiente de Galápagos	a) Completa mente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completa mente en desacuerdo
23. Odio el ambiente de Galápagos	a) Completa mente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completa mente en desacuerdo
24. Es importante para mí proteger el ambiente de Galápagos	a) Completa mente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completa mente en desacuerdo

25. Quiero aprender más sobre el ambiente de Galápagos	a) Completamente de acuerdo	b) Algo de acuerdo	c)Neutral/ No sé	d) Algo en desacuerdo	e) Completamente en desacuerdo

Appendix G: Interview Guide

Introductory statement (to be made by the researcher to each participant prior to conducting interview):

"Soy estudiante en la Universidad de Oxford y estoy haciendo investigaciones aquí en las Galápagos porque amo las islas y quiero hablar con gente joven aquí sobre lo que piensa de las islas. Espero entrevistarte acerca de cómo aprendes sobre el ambiente natural en las Galápagos. Me interesa escuchar cómo describes tu ambiente, las Galápagos, cómo interactúas con el ambiente natural aquí y sobre la importancia de la conservación y de aprender sobre tu ambiente. Si no te sientes cómodo(a) contestando cualquier pregunta, sólo déjame saber. ¿Tienes alguna pregunta para mí antes de empezar?

1. ¿Naciste en las Galápagos o te mudaste aquí? (Si te mudaste, ¿cuántos años tenía cuando te mudaste?
2. ¿Cómo describirías el ambiente (las Galápagos) en donde vives?
3. ¿Cómo aprendes sobre tu ambiente?
4. ¿Cómo aprendiste sobre tu ambiente cuando eras chiquito(a)?
5. ¿Qué es un recuerdo de tu niñez en el cual recuerdas aprendiendo sobre tu ambiente?
6. ¿Alguien te enseñó cosas sobre tu ambiente cuando crecías?
7. ¿Quién te enseña cosas sobre tu ambiente ahora?
8. ¿Qué tan cómodo(a) estás nombrando animales o plantas en las Galápagos?
    a. ¿Dónde y cómo aprendiste esas cosas?
9. ¿Qué otras fuentes tienes para aprender/obtener conocimiento sobre las Galápagos?
10. ¿Puedes describir cómo te sientes sobre las Galápagos como tu ambiente?

11. ¿Es importante para ti aprender sobre tu ambiente de las Galápagos?
    a. Si es así, ¿por qué?
12. ¿Tu escuela pone énfasis en aprender sobre las Galápagos como tu ambiente?
13. ¿Es importante para ti la conservación de tu ambiente de las Galápagos?
    a. Sí es así, ¿por qué?
    b. ¿Tu familia está de acuerdo contigo?
    c. ¿Tus amigos están de acuerdo contigo?

Appendix H: Focus Group Guide

Introductory statement (to be made by the researcher to each participant prior to conducting interview):

"Soy estudiante en la Universidad de Oxford y estoy haciendo investigaciones aquí en las Galápagos porque amo las islas y quiero hablar con gente joven aquí sobre lo que piensa de las islas. Me interesa escuchar cómo describen su ambiente, las Galápagos, cómo interactúan con el ambiente natural aquí y sobre la importancia de la conservación y de aprender sobre su ambiente. Si no se sienten cómodos contestando cualquier pregunta, sólo déjenme saber. Sé que ya han hecho una larga encuesta sobre esto y he podido hablar más con dos de ustedes sobre todas estas cosas, pero me emociono escuchar de más de ustedes hoy y ver lo que tienen para decir. Tengo unos temas aquí que me gustaría que hablen entre ustedes mismos, pero yo no voy a dirigir la conversación - ¡esto es su espacio para hablar! ¿Tienen alguna pregunta para mí antes de empezar?"

