Transformative Ecoliteracy Development in Postsecondary Education: Cultivating Intentional Relationships Through Garden-Based Learning

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Transformative Ecoliteracy Development in Postsecondary Education: Cultivating Intentional Relationships Through Garden-Based Learning

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

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in
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Abstract

Education can play a critical role in empowering learners to address the global, complex, and interconnected sustainability problems humanity currently faces. Ecoliteracy, as an educational aim, may support the cultivation of values, attitudes, and skills required for the development of sustainability solutions and our collective ability to design regenerative ways of living. However, empirical research that explores and supports the development of ecoliteracy in adults is limited. This grounded theory action research study aimed to contribute to this body of knowledge. This study explored how adult ecoliteracy and practical gardening skills may be cultivated through an intentionally designed, holistic, garden-based internship program. Participants of the study were Portland State University students who chose to take part in this 8-week internship at Learning Gardens Laboratory, in Portland, Oregon, in the summer of 2021. The findings showed that internship engagement supported the cultivation of ecoliteracy in participants. Interns experienced an increase in ecological knowledge, developed attitudes of care and stewardship, and gained practical competencies that may support the application of this learning in other contexts. In some cases, participants experienced a sense of personal transformation, including shifts in their perspectives or worldviews, and changes in their planned life path and future goals. In addition, participants' practical gardening and food production skills advanced. Learning occurred through relationships in three thematic categories: interpersonal relationships; intrapersonal relationships; and relationships with land, place, and more-than-human beings. These outcomes are directly
aligned with ecoliteracy literature, and suggest that transformative sustainability education theory, as well as place-based and experiential learning pedagogies (among others), offer strategies that support ecoliteracy development in adults. The results of this study demonstrate that education for ecoliteracy is ideally situated in a garden-based learning environment.
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Chapter I

Introduction

As the global community is confronted with the complex and interrelated problems of climate change, social injustice, environmental degradation, biodiversity loss and impending ecological collapse, our collective response at this moment is critical to our survival. Faced with the challenge of building sustainable communities in which the current needs of humans can be met without compromising the wellbeing of future generations (Capra, 2001; Harding, 2012; Orr, 1992), we must change how we think, redesign how we live, and reestablish our individual and collective relationships with the earth (Kumar, 2019; Orr, 1992; Sepie, 2017; Sterling, 2012).

Education plays a critical role in fostering the development of values, beliefs, attitudes, and behaviors that support true ecological sustainability. Environmentalist and educator Orr (1991) suggests that the aim of education is to support human survival, and claims that we may be saved by “education of a certain kind” (para. 6). Orr’s assertion that “all education is environmental education” (para. 19) implies that education plays a vital role in students’ understanding of their relationship with the environment and natural world. Through the educational experience—the method of instruction, the teacher's role, ethics, and integrity, and what is included and excluded from the curriculum—students learn that they are a part of or separate from nature. Conventional western education and dominant western culture teach that nature is other; separate from the self, a non-living object, a collection of resources to be consumed and valued only in terms of economic worth (Harding, 2012; Kimmerer, 2017; Kumar, 2019; Smith & Williams, 2004). Contrary to this mechanistic, reductionist, capitalistic view,
environmental, ecological, and sustainability education focuses on holism, systems thinking, and the inherent interconnectedness that permeates all relationships: between humans, within the natural world, and between humans and nature or more-than-human beings.

Smith and Williams (2004) suggest the first principle of this kind of ecological education is the development of a personal relationship with the earth. The quality of the relationship must be one of love and care, understanding that “caring is a way of being in relation, not a specific set of behaviors” (Noddings, 1992, p. 17). As we tend to care for what we love, the development of caring, reciprocal relationships with each other, the earth, and all beings is central to environmental education as education for survival. Relationships of affinity, care, stewardship, and reciprocity may begin with a sense of awe and wonder, which, when nurtured, can grow into love and a sense of kinship with all beings and the living world (Orr, 1992). This sense of kinship and interconnection fosters intrinsic motivation for sustainable ways of living where “external compulsion or a sense of duty are no longer necessary to make us act correctly” (Harding, 2012, p. 93).

A number of perceptual shifts support the process of reframing the relationship between humans and the natural world. Prominent examples include embracing a conception of the earth as a sentient being and adopting an animist mindset (Harding, 2012; Harvey, 2019; Sepie, 2017), as well as changing the language used to talk about non-human beings (Kimmerer, 2017; Orr, 1992). Language impacts culturally shared

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1 The terms “more-than-human,” “non-human,” and “other-than-human” all seek to reframe the human-nature relationship in a way that implies an ecocentric, rather than anthropocentric, view. While I fully support this intention, I find these terms problematic in that each still suggests a sense of hierarchy, dualism, and separation. As such, I will use these terms interchangeably throughout this document.
understandings, a point Kimmerer (2017) illustrates by saying, “those whom my [Potawatomi] ancestors called relatives were renamed natural resources” (para. 7). In referring to all non-humans as “it,” animals, plants, trees, and elements are thus turned into objects or commodities and it becomes easy to measure a forest by the lumber it could yield. When the tree is seen not as a commodity, but as a living being with rights, needs, and gifts to offer, it becomes difficult to imagine clearcutting; when the forest is our teacher, our home, and our provider we become responsible to her, we learn from her, and we care for her survival for her own sake and with the understanding that her wellbeing is inextricably linked to our own. Cajete (2005) speaks to this shift in perspective in describing American Indian tribal education as a life-sustaining process that unfolds “through reciprocal relationships between one’s social group and the natural world” (p. 70). If we accept that there exists a deep and inherent connection between humans and the natural world it becomes difficult to compartmentalize education into subjects void of this connection. For example, we cannot teach economics without considering the environmental impact of our economic models, choices, and relationship with raw materials (the earth). Reestablishing the relationships between disciplines can instigate a shift in an individual's beliefs, values, attitudes, and behaviors, and such a transformation can ignite communal evolution. The problems we face collectively are complex and interconnected, thus, designing solutions requires interdisciplinary and relational approaches (Orr, 1992). If education is to functionally prepare student citizens to participate in the cocreation of sustainable communities, educators must seek to engage transformative pedagogy (Burns, 2011; UNESCO, n.d.), view all subjects through an environmental lens, and approach education with the goal of deep ecoliteracy for all
students (Orr, 1991).

“Ecoliteracy” as a term, a concept, and an educational aim, emerged in the 1990s and has roots in environmental and ecological education. A portmanteau that evolved from “ecological literacy,” it represents more than the sum of its parts. While basic comprehension of ecology is one aspect of ecoliteracy, an ecoliterate person would also have an understanding of “human ecology, and the concepts of sustainability, as well as the wherewithal to solve problems” (Orr, 2005, p. xi). As Orr (1992) suggests, ecoliteracy cultivation relies on the development of a triad of competencies: knowing, caring, and practical skills. The development of ecoliteracy requires creating changes in the way we think and perceive the world. These perceptual shifts include shifting focus from the parts to the whole, from objects to relationships, from objective knowledge to contextual knowledge, from quantity to quality, from structure to process, and from contents to patterns (Capra, 2005). Ecoliteracy promotes one’s ability to think like an ecosystem, understand that we are each part of the ecosystem, and that we must live accordingly. Deep ecoliteracy empowers individuals to utilize ecological design and biomimicry, strategies which are fundamental to the ability to design sustainable communities. Ecoliteracy is critical to sustainability and, as such, is, or should be, an essential aim of education.

With sustainability “becoming increasingly relevant in higher education, as the need to address complex cultural and ecological problems intensifies” (Burns, 2015, p. 1), higher education institutions are in a unique position to play a highly influential role in the cocreation of a sustainable future (Blessinger et al., 2018). Portland State University (PSU), where this study was situated, seeks to meet this challenge (in part)
through the Leadership for Sustainability Education (LSE) graduate program located within the Educational Leadership and Policy department in the College of Education. This program strives to support the holistic development of sustainability leaders, educators and changemakers through modeling “education that is inclusive, participatory, experiential, thematic, critically questioning, place-based and transformative” (Leadership for Sustainability Education, n.d., para. 7). LSE courses are designed to foster development in four key learning areas including: 1) self-understanding and commitment, 2) systemic view of the world, 3) bio-cultural relationships, and, 4) tools for sustainable change (Burns et al., 2016). To promote these learning areas, pedagogical strategies utilized include, but are not limited to, mindfulness and self-reflective practices, group work and collaborative leadership, cohort-based learning, and community-based learning (CBL). CBL opportunities provide students with practical and experiential learning situations which complement theoretical studies and locate learning in the real-life context of community. While LSE students are free to choose a community partner with whom they can work or volunteer to fulfill CBL requirements, many opt for engagement with PSU’s Learning Gardens Laboratory (LGL). LGL is an urban farm and garden-based learning site founded by LSE faculty “in order to advance the development of sustainable food systems and sustainability education” (Burns & Miller, 2012, p. 69).

Garden-based learning has roots in experiential, outdoor, and environmental education, and draws from the educational philosophies of Froebel, Rousseau, Montessori, Steiner, Gandhi, and Dewey, among others. Garden-based learning, “defined simply as an instructional strategy that utilizes a garden as a teaching tool” (Desmond et
al., 2004, p. 20), is increasingly popular in both elementary and higher education settings (Gaylie, 2009; Subramaniam, 2002; Williams & Brown, 2021). However, related empirical research is limited (Gaylie, 2009; Subramaniam, 2002; Williams & Dixon, 2013) and available literature is focused primarily on education for children rather than adults. While little exists in academia to specifically support garden-based learning in higher education settings, in the last few decades this practice has grown in tandem with an increased number of educational programs focused on sustainability and sustainable food systems. Learning gardens are becoming more prominent in colleges and universities and exist at Evergreen State College, UC Santa Cruz, Prescott College, Schumacher College, Oregon State University, and Portland State University, to name just a few. Learning gardens and garden-centered educational opportunities not only promote sustainable food production and agricultural skills, they also support the development of ecological knowledge and whole systems thinking (Capra, 2001). In addition, they provide a sense of place and experience of interconnection for students, demonstrating “that a right relationship is possible between nature and culture” (Williams & Brown, 2012, p. 12). Garden-based education offers participants a sense of hope, where hope is not a passive noun, but is something active and tangible, where “hope is a verb with its sleeves rolled up” (Orr, personal communication, October 19, 2021). A learning garden can be an access point and provide an unintimidating and approachable way to offer students ingress to the whole body of knowledge that underlies ecoliteracy. Gaylie (2009) explains that “a survey of theory and practice in school gardens and environmental education supports the idea that garden learning potentially opens students to a wider world of understanding, one that can help address local and global
environmental concerns in practical ways” (p. 39). To end, learning gardens are transformative spaces (Clavin, 2012) that support the development of ecoliteracy (Capra, 2001; Gaylie, 2009; Subramaniam, 2002).