1. ¿Qué es el ambiente aquí en las Galápagos? ¿Cómo describirían el ambiente donde viven?
2. ¿Cómo aprenden sobre su ambiente o quién les enseñó sobre ello?
3. ¿Tienen algún recuerdo bonito o emocionante sobre el ambiente o la naturaleza aquí en las Galápagos?
4. ¿Les gusta aprender sobre los animales y las plantas de las Galápagos? Si es así, ¿por qué? Y si no, ¿por qué no?
5. ¿Pueden describir cómo se sienten sobre las Galápagos como su ambiente?

Appendix I: Galápagos Geology, Climate, and Ecology

While geological and ecological realities anywhere can impact human experience of and in that place, it is particularly important to provide this information about Galápagos because Galápagos has severely distinct ecological zones across small areas of land, which means that child experience will vary drastically based on small differences in location of school, home, outdoor spaces, etc. children living in the Galápagos, on most of the four inhabited islands, have options to attend schools that are physically located in two distinct human habitation areas: in port towns that are not only coastal but also relatively urbanized; or in semi-rural highland communities which usually reside a 10-15 minute drive inland and at higher elevation than port towns. While there are some similarities in experiences in these two main zones, I have found, through the data that I have collected, that the distinct contrasts not only create markedly different surroundings and worlds within schools and in general for children, but they also seem to have a noticeable impact on the ways in which children learn about their environment, thus impacting and shaping the findings that I will discuss for each research question.

Galápagos Geology

To start from a zoomed-out perspective, the Galápagos is a small archipelago, with only 3,092 total square miles of landmass, which is only 3% of total Ecuadorian landmass. Land allotted for human habitation on the islands makes up only 3% of the total, while the remaining 97% is strictly National Park, per federal mandate within the Special Law for Galápagos (*Ley Organica de Regimen Especial para* *la Provincia de Galápagos*, 1998). In general, the variation in climatic zones and, subsequently, flora and fauna, on each of the islands is striking, and while 3% for human settlement is inarguably a small portion of the total, there is still a surprising variation in ecological and geographical "worlds" that exist in that small chunk, meaning that lived human experiences can differ significantly depending on housing and school location. In this study, I have focused on just two of the four inhabited islands, Santa Cruz and San Cristóbal, so will focus on describing the geographic realities of these two islands, though the general climatic and geologic patterns extend to all Galápagos islands. I will start from the bottom up, literally, by describing the relevant geology of the islands, and then highlight how both the geology and climatic realities shaped the current ecological zones on the islands and thus give full background for readers about what children living in the Galápagos experience day to day.

The Galápagos Islands have been, for at least 20 million years (Harpp & Geist, 2018), and are still formed from a mantle plume. A mantle plume is a channel of magma that comes up from the earth's mantle and breaks through the lithosphere or earth's crust, either continental or oceanic, and, in the case of oceanic mantle plumes, may create chains of volcanic islands. The Galápagos is one of many hotspots, or collections of islands formed from these stationary sub-oceanic crust mantle plumes, across the globe. Other notable island hotspots are the Hawaiian Islands and the Society Islands (Burdick et al., 2001). The resulting volcanic Galápagos Islands are positioned on the Nazca plate, one of three oceanic tectonic plates in the near pacific region. A map can be found in the following link that illustrates the location of the Galápagos on and in relation to these plates, while also showing the direction of movement of each of the three plates (Burdick et al., 2001): https://darkwing.uoregon.edu/~drt/Research/Volcanic%20Galápagos/presentation.view@_id=9979

845746990&.html . Movement of the Nazca plate is particularly relevant, as it has determined the actual structure of the Galápagos as an island chain. More pointedly, when each of the individual Galápagos islands was formed from magma produced by the stationary mantle plume that broke through oceanic crust and erupted to form volcanoes, each volcanically formed island was then carried away on the Nazca plate, moving south-eastward away from the site of the plume (Burdick et al., 2001), forming a hotspot chain. Older Galápagos islands, then, are located in the southeasternmost quadrant of the island map, and newer islands and any future islands, will be formed and located in the north-western quadrant.