Learning Gardens Laboratory

Portland State University's Learning Gardens Laboratory (LGL) is a 4-acre education-focused urban farm located in the Brentwood-Darlington neighborhood of Southeast Portland. LGL rests on the ceded and unceded traditional and ancestral homelands of “the Multnomah, Kathlamet, Clackamas, Tumwater, Watlala bands of the Chinook, the Tualatin Kalapuya and many other indigenous nations of the Columbia River” (Native American Student & Community Center, para. 4). It is important to acknowledge the history of this land, and the sacrifices forced upon the ancestors of this place, before discussing the more recent story of the place. The site was host to a dairy farm, then the Green Thumb program—a horticultural education program for Portland high school students—for several decades before a distinctive three-way partnership between Portland Public School (PPS) District, the City of Portland, and Portland State University (PSU), facilitated the emergence of LGL in 2005 (Burns et al., 2017). The 12-acre parcel, jointly owned by PPS and the City of Portland, presently hosts the Brentwood Community Garden, the Green Thumb Orchard, and PPS’s Community Transition Program, as well as a number of organizations including Black Futures Farm, Oregon State University Extension and Master Gardeners, and LGL through PSU’s College of Education. Partnerships are foundational to LGL’s existence and the value of relationships is central to the ethos of LGL as an organization. This is made evident through LGL’s long-standing partnership with neighboring Lane Middle School and
PSU’s Leadership for Sustainability Education (LSE) graduate program, and through continued engagement with the greater PSU community and local Brentwood-Darlington residential community, not to mention the land and more-than-human beings with whom LGL shares the space. LGL is, in every way, part of a dynamic web of relationships.

The mission of the Learning Gardens Laboratory is to support “academic achievement, leadership development, and local sustainable food systems by providing multicultural, interdisciplinary, intergenerational, and experiential garden-based education for public school students and their families, university students, and community members” (Learning Gardens Laboratory, n.d., para. 2). With this focus on sustainability leadership and garden-based learning, LGL offers various engagement opportunities such as providing a weekly garden-based education program for Lane Middle School students, hosting PSU undergraduate students in service-learning senior capstone courses and freshman inquiry course projects, as well as PSU’s LSE graduate students through self-directed LGL internships and community-based learning projects for courses such as Advanced Leadership for Sustainability, Urban Farm Education, and Permaculture. LGL also offers informal participation opportunities such as weekly volunteer hours and community events, as well as hosting the Lane Family Gardens plot where members of the local community grow vegetables for personal use at no cost. Garden plots are stewarded and programs coordinated and led by an annually fluctuating team of graduate students from the LSE program with the support of a LSE-faculty coordinator, plus, more recently, a part-time, year-round LGL manager. In alignment with the values of the LSE program and sustainability education pedagogy, the leadership team aims to utilize a decentralized, horizontal organizational structure, where work is
done collaboratively and decisions are made collectively, despite LGL being nested in the hierarchical institution of PSU. Funding for LGL comes from PSU’s College of Education (which houses the LSE program), as well as from grants, and the fundraising efforts of the above-mentioned student-staff and faculty team. Fundraising occurs through seasonal veggie box sales known as the Harvest Share program, as well as several annual events that aim to both raise funds and provide opportunities for community engagement and connection.

If you were visiting LGL today you would likely approach from Southeast 60th Avenue, where you pass through a row of Sweetgum trees before entering the garden via the People’s Gate. Immediately before you, a wayfinding signpost offers welcome and directional support for first-time visitors. Just beyond this lies the Harvest Share Plot where much of the produce is grown for the summer Harvest Share program. To your right there’s a shady corner with an inviting bench where classes and staff meetings are sometimes held, and where, on Thursday afternoons in the Summer, you might go to pick up the harvest share you ordered. Wander a little farther and you pass the wood chip and burlap piles (mulch materials) before meeting the Garden Education Plot where Lane Middle School students and the LGL garden education team tend beds of veggies, flowers, and perennial fruits; beyond this is the greenhouse where thousands of seedlings are grown each spring, tools are stored, and on rainy days LGL staff meetings sometimes take place. You might notice the dye garden outside the greenhouse, full of Hopi Black Sunflowers, Dyer's Coreopsis, and Indigo—plants used to make natural dyes—or you might observe the Fedge—a perennial food hedge consisting of fruiting trees and bushes—bordering the space. If you made your way back to the entrance to your left
would be the OSU Extension Plot, and the Lane Family Gardens space, followed by the student-designed Mindfulness Sanctuary, while to your right sits the Farmer in Residence Plot currently stewarded by LGL’s manager. Finally, you’d reach the Meadow where students and staff gather, and the beloved Douglas Fir tree, which represents the heart and hub of the garden. This tree provides a shady meeting place and neighbors the Harvest-Wash-Pack Station—the center of activity on harvest days. Beyond this spot lies the PSU Student Plot (newly appointed for this purpose) and the Dry Farming Plot. A bit further on is Black Futures Farm, and then the Brentwood Community Garden, the orchard, and the grand old chestnut tree lovingly referred to as Grandfather.

**Context of Study**

While a sense of flux is inherent to the nature of LGL—largely due to the annual turnover of student staff and seasonality of programming—the onset of the COVID-19 pandemic in early 2020 necessitated shifts beyond traditional fluidity, both in terms of programmatic offerings and operational strategies. As such, my experience of LGL was likely quite different than it might have been during another time. I was hired as graduate student staff at LGL in the fall of 2019 in the role of events and fundraising coordinator. Though I worked at LGL for the next two years, I only experienced pre-pandemic LGL operations for those first six months. By the end of winter term, in early March 2020, classes were moving to online platforms rather than in-person meetings, in response to the spread of COVID-19. Directed by PSU and local ordinances, LGL canceled in-person student and community engagement including volunteer hours and the annual Earth Day event, and moved staff meetings online. As panic buying emptied grocery store shelves and the impact of the pandemic exacerbated the fragility of the global food system
(Clapp, 2020), LGL staff developed a tangible understanding of the importance of building “resilience into our local food systems” (Learning Gardens Laboratory, n.d., para. 1) and thus shifted focus away from education and towards food production.

With few educational offerings and no events on the calendar due to COVID-19 restrictions, staff roles shifted and my position as events and fundraising coordinator became somewhat redundant. However, all staff participated in farming efforts on site and the development of the new Harvest Share program, through which produce was sold to the community at a reduced price. Cut flowers and fresh produce were also donated to local food pantries and community organizations. Although in-person events and educational activities were suspended, LGL senior capstone classes continued remotely. As LGL’s community-based learning (CBL) coordinator had recently graduated, I stepped into the open position. The CBL coordinator traditionally supports senior capstones based at LGL through leading site tours, facilitating onsite engagement, assisting with student projects, and general coordination work, as well as supporting LSE students in fulfilling CBL hours requirements, and acting as the primary contact for LSE students doing a one-credit self-directed LGL internship. Senior capstones act as a culminating experience for undergraduate students at PSU. They are interdisciplinary, organized around a theme, and prominently feature a service-learning component facilitated through partnership with a local community organization. While the desired level of engagement and specific needs of each capstone course may vary depending on theme and instructor, many LGL capstones would normally include a significant amount of student time spent physically working in the garden at LGL and engaging with the space in-person. While remote engagement, given the circumstances, satisfied the
academic requirements, students were not learning to grow food, a desire that, in many cases, had drawn them to the LGL capstone.

By the fall of 2020 cases of COVID-19 had decreased enough to permit limited student participation in-person at LGL, allowing for the reintroduction of student-only volunteer hours, a number of site tours for small groups, and a few LSE classes to take advantage of the outdoor spaces and meet in-person at LGL. As PSU did not offer an LGL capstone that term, my capstone responsibilities were curtailed, and as LGL was without a volunteer coordinator, I shared some of the responsibilities of that role. LGL relies on volunteer involvement to help maintain the site and complete larger, seasonal projects. However, volunteer participation was very low and students would frequently sign up, but then not attend. Gaps in staffing prohibited the transfer of knowledge between staff about volunteer coordination and I suspect that some of the structure of the volunteer program was lost during this period of COVID-19-induced adaptation. Volunteers were often given menial, though important, tasks such as weeding, mulching, and washing plant pots, and sometimes, due to the staff’s lack of time or knowledge, volunteers were left to work alone, leading to disheartening mistakes (like the time someone pulled all the beet seedlings thinking they were weeds) and the sense that the relationship between LGL and the volunteers was somewhat out of balance.

The shortcomings of the LGL internship program were exacerbated by an incompatibility between the academic requirements on LSE students and the stressed resources of LGL. Graduate students, such as those in the LSE program, must take five credits per term to be considered half-time, or nine credits for full-time. Full or half-time standing is a requirement for financial aid eligibility and some student staff positions
(enrollment in five credits per term is required to work at LGL). However, all courses required in the LSE program are four credit courses, leaving many students needing one more credit in any given term. To address this need, there is generally a one-credit LSE course offered each term and a one-credit self-directed LGL internship is also available. Some internship students have a self-directed project they want to complete and are happy to work independently, while others are looking to engage more deeply with LGL. As a formal internship was not in existence during my time at LGL (before or during the pandemic), these students would generally just join volunteer hours, which created an experience that, for some, fell short of expectations. I worked with several students during this period who were taking the LGL internship credit and working on a project independently; though they had created their own program of study or designed their own project, many did not meet goals or fully realize projects as intended. I came to understand that PSU students who engage with LGL often want both the academic, theoretical knowledge related to sustainability as well as the practical, experiential knowledge that can occur through supported, hands-on, garden-based learning. The LGL internship as it has existed (as a credit, but not a program) represents both a challenge and an opportunity; a prime example of a problem that is also a solution (Holmgren, 2018).