The geology of the islands also explains the structure of marine spaces around the islands, and the structure of actual island landmass in terms of elevation and size. Firstly, in terms of marine spaces, as the mantle plume pushes up through the lithosphere, it also pushes the oceanic crust upwards and causes "magmatic thickening of the crust" (Burdick et al., 2001). This contributes to the creation of the Galápagos Platform, a raised area of oceanic crust around the islands. This platform (which can be seen via the link here https://www.times-standard.com/2025/06/14/lori-dengler-the-Galápagos-islands-a-unique-collision-of-tectonics-currents-and-evolution/), creates shallow ocean waters, which in turn allow for specific marine ecosystems to thrive, such as coral reefs. Above water, the creation of volcanic islands means that each of the main islands is composed of at least one volcano, creating mountainous terrain on which ecosystems form.

However, these mountains, and the actual islands themselves, don't last forever. Because islands are carried away from the stationary mantle plume on the moving Nazca plate, older islands are cut off from the source of their creation and volcanoes on those islands become extinct. Both above and below sea level, these then older island masses weather away, due to wind, waves, other erosion, and possible compression and sinking of oceanic crust (Burdick et al., 2001). This means that older islands shrink both in elevation and in total landmass as they weather and sink. Shorter islands, then interact differently with the regional climate, creating different conditions for evolving ecosystems. Because the Galápagos mantle plume is smaller, relatively, than, for example, the Hawaiian mantle plume, and because of the speed of the Nazca plate, the Galápagos islands generally only stay above sea level for a few million years (Chu, 2020). As Chu points out, “an island’s age can determine the life and landscapes that evolve there” (2020) because of the actual time an island is above sea level, and because of the changes in size and topography through an island’s life.

Currently, Wolf Volcano, one of the still-active volcanoes on Isabela Island, the largest and one of the newest islands in Galápagos, is the highest elevation point in the archipelago at 5,600 ft. But the two islands I conducted research on are older, and thus both smaller and shorter than Isabela. Santa Cruz, the most populous island, is presumed to be made of at least one extinct, eroded volcano which is 2,835 feet high. The island has 381 square miles of land area (*Santa Cruz Island*, n.d.). San Cristóbal, the capital island of the province, with only 215 square miles in land area, is made up of “three or four fused” and extinct volcanoes and its highest elevation is 2,395 feet (*San Cristóbal Island*, n.d.). Both the size and height of each island, together with the regional climate, provide conditions for the distinct ecosystem zones that will be discussed in future subsections, and thus shape the flora and fauna that the children on each island are exposed to.

Galápagos Climate

It is worth noting here that the Galápagos, despite being directly on the equator, are not what one might imagine as tropical islands in their ecological make up or climate. The regional climate around the Galápagos is also, as mentioned above, a variable that directly influences ecosystem formation on the islands and in turn shapes the environmental experiences of people living on the islands.