PSU student engagement at LGL occurs primarily through volunteering (often to fulfill course-required CBL hours), one-credit internships, and senior capstone courses where LGL acts as the community partner. While capstone students and those completing a CBL project may be supported to some degree by their related coursework, LGL internships are almost entirely self-directed by the student. In most of these cases, if students seek hands-on engagement at LGL this occurs through joining labor-focused
volunteer hours led by graduate student staff. There is little structure or curriculum to support these student engagement opportunities, or to support LGL staff in facilitation of said opportunities.

To summarize the circumstances, an organizational aim of the Learning Gardens Lab was to connect with more PSU students. Based on my personal experiences working at LGL, I would say that LGL also had the desire to connect more deeply and meaningfully with PSU students, in a way that supports student’s sustainability literacy, ecoliteracy, and practical gardening skills. Prominent in LGL’s vision and direction has been Wheatly’s (2006) concept that the health of a system is increased by connecting that system to more of itself. A primary element in the LGL system is PSU and PSU students, so the desire to connect LGL with more of itself leads to considering how to connect with more PSU students, many of whom are unaware that LGL exists. From this understanding, I developed a guiding question: what programmatic shifts could enable LGL to increase student engagement and connect more deeply with students engaged? I recognized the under structured one-credit LGL internship and student volunteer hours to be missed opportunities for deep engagement, relationship building, and education; to be places where the pathway for connection existed within the system of LGL, but were underutilized. Further, the plot at LGL previously known as the Capstone Plot, where LGL hosted capstone student learning, had, in becoming the Mindfulness Sanctuary in the fall of 2019, left no physical space at LGL allocated to PSU students for growing food. However, another plot which had been the Lane Student Beds for many years, was without steady stewardship. Imagining that a dedicated space for PSU students could
catalyze the increase of relationships between PSU students and LGL, I initiated designating this space as a new PSU student plot.

**Rationale**

The rationale for this grounded theory action research study is multilayered; it is specific to LGL, while also being an exploration into how holistic, garden-based, adult education for ecoliteracy can be used as a means of education as sustainability. This qualitative research study has drawn on my threefold experience—as a student in the LSE program, as a teaching assistant for capstone and permaculture courses connected with LGL, and as the CBL coordinator at LGL over the last 2 years. My research has also been supported by literature on ecoliteracy and transformative sustainability education, as well as Indigenous, critical, experiential, place-based, and garden-based education philosophies and pedagogies. This study emerged from a few primary observations and understandings. First, LGL’s internship program is lightly-structured and not in direct dialogue with garden-centered educational philosophies and pedagogical practices. Second, PSU students repeatedly expressed interest in opportunities to learn how to grow food at LGL. Third, research that explores students' experiences in an internship program at LGL could provide the data needed to further develop said program to best support students, and, finally, existing research focusing on garden-based adult education is limited (Gaylie, 2009; Okur-Berberoğlu, 2018; Subramaniam, 2002), while empirical research in the field of education for ecoliteracy is almost nonexistent. The intervention—an LGL summer internship program—originated through the synthesis of my understanding of the needs of students desiring engagement with LGL, and the needs of the LGL organization, together with the resources available. This program is one
possible answer to the guiding question regarding programmatic shifts that could enable LGL to increase student engagement and connect more deeply with students engaged.

**Intervention Design**

Seeing myself as a practitioner of garden-based education within the role of CBL coordinator at LGL, I chose an action research design. This study was a procedure intended to gather qualitative data that would support and improve the practice and impact of garden-based education at LGL, and support ecoliteracy development (Plano Clark & Creswell, 2005). In carrying out this action research study, I developed an intervention, which was the design and implementation of a summer internship program at LGL.

Action research designs typically utilize a dynamic and cyclical process that includes periods of reflection, data collection, and action (Plano Clark & Creswell, 2005). LGL staff and LSE students frequently employ a similarly cyclical ecological design process in design projects of all kinds, including events, garden spaces, and educational offerings. Ecological design seeks to model ecological relationships, patterns, and systems and apply nature-based learning in the creation of sustainable designs. Ideally these designs consider humans, nature, and future generations equally. This kind of design is generally a slow and dialogical practice that engages multiple perspectives and intelligences, while moving through an iterative process of observing, envisioning, shaping, patterning, and engaging (Burns, 2022). Seeing congruence between the action research process and the ecological design process affirmed that an action research model was appropriate for this study and was a process that would likely be in alignment with the values of LGL as an organization.
I created the internship program using an ecological design method created by Burns, LSE professor and LGL faculty coordinator. Rooted in permaculture and intended for social and educational applications, this model provided for me a list of questions that guided each phase of the internship design process and supported the formation of its central values, intentions, and pedagogies. The interconnected aims of fostering the development of reciprocal relationships and a sense of belonging became central. These aims were supported through a focus on stewardship over ownership, locating the internship in the PSU Student Plot specifically (versus the LGL site in general), modeling and discussing the concept of companion planting, and making sure interns went home with food that they helped to grow and harvest. Accessibility and inclusivity was promoted through a flexible structure and schedule, and the decision to make the internship open to all PSU students. As the program lead, I sought to empower interns through honoring their instinctual and intuitive knowledge, I advocated for collaborative decision-making, and aimed to position myself as a co-learner rather than an expert.

The Research

The primary aim of this grounded theory action research study was to empirically explore how a Learning Gardens Laboratory (LGL) garden-based internship program could support Portland State University (PSU) student participants’ development of ecoliteracy and practical gardening and food production skills. The secondary aim of this study was to provide empirical qualitative evidence that adds to the existing body of knowledge around adult ecoliteracy development in the context of postsecondary education. The research questions guiding this study were: 1) What aspects of an LGL garden-based internship most impact participants’ development of ecological literacy?
and 2) How does the LGL garden-based internship program impact participants’ practical gardening skills?

The intervention component of this study was the aforementioned garden-based summer internship program. This program was experiential in nature, and focused on holistic development of ecological literacy and practical gardening skills through hands-on engagement at LGL. This was paired with supportive weekly readings and reflective and contemplative practices. Participants focused on growing food in the newly designated PSU Student Plot, working with the program lead and LGL staff to develop understanding about how to care for and harvest their crops and to create a planting plan for the fall harvest and overwintering crops. In alignment with LGL’s goals of contributing to PSU student food security and expanding the LGL Harvest Share program—and coupled with the programmatic aim of fostering reciprocal relationships—the veggies, herbs, and flowers grown in this plot were harvested and split into small shares for internship participants, while the surplus was donated to PSU students through the PSU Food Pantry. In order that the program may continue beyond the research, it was nested within the structure of LGL and staff leadership projects. The program was led by myself, as LGL’s outgoing CBL coordinator, with support from the LGL manager, as well as other staff members who would be continuing on at LGL for another year. This internship program was directly evaluated by students involved, and qualitative data describing their experiences was collected to help understand the impact of the program and support the research questions. Should the program be deemed successful and valuable to LGL, the design could be applied to CBL, capstone, and volunteer opportunities at LGL in the future.
Overview of Chapters

This first chapter has introduced the study, the intervention, and LGL as the research site. The second chapter explores relevant literature on ecoliteracy, related educational philosophies and pedagogies, and existing research. Chapter Three outlines the methods employed in this study and the fourth chapter reveals the findings of the study as they emerged through thematic analysis of the data. In the fifth, and final chapter, the results of the study are discussed in relation to the reviewed literature, recommendations are offered, as well as a conclusion to the study.
Ecoliteracy is an educational aim that supports authentic sustainability and regenerative ways of being through the development of ecological knowledge, shifts in perception, and learning that is deeply transformative. While the literature makes it clear that ecoliterate citizens and leaders are vital for true sustainability (Capra, 2012; Kumar, 2019; Orr, 1992; Sterling, 2012), adult ecoliteracy education lacks a distinct framework, and relevant empirical research is limited. This study was an exploration of ecoliteracy development through garden-based learning in the context of higher education as facilitated by the intervention of a new internship program at Portland State University’s Learning Gardens Laboratory.

This literature review begins with a review of ecology as it pertains to ecoliteracy, followed by a discussion of ecoliteracy, including core ecological concepts, perceptual shifts, and application through ecological design. The next section explores ecoliteracy and education through educational theories and pedagogies that share the ethics and objectives of ecoliteracy, including: place-based learning, critical pedagogy, experiential learning, transformative sustainability education, and garden-based learning. The literature suggests that adult education for ecoliteracy combines elements of the above educational theories and pedagogies and is ideally situated in a garden-based learning environment.

Origins of Ecoliteracy

The term *ecoliteracy* developed through the work of Orr and Capra in the 1990s (McBride et al., 2013), and was preceded by a number of related concepts. The concept
of “environmental literacy” was attributed to C. Roth who asked in 1968, “how shall we know the environmentally literate citizen?” (Roth, 1968, as cited in McBride et al.). Then, the idea of “ecolacy” was used by G. Hardin in 1981 to describe a third level of education, beyond basic literacy and numeracy, a “level at which a person achieves a working understanding of the complexity of the world” (p. 246) and the ability to ask “and then what?” (p. 246). The subsequent emergence of the term “ecological literacy” is ascribed to Risser’s (1986) Address of the Past President in which they sought to engage ecologists in addressing growing concern that “many Americans had little or no knowledge of basic scientific concepts” (p. 264). Risser, who noted the intensification of ecological problems, asserted “scientific, especially ecological literacy” (p. 264) as educational imperatives and affirmed the need for the general adult public and undergraduate learners to have at least a basic understanding of the concepts that constitute scientific and ecological literacy.

The concept of ecological literacy has evolved considerably since first use of the term, in large part due to the work of Orr, most notably their seminal book *Ecological Literacy: Education and the Transition to a Postmodern World*, published in 1992. While Risser’s idea of ecological literacy was specific to ecology and the sciences, “Orr advanced a vision of literacy that was distinct from the ongoing conversation” (McBride et al., 2013, p.10) around environmental education and ecological knowledge. Orr’s vision of ecology itself is expansive and includes elements of human, deep, and reverential ecologies, thus promoting the emergence of an ecological literacy that engages biophilia, ethics of care, and stresses the importance of sense of place and relationship with nature. Orr’s work represents a shift from a science-centered approach
to the natural world, to one that is interdisciplinary and stresses the relevance of the ecology to all areas of study and life.

Capra, founder of the Center for Ecoliteracy, first published the term “ecoliteracy” in the 1990s (McBride et al., 2013). Capra (2011) credits Orr with coining “ecological literacy” and refers to them as a “longtime friend and colleague whose thoughts and writings have influenced and inspired my own work for many years” (p. xii), a statement which suggests that the concept of ecoliteracy emerged through collective effort. Through Capra’s (1996, 2005) work ecoliteracy ideas crystallize; core ecological concepts are clearly defined and perceptual shifts essential to ecoliteracy are plainly outlined. While distinction must be made between the terms environmental literacy and ecological literacy as significant differences exist between the two concepts, the terms ecological literacy and ecoliteracy (and sometimes ecological intelligence) are found to be used interchangeably in contemporary literature on the subject with no obvious difference in the concepts.

**Ecology: Exploring the Concept**

Ecological knowledge is central to ecoliteracy. In the context of ecoliteracy, the concept of ecology includes not only scientific ecology, but also human ecology, as well as a sense of deep and reverential ecolgies, and the idea of ecology as a worldview. Before further discussion of ecoliteracy, it is logical to focus briefly on ecology itself, and explore these distinct but interconnected fields of ecology.

**Ecology as a Natural Science**

Bauman et al. (2017) explain that “ecology is best understood as a broad idea that covers a lot of territory and can be bent and shaped in various ways” (p. 49); it has many
definitions, aspects, branches, and applications. The term is derived from *oikos*, the Greek word for “household” and originated in the 1800s through the work of German biologist and naturalist Haeckel, who understood ecology as both a natural science and a worldview. In academic tradition wherein ecology is considered a natural science, it is chiefly the study of organisms in context; it rests on Darwinism and is a branch of biology concerned with the relationships between organisms, and between organisms and their biological and physical environments.

**Human Ecology**

Human ecology is a subdiscipline of ecology generally defined as the interdisciplinary study of humans in relationship with their environments. However, as humans are biological organisms, the mere existence of human ecology is a testament to the fact that humans have been understood as being separate from nature. Martin (2001) speaks to this in saying that “although humans are part of the ecosystem, it is useful to think of human-environment interaction as interaction between the human social system and the rest of the ecosystem” (para. 3). Human ecology is concerned with the ecological implications of human activity and can be used to help us understand the impact of humans on ecosystems over time; it is used to “emphasize how people are subject to the same environmental limitations as other animals” (Steiner, 2008, p. 336) and to support the development of sustainable relationships between humans and the earth. Moolakkattu (2010), drawing from Gandhian philosophy, suggests human ecology is a holistic frame, rooted in a deep sense of love and responsibility for humans, the environment, and all of life. As ecoliteracy involves not only comprehension of environmental systems, but also an understanding of human-environment relationships, human ecology is relevant to
ecoliteracy. Regardless of its application, ecology is inherently relational and based on the idea that nature, including humans, and indeed all of life, exist in an interconnected web of relationships.

**Ecology as a Worldview**

The dominant western paradigm is characterized by reductionist, mechanistic, patriarchal, anthropocentric assumptions and the idealization of perpetual growth. While some of these concepts have made valuable contributions to the evolution of our collective understanding of the world and may be, or have been, useful in certain contexts, they are antithetical to the contemporary understanding of ecology that I am working with, and destructive in the context of sustainability (Du Plessis & Brandon, 2014). While it may be difficult for some to imagine a world that is not defined by these restrictive concepts, the shift toward ecological sustainability requires radical adjustment of values, beliefs, and perceptions—a new worldview. This new paradigm is emerging as an ecological worldview that is both new and ancient, as countless indigenous peoples have lived well with nature throughout time (Capra, 2012; Kumar, 2019; Harding, personal communication, September 30, 2021). This ecological worldview is a relational view through which we can understand the world as a dynamic and interconnected whole, of which humans are part (Capra, 1996; Du Plessis & Brandon, 2014).

**Deep and Reverential Ecologies**

According to Kumar (2017b) “there are three ways to understand and describe the relationship between Nature and humans: shallow ecology, deep ecology and reverential ecology” (para. 1). The philosopher Naess (1973), known as the parent of deep ecology, described the shallow ecology movement as a “fight against pollution and resource
depletion” (p. 95), with the intent to preserve the status quo of perpetual economic growth and allow business as usual to persist. Although shallow ecology may seek the conservation of nature, it is driven by either the utilitarian view that nature is useful as an economic resource (Kumar, 2017b) or the romantic view of nature as scenery (Devall, 2000). This anthropocentric understanding of ecology maintains the perception that humans and nature are separate, that nature is inanimate, and non-human beings insentient (Kumar, 2017b), while focusing on practical, short-term solutions to environmental problems that are often viewed in relative isolation. Ecology, as described by Naess (1973), “is a limited science which makes use of scientific methods” (p. 99). This is not to imply that ecology is not valuable, but rather to suggest that a deeper, more expansive ecological understanding is critical to the fundamental changes and perceptual shifts required to address present social and environmental challenges.

The deep ecology movement is distinguished by the recognition that nature and all beings have intrinsic value and “the equal right to live and blossom” (Naess, 1973, p. 96). As described by Naess, deep ecology values diversity of all kinds, including biological, cultural, and demographic diversity. It suggests the concept of “the survival of the fittest” be reinterpreted as the ability to cooperate and coexist rather than compete; “‘live and let live' is a more powerful ecological principle than ‘either you or me’” (Naess, 1973, p. 96). Devall (2000) characterizes the deep ecology movement as “a social movement. It is not an ideology. ‘Social’ meaning: people working together in a community. It is based upon ecology, the relationship between organisms and their habitat. It is ‘long range’ because it does not discount the future” (p. 19), and it is “deep” in that it encourages a deep questioning of our assumptions, beliefs, purposes, and values.
Deep ecology engages the idea of an ecological self, that is a self that exists in personal and intimate relationship with a specific place and the knowledge that this self belongs to and is part of the natural system. Through the lens of deep ecology, ecology becomes a worldview and philosophy; a relational way of living and being.

The concept of reverential ecology aligns with deep ecology, and adds a spiritual aspect; “it considers Nature to be sacred. Life is sacred” (Kumar, 2017b, para. 5). In reverential ecology, humans are seen to be an integral part of nature; nature is intelligent and sentient, deserving of care, gratitude, and deep respect. Reverential ecology is holistic and engages the whole person—mind, body, and spirit. The concept is expansive and related to a series of other ideas such as: Gandhi’s theories of nonviolence, simplicity, and enoughness; ideas of interbeing as taught by Thich Nhat Hanh; Indigenous wisdom, and animist traditions.

Animism is a concept with various meanings; in many cases it parallels reverential ecology. As defined by Harvey (2019), Animism is “the understanding that the world is a community of persons, most of whom are not human, but all of whom are related, and all of whom deserve respect” (p. 80). Harvey suggests that the traditional animist ethos of countless Indigenous peoples offers vital examples of reverential and respectful interspecies and human-world relationships. Animism has been used to describe Indigenous traditional religions, however, Adamson (2008) explains that while “the indigenous understanding has its basis of spirituality and recognition of the interconnectedness and interdependence of all living things” (p. 34), tribal people worship the sacredness of creation as a way of life, not as a philosophy or religion. In fact, none of the native languages have words or terms
synonymous with religion. The closest expression of belief literally translates to the way you live. (p. 35)

Rather than idolizing and worshiping individual elements of the natural system—this would imply othering and separation—spirituality in the sense that Adamson describes, suggests a reverence for nature that is rooted in a sense of kinship and the belief that relationships are sacred, indeed, the web of life is sacred.

Kimmerer (2017) writes about the grammar of animacy and explains that language has the power to shape relationships with the more-than-human world. A member of the Citizen Potawatomi Nation, Kimmerer relates that in Potawatomi, birds, bugs, and berries are spoken of with the same respectful grammar as humans are, as if we were all members of the same family. Because we are. There is no it for nature. Living beings are referred to as subjects, never objects, and personhood is extended to all who breathe and some who don't. (para. 6)

The objectification of nature removes life from the land and all non-human beings, effectively separating and elevating humans. Through this Potawatomi conception, all beings are interconnected, interdependent, and related; “Indigenous philosophy recognizes other beings as our relatives” (Kimmerer, 2017, para 16). This relational understanding increases in depth in the context of the land. As Okanagan Canadian author and educator Armstrong (2008) describes, “in the Okanagan, our understanding of the land is that it’s not just that we’re part of the land … the land is us” (p. 67), there is no separation. Sam (2008) agrees and adds to this “as Okanagan people, we are from the land; we are part of it; therefore, we have an obligation … to protect and speak for this land that can’t speak for itself” (p. 40). Kumar (2005) suggests that reverential ecology is
an example of “right relationship” between people and nature, and states that “without reverence there can be no ecology, and without spirituality there can be no sustainability” (p. 181); we care for what we love, and protect what we believe to be sacred. Here, Kumar speaks to a sense of spiritual connection with the earth and reverence for nature, and suggests that these modes of relating are fundamental to ecoliteracy and authentic sustainability. The key distinction between these two conceptions of ecology is that deep ecology considers nature to have rights and intrinsic value, while reverential ecology deems nature to be sacred and divine.