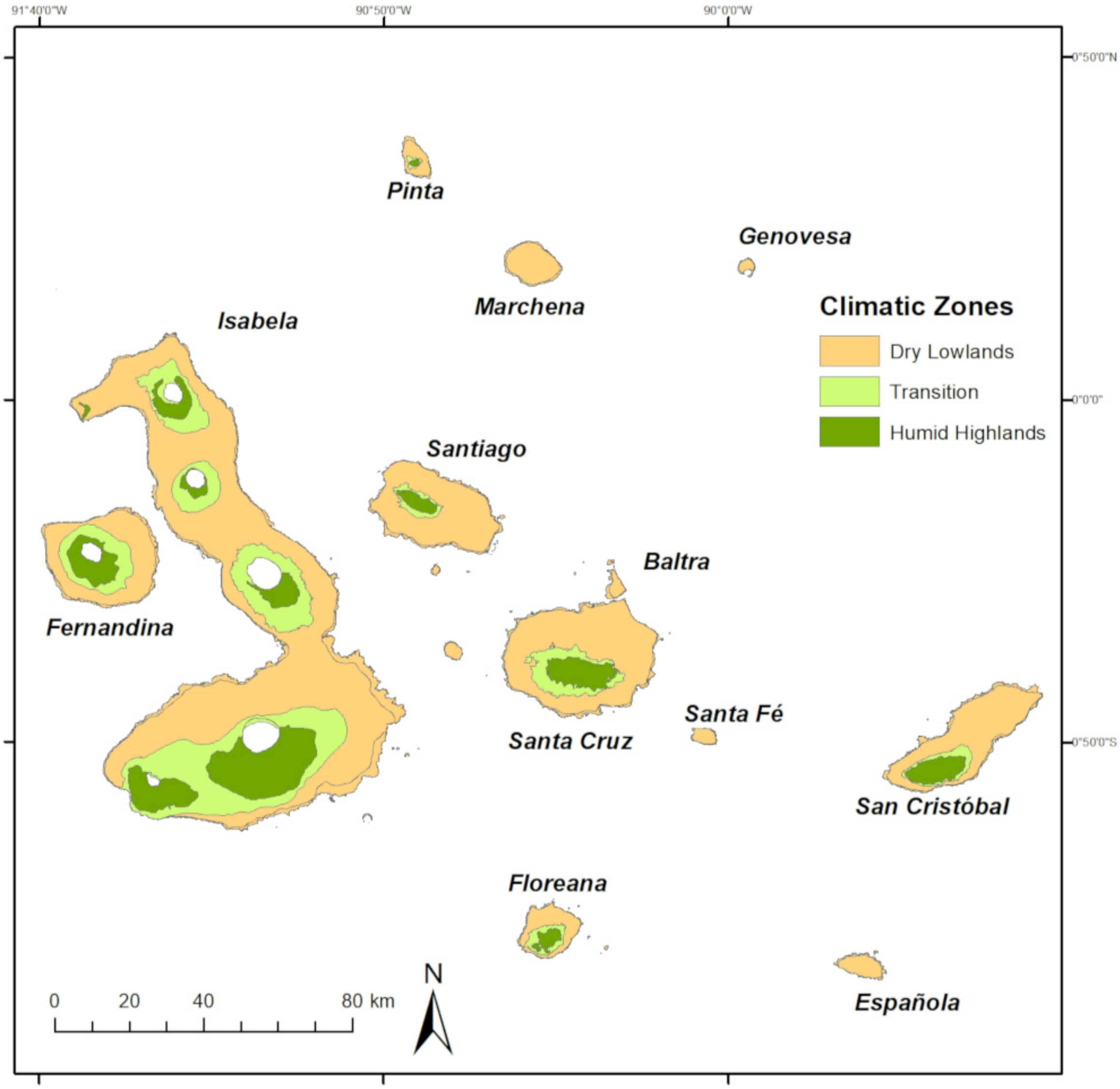
The archipelago happens to be situated so that four main ocean currents travel around and through it which influences climate and ecosystem development. Galápagos' unique location means that it is in the paths of the Cromwell, Panama, South Equatorial, and Humboldt (also known as the Peru) currents (Gilliard, 2022) (a map of the currents can be found here: https://focus.science.ubc.ca/darwins-eden-awash-in-plastics-8a4cf97d4679). As Wolff (2010) explains, the Galápagos benefits from these currents because the mixing of the warm South Equatorial and Panama currents with the cold Cromwell and Humboldt currents creates overall cooler near-surface ocean temperature and thus more nutrient dense marine environments. This has the effect of bolstering oceanic habitats rich with contradictions, including small Galápagos penguins, fur seals, sea turtles, and marine iguanas who take full advantage of the nutrient-dense marine vegetation that flourish in cooler waters.

Terrestrially, the Humboldt Current, the cold ocean current that flows upwards from Antarctica along the West coast of South America, brings consistent winds from the southeast which shape the two main seasons and the three climatic zones of the islands. The winds that accompany the current weaken from January to May, causing a decrease in the influence of the cool Humboldt waters and an increase in sea and air temperatures; this is known as the hot season and is accompanied by more rainfall. Contrastingly, from June to December, winds pick up, cooling both sea and air temperatures and creating the cool season (*Climatology Database*, n.d.). During the cooler months, cooler air “forces the warm air upwards, creating an ‘inversion layer’ and cloaking the highlands in drizzly mist or garúa” (Stewart, 2007, p. 34). Despite this mist, and rather confusingly, the season in general is drier in terms of actual rainfall in lower elevation zones (Sachs & Ladd, 2010; Stewart, 2007).