Ecology in the context of ecoliteracy includes scientific ecology, human ecology, deep ecology, a sense of reverential ecology, and ecology as a worldview. However, “ecology, like most learning worth the effort, is an applied subject. Its goal is not just comprehension of how the world works, but, in light of that knowledge, a life lived accordingly” (Orr, 1992, p. 87). Ecoliteracy provides a useful and valuable framework for the learning, integration, and application of this body of ecological knowledge. This review of ecology serves as the foundation for the following exploration of ecoliteracy.

**Ecoliteracy**

Kumar (2019) suggests that in order to repair the human-planet relationship we must regard the earth as our home. He points out that “eco” comes from the Greek word *oikos*, meaning “home” or “household,” and suggests that “ecoliteracy means knowledge of home” (p. 88); we cannot properly take care of our home without intimate knowledge of it and the relationships that exist within. Capra (2005) describes ecology as the language of nature, and ecoliteracy as the ability to understand nature’s language, the ability to understand and embody ecological principles. While ecology is fundamental to
ecoliteracy, Orr (2005) suggests that an ecoliterate person would also have an understanding of human ecology and sustainability, as well as general problem solving skills, and an attitude of care. As described by Orr (1992) “knowing, caring, and practical competence constitute the basis of ecological literacy” (p. 92). These ecological thinkers agree that ecoliteracy is more than theoretical knowledge, it is theory realized and embodied through praxis.

**Perceptual Shifts**

The complex ecological problems we now face are both interdependent and interconnected; these problems “cannot be understood in isolation” (Capra, 1996, p. 3). The current ecological crisis is a product of outmoded mindsets, specifically dualistic and mechanistic Western ways of thinking; indeed, it is first “a crisis of perception” (Capra, 1996, p. 4; Sterling, 2001, p. 23). Problems cannot be solved with the same thinking that created them; we must “learn to see the world anew” (Einstein, n.d., as cited in Sterling, 2001, p. 12; Wheatley, 1994, p. 5). The development of ecoliteracy requires cultivating a worldview that is in many ways contrary to the dominant Western paradigm (Capra, 1996, 2005; Kumar, 2005; Sterling, 2001, 2012); we must critically readdress the beliefs, values, and perceptions that precede the problem. “The world is increasingly complex, interdependent and unsustainable, yet conversely, the way we perceive, think, and educate tends to be fragmentary and limited” (Sterling, 2012, p. 77). We need to think relationally, systemically, contextually and with an aim of considering and caring for the whole. Drawing primarily from systems thinking and ecology, Capra (2005) describes six key perceptual shifts necessary for ecoliteracy development. These include shifting focus from *the parts* to *the whole*, from *objects* to *relationships*, from *objective knowledge* to...
contextual knowledge, from quantity to quality, from structure to process, and from contents to patterns. These terms are italicized below for clarity.

Shifting focus from the parts to the whole is to depart from reductionism and move toward a holistic or ecological worldview. This shift is centered in the conception that a living system is something different than the sum of its parts and that no such system can be understood through viewing its elements independently. Living systems are defined by the relationships between elements; it follows that importance be placed on relationships over objects. As Capra explains, communities “are characterized by sets, or networks, of relationships. In the systems view the ‘objects’ of study are networks of relationships” (p. 20). Thus, to “isolate a single cause for any observed event” (Morris & Martin, 2009, p. 157) would be to take a detrimentally oversimplified view of the event; in order to understand and address complex and interconnected problems we must also consider causes holistically and relationally.

In the complementary field of quantum physics we have learned that elementary matter contains the potential to manifest in either particulate or wave form. Wheatley (1994) explains that relationality is “the key determiner of what is observed and how particles manifest themselves” (p. 10). Humans in psychological terms, for example, contain similar potentiality, as different contexts can bring out different qualities; “each of us is a different person in different places” (Wheatley, 1994, p. 34). Similarly, an intervention that proves beneficial in one context may have an entirely dissimilar outcome in another. Thus, the understanding that “the properties of the parts are not intrinsic, but can be understood only within the context of the whole” (Capra, 2005, p. 21) necessitates a shift from objective knowledge to contextual knowledge.
Western science has placed value on that which can be measured, weighed, and quantified, often dismissing that which cannot. Gross domestic product, for example, is an established system of quantification which says little about the comprehensive health of a nation and its people. While holistic health and happiness are harder to measure, it is possible. The shift from *quantity* to *quality* arises, in part, from the fact that relationships are better mapped than measured, and are best understood through qualitative rather than quantitative characterization (Capra, 2005). This shift also highlights that how events occur, or how we do things, is every bit as important as what we do, or what occurs (Brown, 2017).

The shift from *structure* to *process* is centered in the understanding that living systems are inherently dynamic; evolution, development, and transformation are innate characteristics of living systems (Capra, 2005). This shift engages phenomenology, suggesting direct observation and experience of phenomena, without the imposition of preconceptions. The phenomenological lens is one through which we receive what is, versus projecting what we believe to be. This perceptual shift allows for focus on process over outcome; suggests a cooperative strategy of inviting and allowing instead of forcing; promotes a move away from hierarchy and towards cooperative organizational structures.

In living systems, “certain configurations of relationships” (Capra, 2005, p. 21) appear repeatedly, creating patterns like flows, cycles, and feedback loops. Turning attention from *contents* to *patterns* suggests focusing on the patterns of relationship within a system, rather than on the constituent elements of the given system. This indicates a shift from learning about nature to learning from nature. “The commonality of patterns observable in nature and society allows us to not only make sense of what we
see, but to use a pattern from one context and scale, to design in another” (Holmgren, 2018, p. 16). Learning to see patterns in one system can enable the application of ecological design thinking within the development of sustainable human systems, habitats, and communities.

The perceptual shifts outlined above, exemplify ecological thinking—the “quality of mind that seeks out connections” (Orr, 1992, p. 92)—the central tenet of ecoliteracy. Nelson (2008) describes this shift in consciousness as part of the process of decolonizing the mind and suggests that “we need to embrace a type of trickster consciousness to break out of the binary thinking imposed on us by Eurocentric thinking” (p. 291). Nelson explains that the trickster mindset embraces humor, diversity, paradox, change, adaptation, emergence, plurality, and a move from the binary “either/or” to the expansive and relational “both/and” mindset. “The trickster is a healer in a fragmented world. … The trickster is going to help us get to our next place” (Vizenor, 1990, as cited by Nelson, 2008, p. 291). Trickster consciousness can help to “free the mind of the limits of the Western intellectual paradigm” (Nelson, 2008, p. 291). Reconceptualizing the world—shifting perceptions, values, and beliefs—is part of radically transforming outdated and unsustainable worldviews, and thus contains the potentiality for transforming the world. “The patterns of the universe repeat at scale. …what we practice at a small scale can reverberate to the largest scale” (Brown, 2017, p. 52). As such, changing ourselves, in turn, changes the world. Ecoliteracy development is a transformative process that begins with the ability to recognize the ecological patterns of the universe.

**Core Ecological Concepts**
Becoming ecoliterate involves developing ecological knowledge—learning to see natural patterns and speak “the language of nature” (Capra, 2005, p. 19). Some relatively simple, observable examples of patterns found in nature include spirals, waves, fractals, and branching patterns. In order to learn from nature and apply this learning in creating regenerative life-sustaining human systems we need to develop an understanding of the complex patterns and processes that represent the fundamentals of ecology and “how nature sustains the web of life” (Capra, 2005, p. xiii). Capra identifies these central concepts that have emerged from ecology and systems thinking (as well as from the fields of quantum physics, biology, complexity theory and others) to provide a framework for understanding ecological patterns and processes. These core concepts include: networks, nested systems, interdependence, diversity, cycles, flows, development, and dynamic balance, which are described in detail in the following paragraphs and italicized for clarity.

Through the ecological lens it is clear that all of life is comprised of living systems that are self-organizing and self-sustaining, which exist as complex networks of relationship, and form patterns that imply intrinsic interconnection, interdependence, and cooperation (Capra, 2005; Kumar, 2005). These living systems are nested, meaning that individual organisms, or communities, are simultaneously entire living systems, while being part of, or nested within, larger systems (Capra, 2005). Diversity is critical to the health and resilience of living systems (Capra, 2005; Devall, 1980), however, it is less “the diversity of the component species themselves [and more] the diversity of beneficial relationships between them” (Whitefield, 2012, p. 65). In human systems, cultural diversity, for example, may yield multiple perspectives, approaches, and solutions, while
in ecological systems, biodiversity implies that each function of the system is supported by multiple elements, promoting the system’s ability to recover from disturbance or loss of a single element.

The concept of cycles relates to the exchange of resources within a system (Stone, 2012); "through cyclical systems, Nature always renews itself" (Kumar, 2019, p. 90). In natural systems, there is no waste—small animals feed on plants and bugs, large animals eat small animals, decaying matter and biological wastes feed the soil, from which plants grow, and the cycle of interdependence continues. The idea of flows as a core ecological concept is similar to that of cycles, but is used here to describe the flow of energy (rather than matter) in a system. In ecological systems the flow or transfer of energy begins with plants converting the sun’s energy through photosynthesis, thus making it available to animals through consumption of plant matter (Stone, 2012). Development refers to the fact that all of life develops and changes, in fact, the only constant is change. Humans and all beings adapt to environments and each other, and vice versa, as they change, develop, and coevolve (Capra, 2005); thus emergence is a key characteristic of a living system. Dynamic balance describes a system's ability to self-regulate through the use of feedback loops in order to maintain a state of stability within constant fluctuation and change (Stone, 2012).