In addition to these two seasons, there are three climatic zones on the islands. These zones are the result of the interaction between the topography of the islands that we discussed in the previous section (namely, the volcanic structures in the forms of single mountains and surrounding flatter land mass) and incoming winds and variable temperatures influenced by the currents. All three climatic zones are illustrated in Figure 46 below.

Figure 46

Map of climatic zones in the Galápagos Islands



Note: "Galapagos Climatology Database", dataZone, Charles Darwin Foundation, https://datazone.darwinfoundation.org/en/climate/. Accessed 30 November 2025. (reproduced with permission stated on the site listed above)

The vast majority of Galápagos landmass is within the Dry Lowlands zone which receives little rainfall year-round and is, as the name implies, close to sea level in elevation. In the highest elevation areas of the islands, winds and temperatures combine to create a rain shadow effect on the windward sides of each island, characterized by persistent cloud cover and drizzling rain, hence the Humid Highlands moniker. In between these two main zones is the transitional zone, which is simply described as a mixing of the two predominant zones climatically (*Climatology Database*, n.d.). These climatic zones will be useful to keep in mind when visualizing the distribution of ecological zones in the next subsection.

A final relevant note about the Galápagos climate is that the islands experience the effects of two major climatic events: El Niño and La Niña. The El Niño Southern Oscillation (ENSO), which includes both El Niño and La Niña years, is "a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean" (US Department of Commerce, n.d.). Historically, ENSO events would happen every 2-7 years, though research is exploring how climate change is impacting the frequency and strength of these events (Sachs & Ladd, 2010). For the Galápagos, an El Niño year means that the surface ocean increases in temperature and subsequently, the islands receive substantially more rainfall than in a non-El Niño year. Warmer waters are poorer in nutrients than the normal cool waters of Galápagos, in fact, "almost devoid of phytoplankton," (Stewart, 2007, p. 35) which causes devastation in marine fauna and seabird populations while the increased rainfall on land leads to dramatic growth of most terrestrial vegetation (Sachs & Ladd, 2010). La Niña years are characterized by dangerously low levels of precipitation, leading to short term die-off of many terrestrial species (Sachs & Ladd, 2010). These climatic events, while not consistent enough to impact annual seasons and establishment of ecological zones on the islands, still have significant impacts on Galápagos environments and evolution of individual species and thus on the people living in and experiencing those environments.

Resulting Galápagos Ecosystem Zones

The unique geology of the Galápagos, together with the climatic patterns and zones of the islands, create ecological zones in which the people and flora and non-human fauna of Galápagos live. As Oxford and Watkins (2009) explain, "altitudinal changes in temperature and rainfall are therefore the major determinants of different plant zones" (p. 57) and the fauna that then survives off of and among those plants are subsequently determined. From lowest to highest elevation, the main terrestrial ecological zones are: Coastal, Arid, Transition, Scalesia, Brown, Miconia, and Pampa (as illustrated in the figures found here: https://web.mit.edu/12.000/www/m2008/teams/egilbert/ecosystems.html). In terms of ecological zones and vegetation, there are at least 180 species of endemic flora and 370 species of native flora across the islands (Aldaz, 2008).

The terrestrial ecological zones are closely related to the three climatic zones mentioned above. The Pampa and Miconia zones benefit from the previously described rain shadow effect, with near-constant moisture from collecting clouds and cooler temperatures. The Brown and Scalesia zones still benefit from the decreased temperature of increased elevation and fall within the humid climatic zone as well. The transition zone fits with its climatic zone pair, and the arid and coastal (also called the littoral) zones, both near or at sea level, constitute the dry lowland climatic zone. Descriptions of each of the seven zones are below, with notable flora and fauna for each in order to orient readers to the most likely lived experiences and exposures that children will have had in those areas.

The **coastal or littoral zone** is characterized by flora that survives in sandy and rocky coastal environments including dense evergreen native mangrove forests (Craven & Seddon, 2001) and other salt-resistant plants also thrive along the shoreline (Oxford & Watkins, 2009). Iconic fauna in this area would be the Galápagos sea lion, marine iguanas, any marine species that comes onshore like sally lightfoot crabs, marine iguanas, pelicans, or other water birds like blue footed boobies or flamingos, and sea turtles when laying eggs.

The **arid zone** is, unsurprisingly, quite dry, and characterized by dry forests of palo santo trees and tall candelabra and opuntia cacti, and other deciduous plants including the native and poisonous manzanillo trees and the endemic pega pega trees all of which are species that survive in water-constrained environments (Oxford & Watkins, 2009). The endemic Algodoncillo or Galápagos or Darwin's cotton shrub also is common and occurs regularly in neighbourhoods in towns (Aldaz, 2008). The terrain is composed of mostly chunks of volcanic rock, namely basalt, making it difficult to walk through and for things to grow on because of minimal soil and water retention (Craven & Seddon, 2001). Notable fauna in these areas would be Darwin's finches, the Galápagos mockingbird, lava lizards, and land iguanas in some parts of the islands. It is worth noting that, as in any urbanized area, children who live in port towns in the arid and transition zones will be exposed to non-native human-introduced species in the form of pets (predominantly cats and dogs), private gardens and other introduced vegetation through landscaping.

The **transition zone** is similar in terrain to the arid zone, though will have more dense collections of shrubs and less bare volcanic rock as conditions transition literally from dry to wet. The endemic guayabillo and pega pega trees and native matazarno and cat's claw trees dot the landscape, and the endemic tiny Galápagos tomato, or tomatillo, continues to grow (it spans the arid up through scalesia zones) (Aldaz, 2008). Fauna will still include many bird species such as Darwin's finches and the Galápagos mockingbird.

The **scalesia zone** suddenly becomes quite damp, as this zone matches with the start of the humid climatic zone with numerous "epiphytes and herbaceous plants" (Stewart, 2007, p. 102) including vines and dense scalesia forests. Scalesia is, essentially, a daisy tree. The woody stalks of the plants grow up to forty feet high, effectively creating forests that cover this area (Aldaz, 2008). Overall, the "the vegetation becomes lush and very dense" and some of the 90 species of ferns, 90 species of moss and 110 species of liverworts begin to grow (Oxford & Watkins, 2009, p. 61). Notable fauna include species of giant tortoise, and the vermilion flycatcher (though it is endangered and not seen often). It is worth noting that usually, agricultural practices in Galápagos take place in the scalesia zone, so children living in this area may be exposed to many non-native, introduced farm animals and plant species in addition to the still-common dogs and cats.

The **brown zone** is small in land area and is often cleared for agriculture, but when it is intact, it gets its moniker from brown lichens or liverworts that cover "the dominant cat's claw trees and makes them look brown during the dry season" (Stewart, 2007, p. 104). Additionally, this zone is higher into the humid region so can be home to giant tortoises that make use of the small pools of water that collect (Stewart, 2006).

The **miconia zone** is named after a shrub that populates the area and is also characterized by increased humidity and persistent cool, damp weather. The endemic miconia shrub, recognized by broad reddish leaves and small purple flowers and berries, densely populates this zone, along with ferns, mosses, and liverworts (Stewart, 2007). This zone has been particularly impacted by invasive plant species, but the miconia is "beginning to make a comeback in certain places" (Oxford & Watkins, 2009, p. 67). This zone is particularly unique to islands like Santa Cruz and San Cristóbal, vs other newer Galápagos islands, as the dense, moist vegetation would not be able to grow on newer and still-active volcanos at this elevation on other islands such as Isabela. The endangered Galápagos rail (bird species) survives in this habitat though may be hard to spot (Stewart, 2007).