As Capra (2005) explains, “these closely related concepts are different aspects of a single fundamental pattern of organization: nature sustains life by creating and nurturing communities” (p. 23). A central component of ecoliteracy development is creating an understanding of these patterns and processes that sustain life, then using this ecological knowledge to design sustainable solutions and regenerative ways of living.
Ecological Design

Orr (2002) suggests that most environmental problems are not created intentionally, but rather, are the by-product or unforeseen consequence of activities with other objectives. “Environmental problems, then, are mostly the result of a miscalibration between human intentions and ecological results, which is to say that they are a kind of design failure” (Orr, 2002, p. 14). This has two implications: design is a partial solution and ecoliteracy is an imperative. Looking at ecological challenges through the lens of design can be empowering and hopeful; if design failures have led to unsustainability, an intentional, holistic, ecological design could be part of sustainability solutions.

Understanding a sustainable community to be one that is able to meet its current and future needs in a way that does not “interfere with nature's inherent ability to sustain life” (Capra, 2001, para. 2), a logical inclination is to model human-centered design on existing sustainable communities. We can learn from societies who have lived in harmony with their environments, and we can learn directly from nature, as earth’s systems are self-organizing and self-sustaining ecological communities (Capra, 1996, 2005; Kumar, 2017a; Holmgren, 2018). “The planet’s ecosystems have organized themselves in subtle and complex ways so as to maximize sustainability. This wisdom of nature is the essence of ecoliteracy” (Capra, 1996, p. 298) and the essential starting point for ecological design. Permaculture and biomimicry are both examples of ecological design frameworks, and though they are very different, each seeks to learn from nature and apply ecological patterns in the design process. The perceptual shifts and core ecological concepts of ecoliteracy as described above represent another design
framework. The essence of ecological design is the practice of thinking like an ecosystem and applying patterns found in nature in myriad contexts.

“Knowing, caring, and practical competence” (Orr, 1992, p. 92) are the triad of competencies that constitute ecoliteracy. Ecological design is an example of the third part of this triad. Ecoliteracy is not knowledge to be accumulated, memorized, and stored; it is active and must be lived. As Capra (1996) explains, being “ecoliterate means understanding the principles of organization of ecological communities (ecosystems) and using those principles for creating sustainable human communities” (p. 297). Ecoliteracy is inherently active; it is developed through experience and is necessarily applied. It cannot be acquired through traditional passive, classroom-based, lecture-style education. As ecoliteracy is relational it cannot be developed in isolation. For ecoliteracy to occur “we must rethink both the substance and the process of education at all levels” (Orr, 1992, p. 90).

**Ecoliteracy and Education**

Learning is critical to creating a more sustainable world (Sterling, 2001; Orr 1991, 1992; Sipos et al., 2007), indeed, “education is the most vital of all resources” (Schumacher, 1973/2010, p. 84). Orr (2009) proclaims that the ecological crisis is one of education and asserts that “more of the same kind of education will only compound our problems” (Orr, 1991, para. 6). As many of the people responsible for decisions contributing to modern social and ecological crises are considered to be highly educated (Kumar, 2019; Orr, 1992;), it can be said that contemporary education contributes to unsustainability (Sipos et al, 2007; Sterling, 2001). Education in today's schools, colleges, and universities primarily prepares people for participation in the global
economy (Davies, 2012), but “does little to sustain the ‘whole person’” (Sterling, 2001, p. 12). Devall (1980) agrees, and suggests that “education should have as its goal encouraging the spiritual development and personhood development of the members of a community, not just training them in occupations appropriate for oligarchic bureaucracies and for consumerism in advanced industrial societies” (p. 312–313). Informed by a dualistic and mechanistic worldview, mainstream learning is highly fragmented, specialized and standardized, while being technologically and intellectually focused; it reinforces Darwinian conceptions of scarcity and competition, anthropocentric patterns of consumption, and general disconnection. Thus, “if still more education is to save us, it would have to be education of a somewhat different kind” (Schumacher, 1997, p. 208), or as Orr (1991) asserts, “education of a certain kind” (para. 6). It is not only the educational content that matters; the context of learning and method of teaching is critical for the development of ecoliteracy (Burns, 2011, 2015; Orr, 1992).

In describing quantum field theory, Wheatley (1994) cautions that space is never empty; “space everywhere is now thought to be filled with fields” (p. 48). As Wheatley describes, though fields are non-material, invisible structures, they shape behavior and are observable through their effects. Wheatley applies the concept of fields to the organizational space and suggests that the vision of an organization may be understood as a field. Fields are often self-sustaining, which implies that if we have not created a coherent field of vision, people will encounter the fields that already exist, fields created carelessly or unintentionally. We can think of ecology as a field in the quantum sense, and education as an organization. The ecological field, or lack of, informs any worldview. Ecology is relevant to almost every subject of study, however, environmental and
ecological education has existed primarily as an afterthought and an isolated discipline. Orr (1991) suggests that “all education is environmental education. By what is included or excluded we teach students that they are part of or apart from the natural world” (para. 19). In failing to create an ecological field in education a learning situation is created that, intentionally or unintentionally, participates in the perpetuation of an unsustainable status quo, which reinforces the counterproductive concept that humans and nature are separate.

Beyond the development of the “knowing, caring, and practical competence [that] constitute the basis of ecological literacy” (Orr, 1992, p. 92) lies a second stage in ecoliteracy wherein one begins “to know something of the speed of the crisis that is upon us” (p. 93). Unfortunately, traditional classroom-based environmental and sustainability education—and Western culture in general—focuses predominantly on this sensational second part of ecoliteracy while ignoring the first almost entirely. Concentrating on problems and the “speed of the crisis” serves to create fear and dis-ease. This sensationalization of the problem leads to reactive change and shallow, technical solutions for seemingly isolated issues which are, in truth, merely symptoms of much deeper interconnected systemic problems. Casting humans as villains in the story of our contemporary ecological crisis can lead quickly to overwhelming pessimism, apathy, and narrow thinking which only perpetuate the disconnection that lies at the root of the problem; even “a passionate single-minded concern for nature can reinforce the separation between humans and nature” (Kumar, 2005, p. 181). Sterling (2001) suggests that much environmental education is based on the assumption that people's behavior would change if only they were aware of environmental issues; steadily increasing global temperatures despite decades of so-called “environmental education” and shallow
attempts at mitigation, make it clear that much more than awareness is needed. Exclusively problem-focused sustainability and environmental education can be disempowering and leave students at an impasse (Burns, 2011; Sterling, 2001). Indeed, “the study of environmental problems is an exercise in despair unless it is regarded as only a preface to the study, design, and implementation of solutions” (Orr, 1992, p. 94). Education itself therefore must be ecological, experiential, and participatory in order to not only inform students of the issues, but also to prepare them “to engage in these complex issues and become problem solvers and change agents” (Burns, 2011, para. 1).

Education that promotes this kind of proactive ecoliteracy and sustainability is holistic (Kumar, 2017a, 2019; Sterling, 2001, 2012), interdisciplinary (Capra, 2005; Sly, 2015) experiential (Capra, 1996, 2005; Orr, 1992), critical (Sterling, 2012), place-based (Orr, 1992; Sly, 2015), and transformative (Burns, 2015; Kumar, 2019; Sterling, 2001). It engages a systems thinking perspective (Capra, 2005; Orr, 1992; Sterling, 2001), is informed by Indigenous lifeways (Burns, 2015; Capra, 2012), occurs in community (Davies, 2012), and is ideally garden-based (Capra, 2001; Clavin, 2012; Davies, 2012). Table 1 included on page 39 outlines connections between the central elements of ecoliteracy and the educational theories and pedagogies which support them. The following sections explore these educational theories, pedagogies, and perspectives and their relationship with ecoliteracy.
Table 1
Connecting Ecoliteracy and Educational Theories and Pedagogies

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<td>Ecological Knowledge and Systems Thinking</td>
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**Systems Thinking and Holism**

Recent scientific advances in the fields of quantum physics and systems sciences, in complexity theory and the development of the Gaia hypothesis, have changed the way the universe and planet earth are understood. In an illustration of the living systems view of the world, Capra (2012) explains that “we have discovered that the material world, ultimately, is a network of inseparable patterns of relationships; that the planet as a whole is a living, self-regulating, and self-organizing system" (para. 4). This is the fundamental theory of ecoliteracy. While this relatively new way of thinking may be prevalent in some scientific and academic disciplines, it is still in the process of emergence and has yet to supersede the dominant miopic Western paradigms at work in human systems, organizational models, and ways of living. Engaging whole systems thinking in the
context of ecoliteracy and sustainability education has several implications. Students would not only learn about systems and systems thinking as part of the curriculum, the method of education would also reflect a systems view and promote a sense of wholeness, relatedness, and interconnection.

Various forms of separation are pervasive in traditional education systems. Schools are often disconnected from the communities they exist within; teachers are set apart from students through hierarchy; subjects are isolated through specialized courses and departments; learning is removed from experience (and increasingly mediated by technology); the concept of knowledge itself is reduced to intellectual knowledge, with learning restricted to the mind. In contrast, a whole systems approach to education is inherently holistic and enables the mending of these severed relationships. Holistic education seeks to educate the whole person—head, heart, and hands—equally “developing the power of thinking, feeling, and making” (Kumar, 2017a, p. 114). Diverse ways of knowing are reconnected through engaging and valuing the multiple intelligences of feeling, intuition, sensing, and thinking (Harding, personal communication, September 30, 2021; Orr, 1992; Sterling, 2001). Learning is reunited with experience when it moves beyond the confines of the classroom and is resituated within the local environment and community. In this type of learning environment, education naturally becomes interdisciplinary and students and teachers are reconciled as co-learners. These instances of reconnection are each beneficial in their own right, while also serving to promote a broader sense of reconnection—reconnecting people with under-stimulated parts of themselves, with each other, their places, their communities, and the natural world. While holism and the living systems worldview may appear new
and revolutionary in contrast with dominant Western mental models, “the templates for how to live well together on the planet, based on reverence, responsibility, reciprocity, respect, and relationship, are very evident in traditional and indigenous life ways” (Sepie, 2017, p. 3). Thus, including Indigenous voices and perspectives in this discussion is relevant and extremely important.