The **pampa zone,** also called the fern sedge zone (Stewart, 2007) is characterized by open humid, damp grassland, with few tall trees and shrubs. This zone is the highest in elevation so essentially covers the tops of old volcanoes present on both Santa Cruz and San Cristóbal. As Stewart explains, the zone resembles "moorland in its luxuriance of mosses, sedge and grasses" and is "generally rather devoid of animal life" (Stewart, 2007, p. 105). This is the wettest vegetation zone on the islands, receiving anywhere from 1.5 to 3 meters of rain annually depending on how wet the year is (Stewart, 2007). It is also worth noting that typically, this zone would not have any allowed human habitation and reaching it via National Park guides would be difficult, so children may have little to no exposure to this environment.

Marine environments around Galápagos are equally biodiverse and varied in marine topography. The Galápagos Marine Reserve, covering over 76,000 square miles of waters surrounding the islands, was created in 1998 by the Galápagos federal government in partnership with the Galápagos National Park and is home to some 3,000 species of marine wildlife, making it one of the most biodiverse marine habitats on the planet (*Strengthening Marine Protection*, n.d.). In terms of marine ecosystems, the converging currents influence oceanic extremes, and the geologic Galápagos platform of raised oceanic crust hosts habitats from coral reefs to deeper colder pockets. Most notably, the cool Cromwell current travels eastward through the Pacific until it hits the Galápagos Platform and then “the 4,000-foot volcanic slopes cause the current to surface rapidly with cold, nutrient-rich water” that wells up near the eastern islands and then flows around the rest of the archipelago (Stewart, 2007, p. 142). Because of conflicting current temperatures and climatic conditions, the marine environment around Galápagos can be categorized as anything from subtropical in some areas, to warm temperate and even subpolar in others, which of course influences the evolution of contradictory and deeply biodiverse ecosystems (Stewart, 2007).

If children have had the chance to spend time on any of the local beaches on their island, or even take trips out on fishing or transit boats (the most common way to travel from island to island is to catch a ride on one of the many bus-like boats that predominantly transport locals), they will undoubtedly see a wide variety of marine life. Near beaches, children may see sea lions, sally lightfoot crabs, sea turtles, or marine iguanas. On short boat trips, or if they have the chance to go snorkelling or diving off of other islands (the latter is rare as it is difficult to access both financially and logistically), they may have seen dolphins, orcas, hammerhead sharks, white and black tipped reef sharks, manta rays, penguins, flightless cormorants, schools of fish, coral reefs, and other groups of marine wildlife (Stewart, 2007). As mentioned previously, school-aged children in the Galápagos have access to schools in either the port cities, or in the highlands (or “Parte Alta”), depending on where they live.

Santa Cruz schools and ecological zones: Per Figure 8 above, port schools on Santa Cruz are located entirely within the bounds of Puerto Ayora, the most populous city in Galápagos. Highland schools on Santa Cruz are located in and around either the Bellavista or Santa Rosa communities. Puerto Ayora, located on the coast, spans the coastal, arid, and part of the transition ecological zones, so children in those schools would have the most immediate and day-to-day exposure and access to flora and fauna in those zones. Bellavista and Santa Rosa span the scalesia and edge of the brown zones.

San Cristóbal schools and ecological zones: On San Cristóbal Island, per Figure 9 above, port schools are located in Puerto Baquerizo Moreno, the capital city of Galápagos and second-most populous city, and highland schools are located in the El Progreso community. Puerto Baquerizo Moreno, similar to Puerto Ayora, spans the coastal, arid, and part of the transition ecological zones, so children again would have the most immediate and day-to-day exposure and access to flora and fauna in those zones. El Progreso is located in the scalesia zone.

With an overview above of the environmental realities in the Galápagos readers are better positioned to now follow trends and child narratives within the findings in relation to how children state that they learn about their local environment.