**Indigenous Education**

Many Indigenous peoples have lived well with nature throughout time, indeed, some “Indigenous peoples have sustainable, time-tested practices that go back thousands of years” (Nelson, 2008. P. 290). Indigenous teaching and worldviews have had a formative impact on the development of permaculture, ecological thinking and design (Burns, 2022), environmental education (Gaylie, 2009) and ecoliteracy (Capra, 2012). As Gaylie (2009) explains, “predating Western theories about experiential and environmental education, and current notions about sustainable resources and economies, indigenous education was the basis for environmental education learning principles that promote and nurture well-being in and for the earth” (p. 23). Thus, in some senses, Indigenous education may be understood as the root of sustainability education.

Indigenous education, as described by Cajete (2005), is a deeply holistic process involving the whole self and “all dimensions of one’s being” (p. 70). Here, the concept of “the whole self” includes multiple intelligences and the expansive ecological understanding of the self as part of the land, place, and community. Armstrong (2005) explains that traditional Okanagan education was predicated on a system of belief “which celebrates life [and] puts high value on careful taking of the land’s resources” (p. 82), collaboration, right relationship, and sharing within the community of human and
more-than-human beings. Tribal education has functioned as “a cultural and life-sustaining process” (Cajete, 2005, p. 70), where “survival knowledge and skills were acquired through real-world learning” (Armstrong, 2005, p. 82). As Cajete describes, in tribal education one gains knowledge from firsthand experience in the world and then transmits or explores it through ritual, ceremony, art, and appropriate technology. The individual then uses knowledge gained through these vehicles in the context of everyday living. Education in this context becomes education for life’s sake. Indigenous education is at its very essence learning about life through participation and relationship to community, including not only people but plants, animals, and the whole of nature. (p. 70)

Here, education is decentralized and integrated with life, place, and community; learning happens through reciprocal relationships, participation, and experience. Learners are not taught by one designated teacher, rather, they learn from family, community members, non-human beings, and the environment; “the important lessons in life are not just held by people but are part of the larger world. … The entire world is a teacher” (Margolin, 2005, p. 78). Indigenous education sees the individual as intrinsically whole and “recognizes that the true sources of knowledge are to be found within the individual and entities of nature” (Cajete, 2005, p. 71).

Indigenous education is an example of deeply relational and inherently place-based education in practice—a model of ecological education—and as such, is foundational to ecoliteracy. Ecoliteracy is, as Capra (2012) describes, “embodied in the traditional knowledge of many Indigenous cultures” (para. 10). This discussion acts as a point of departure for the exploration of place-based learning that follows below.
**Place-Based Education**

Many ecological thinkers suggest that the ecological crisis is, in part, a result of the disconnection of humans from nature (Devall, 2000; Harding, 2012; Kumar, 2019; Sepie, 2017). If we do not have direct experience of nature and an intimate relationship with our places, we may be unable to make the crucial distinction between “health and disease in natural systems” (Orr, 1992, p. 86), and unable to understand the potential effects of our actions and the limits of the ecosystem. Thus, ecoliteracy can only occur through prolonged, first hand experience in nature. This necessity represents a challenge to the popularization of ecoliteracy as human populations reside increasingly in urban environments where opportunities for contact with nature may be more limited than in rural environments. It can be said that there exists a growing trend toward “greening” urban spaces through an increase of parks, roof gardens, and tree-lined streets. While green spaces in urban environments offer myriad benefits, they represent an example of design for behavior change (Kruize et al., 2019), which typically addresses symptoms, rather than the root of a problem. As such, increased green spaces alone cannot heal the relationship between humans and our places. In order to fully address this disconnection—the sense of placelessness that is detrimental to our sense of self and the difference between inhabiting and merely residing in our places—a shift in values and beliefs is required.

A resident, as opposed to an inhabitant, occupies a place temporarily, potentially knowing, caring, and investing very little in their relationship with that place. The inhabitant, conversely, has a committed relationship to place, and is therefore likely to be observant, caring, and rooted through reciprocal relationships. Orr (1992) states that:
The sum total of violence wrought by people who do not know who they are because they do not know where they are is the global environmental crisis. To reside is to live as a transient and as a stranger to one’s place, and inevitably to some part of the self. The inhabitant and place mutually shape each other. Residents, shaped by outside forces, become merely “consumers” supplied by invisible networks that damage their places and those of others. (p. 102)

While the resident essentially goes through life as a tourist, the inhabitant belongs, and through living well in place makes an art of living (Illich, 1984). The ecological self emerges through experience of identifying with, and understanding the self as innately connected with place. “Knowledge of a place—where you are and where you come from—is intertwined with the knowledge of who you are. Landscape, in other words, shapes mindscape” (Orr, 1992, p. 130).

Placelessness can be understood as a byproduct of “a dualistic metanarrative which separates cultured civilization from nature” (Johnson, 2012, p. 830). This narrative disconnects humans from landscapes, environments, and localized ecological wisdom. While placelessness is perpetuated in the global West through this deeply ingrained (but outdated) dualistic worldview, it also has roots in patterns of displacement through colonization. Sepie (2017) refers to colonialism as a collectively “remembered phenomenon” (p. 10) and suggests that displacement is part of every person’s ancestral story. Cree philosopher and educator Donald (2010) expands on this idea by stating that colonization is “an extended process of denying relationships. … Everybody has been colonized. It doesn’t matter what color your skin is, or where you’re from” (12:15). In this sense, colonization has effectively severed intrapersonal and interpersonal
relationships, relationships between humans and places, environments, and more-than-human beings. Sepie (2017) argues “that the core socio-ecological issues we face, as a species, are a by-product of this very long and complex process of colonizing people the world over” (p. 12). This is not to suggest that the acutely harmful lived experience of colonization is equal to colonialism as an remembered phenomenon through ancestry—it is not. While an in-depth discussion of colonialism and decolonization cannot take place here, the impact of colonialism is integral to any conversation around the relationship between humans and place.

Reestablishing relationships with place and the natural world is central to ecoliteracy and can be supported by place-based education. The aim of this educational mode is ecological reinhabitation, understood as the development of relationships of care and responsibility between local people and their environments. Place-based education seeks to ground learning “in local phenomena and students' lived experience” (Smith, 2002, p. 586) so that “the education of citizens might have some direct bearing on the wellbeing of the social and ecological places people actually inhabit” (Gruenewald, 2003, p. 308). Place-based pedagogy is practically and theoretically linked to critical pedagogy, experiential learning, and community-based, indigenous, environmental, and ecological education traditions. Place-based pedagogy is inherently location specific, thus, highly adaptable. Kimmerer (2013) suggests that planting a garden is one of the best ways “to restore relationship between land and people” (p. 126). Which is to say that gardening can be a healing and reconnective practice.

Smith (2002) describes several themes that arise with consistency and suggests that place-based learning is often focused on nature or cultural studies while engaging
processes of real-world problem solving and community-centered learning. It is localized and experiential; teachers and students “spend time out-of-doors building long-term relationships with familiar, everyday places” (Gruenewald, 2003, p. 316). In this way, the boundaries between school and community are diminished. In contrast to dominant methods of passive learning and teaching as a means of test preparation, place-based learning is participatory and guided by student’s questions and interests. In this context teachers act as guides, facilitators, and co-learners rather than experts and knowledge keepers. A “critical characteristic of place-based education is its emphasis on learning experiences that allow students to become the creators of knowledge rather than the consumers of knowledge created by others” (Smith, 2002, p. 593). Place-based education not only enhances student achievement, promotes critical thinking, and fosters problem solving skills, it also nurtures student’s relationships with others and the local natural environment (Smith, 2002). In short, place-based learning contributes to “reeducating people in the art of living well where they are” (Orr, 1992, p. 130), a learning process that begins with critical examination of the values, beliefs, and assumptions that underlie current worldviews and unsustainable ways of living. To this end, critical pedagogy can support perceptual shifts that are central to ecoliteracy.

**Critical Pedagogy**

Critical pedagogy is attributed to Freire (1970/2005) who condemned what he called the “banking” model of education, and promoted instead a concept of education as a means of liberation and humanization. Believing that education was inherently political, Freire described the banking model as a paradigm in which “knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they
consider to know nothing” (p. 72). In this view, teachers deposit knowledge into students—students are empty vessels who receive, accept, memorize, and repeat facts—and education is a means of molding and adapting people to the world, thus “the educated individual is the adapted person, because she or he is better ‘fit’ for the world” (Freire, 1970/2005, p. 76). As students passively accept the imposed worldview, they lose critical capabilities. The possibility of liberation or transformation for these “educated individuals” declines, which ultimately promotes the “domestication” of students and perpetuates the status quo. The still prevalent banking model is a disjunctive, hierarchical structure and assumes “a dichotomy between human beings and the world” (Freire, 1970/2005, p. 75). In contrast, Freire advocated a connective model of education where teacher and student are reunited with the world and each other as critical co-investigators engaged in problem-posing and dialogical inquiry that is related to the student’s lived experience. Freire posits that this practice promotes a student’s ability to critically understand the human-world relationship and ultimately transform it. Though transformation through critical education may occur at the level of the individual student, Lange (2015) describes that the intent of critical pedagogy “is societal transformation, where education fosters Action against poverty, oppression, repression, and injustice, and for social justice, equality, democracy, and freedom” (p. 30). Through such critical education students develop a new understanding of the world and their place in it, and in being “empowered in their new perspective, they could act to transform their world” (Baumgartner, 2001, p. 16).

The perceptual shifts that characterize ecoliteracy, as outlined by Capra (2005) and discussed earlier in this chapter, can be developed through these critical pedagogical
practices. Gruenewald (2003) asserts that “critical pedagogies are needed to challenge the assumptions, practices, and outcomes taken for granted in dominant culture and in conventional education” (p. 308). Thus, the critical practice of examining one's worldview—together with underlying assumptions, beliefs, and values—is the first step in the process of understanding the foundations of social and ecological crises. Transforming worldviews that perpetuate socio-ecological problems is a liberating—though often uncomfortable—process of learning and unlearning. Orr (1992) states that “real ecological literacy is radicalizing in that it forces us to recon with the roots of our ailments, not just with their symptoms” (p. 88). Education that promotes wholeness fosters perceptual shifts; it leads to a renewed sense of belonging and responsibility, an expanded concept of citizenship that includes “membership in a planetwide community of humans and living things” (Orr, 1992, p. 88). Critical pedagogy supports ecoliteracy not only in the facilitation of perceptual shifts, it also promotes the subsequent action that ecoliteracy requires. As critical pedagogy and perceptual shifts both suggest a process of transformation that supports sustainability, a deeper discussion of transformative sustainability education is required here.

Transformative Sustainability Education

Transformative sustainability education (TSE) and critical pedagogy have much in common, though their aims and means differ. Where critical pedagogy is distinct and somewhat limited, TSE is expansive; while critical pedagogy promotes freedom from oppression and individual transformation with the aim of collective change, “TSE goes beyond human and social transformation to fostering intimate, interconnected, reciprocal relationships between humans and the living earth of which we are innately a part”
Burns (2018) describes that the emergence of TSE can be attributed to “a growing consciousness/renewal of an interconnected and relational worldview that is (re)surfacing in many fields and thought arenas, provoked by the discoveries of quantum physics and a renewed reverence for indigenous philosophies and ecological systems" (p. 277). TSE, like ecoliteracy, promotes a shift toward wholism, relationalism, and systems thinking and correspondingly a shift away from reductionism, dualism, and mechanistic thought. TSE is primarily concerned with empowering “individuals to change their frames of reference or worldviews” (Sipos et al., 2007, p. 71), and therefore supports the perceptual shifts that ecoliteracy requires.

The theoretical underpinning of TSE is informed by sustainability education and transformative learning theories, and may be understood as the convergence of these theories (Burns, 2018; Sipos et al., 2007). Alone, these theories do not necessarily support holistic learning for sustainability. Transformative learning theories have been criticized for “focusing disproportionately on personal learning” (Elias & Merriam, 2005, p. 141) while “ignoring the affective, emotional, and social context aspects of the learning process” (Baumgartner, 2001, p. 17). Likewise, sustainability education, as previously discussed, has been critiqued for focusing on the visible symptoms of complex systemic problems while ignoring their foundational patterns, an educational paradigm that leaves students disempowered and unintentionally perpetuates unsustainability. The following paragraphs outline sustainability education and transformative learning theories separately before further exploration of TSE as it has evolved from the combination of these theories.
Sustainability Education. Education that aims to promote sustainability—which has become increasingly relevant and prevalent in higher education in the United States and beyond—is commonly situated within the fields of sustainable development and environmental sustainability. It is often informational learning that focuses on environmental problems and their practical and technical solutions. Though this approach is not without merit, at best it is a mitigation technique that resolves symptoms rather than addressing the root causes of complex and interconnected problems. At worst, it aims to sustain the status quo of constant growth, a goal that contradicts the true meaning of sustainability and can be destructive (Kumar, 2019). This type of education may be effective in creating surface level change in behavior and attitude; however, it does little to support critical development of values and beliefs. The way sustainability is taught—the method of instruction, context of the learning, and role of the teacher— influences the type of learning that occurs and its potential impact on the student, and the student-world relationship (Burns, 2015; Orr, 1992; Sterling, 2001). In order for education to promote sustainability, and cease to intentionally or inadvertently perpetuate unsustainability, sustainability learning must seek deep transformation of perceptions, worldviews and ways of being (Burns, 2018; Orr, 1992; Sipos et al., 2007; Sterling, 2001). To this end, transformative learning is critical to authentic and effective sustainability education.

Transformative Learning. Transformative learning theory is a humanist adult learning theory attributed to the work of Mezirow (Elias & Merriam, 2005). Transformative learning “is a process of questioning beliefs, values, and perspectives that have been uncritically assimilated and that form a personal frame of reference” (Lange,
2015, p. 29), which Mezirow (1997) describes as “the structures of assumptions through which we understand our experiences” (p. 5). Baumgartner (2001) describes Mezirow’s conceptualization of transformative learning as a linear process that would begin with the learner experiencing a “triggering event or disorienting dilemma” (p. 18), then engaging in critical reflection, dialogical practice, and action. Knowledge about the process of transformative learning has since developed and is now understood as an iterative process, which could begin with a single triggering event, but is more likely to occurs as an uncomfortable culminating process described by Robertson (1997) as “an epistemological transition during which learners move from one paradigm of knowledge to another” (p. 106).

Distinction is commonly made between learning that is informational versus learning that is transformative (Baumgartner, 2001; Freire, 1970/2005; Gaylie, 2009; Orr, 1992; Robertson, 1997), a contrast that Freire emphasized by saying that “liberating education consists in acts of cognition, not transferrals of information” (p. 80). Informational learning, also referred to as simple learning, is related to Freire’s concept of the banking method, and though not always entirely passive, it relies on learning mediated by books and media, and the lecture-style, teacher-as-expert approach (Robertson, 1997) that is still common in adult learning. Informational learning is fundamentally additive; it augments what we know through adding new information (Baumgartner, 2001), but does not elicit a change in the learner's epistemological system (Robertson, 1997). Conversely, in transformative learning, the addition of new information is followed by reflection, discussion, and questioning, thus, the integration of new learning catalyzes a metamorphosis of “the epistemological system regarding the
topic” (Robertson, 1997, p. 107); changes are not only made to what we know, but also to the way we know (Baumgartner, 2001). Thus, for learning to promote genuine sustainability, education cannot solely consist of information about environmental problems, instead, it must also model sustainability and embody ecological patterns of relatedness and interconnection. As social and ecological problems are systemic and inextricably linked, solutions emerge through connective thinking and interdisciplinary learning, not ingesting information within isolated disciplines. Sustainability requires "learning that can more deeply transform our unsustainable ways of being and knowing" (Burns, 2018, p. 277); hence, the emergence of transformative sustainability education.

**Ecoliteracy and Transformative Sustainability Education.** Akin to ecoliteracy, TSE has, in part, emerged from the need for education to promote sustainability and positively impact the human-world relationship. TSE combines transformative and sustainability education, and draws from traditional ecological knowledge, critical pedagogy, environmental education, experiential, interdisciplinary, community-based, and place-based learning to create a distinct learning tradition and useful pedagogy (Sipos et al., 2007). As Burns (2018) describes, “TSE relies on pedagogies that are related, emotional, spiritual, imaginative, embodied, learning that embraces the whole person while also understanding and cultivating wholeness more broadly as intrarelationship with the living world” (p. 279). Scholars agree that effective TSE must be holistic and engage head, heart, and hands while being contextual and centered in student’s lived experience and in relationship with place (Baumgartner, 2001; Burns, 2011; Sipos et al., 2007; Sterling, 2001).
The transformative learning process may, as much education does, begin with the intellectual, academic learning and acts of cognition. As Sipos et al. (2007) describe, the hands are engaged in the “enactment of theoretical learning through practical skill development and physical labour (e.g. building, painting, planting)” (p. 74), while the heart or feeling self is engaged in order to promote the translation of values and beliefs into behaviors and ways of being. Research shows that transformative learning is often dependent on a student’s ability to experience, express, and work through their feelings as part of the learning process; in fact, critical reflection may not occur without the involvement of one's feeling self (Baumgartner, 2001). Kumar (2019) describes pedagogy implemented at Schumacher College, Devon, England as exemplary of the relationship between holistic education and transformative learning: “Here students are transformed because they have gone through an experience of holistic living which included study, work, contemplation, and creative activities. Having transformed themselves, they go out into the world and find a way of transforming the world” (p. 83). Kumar’s description here illustrates my own experience of Schumacher College and other transformative learning environments.

TSE engages holism in an expansive, ecological sense, as a relational worldview that encourages the mending of myriad relationships—those intrapersonal relationships within the self, between ones’ multiple intelligences or ways of knowing, and interpersonally between the self and others, between humans and places, and between humans and the more-than-human world. “This learning reconnects us to our bodies and intuitions, and to our lived places, reigniting our reciprocal relationships with the earth and a kin-centric understanding of learning” (Burns, 2018, p. 278). In many ways TSE
and ecoliteracy mirror each other. TSE provides a theoretical and pedagogical framework for the cultivation of ecoliteracy; while ecoliteracy “provides an inspiring example of transformative learning” (Kumar, 2019, p. 87). Both TSE and ecoliteracy are framed by holistic models; the triad of head, heart, and hands discussed in relation to TSE manifest as “knowing, caring, and practical competence” (Orr, 1992, p. 92) in the context of ecoliteracy. As the element of ecological knowledge development was discussed directly through the ecoliteracy section earlier in this chapter, and caring was explored in the context of place-based learning and reverential ecology, the following section focuses on the third element of the triad: experiential learning.

**Experiential Education**

Within the previously discussed educational theories, knowledge is not something that can be passively received and stored, it can only be gained through a process of experience and participation; it must be lived (Capra, 1996; Margolin, 2005; Orr, 1992). Margolin (2005) radically characterizes this concept in stating that “when you teach someone something, you’ve robbed the person of the experience of learning it” (p. 70). If education is understood not as a product or destination, but as a dynamic life-long journey, education becomes inseparable from experience, and essential to learning itself (Kolb, 1984). Experiential learning is a foundational element of ecoliteracy, as well as garden-based learning, transformative sustainability education, place-based learning, critical pedagogy, and Indigenous education. Experiential learning theory originated in the work of Dewey (among others) and can be simply described as a theory which claims that education is a continuous process of constructing knowledge through direct experience (Kolb, 1984; Subramaniam, 2002). The experiential learning cycle, as
conceptualized by Kolb, is an iterative process that begins with “concrete experience,” and meaning-making through “reflective observation,” followed by “abstract conceptualization” or theorizing, planning, and problem-solving, before finally engaging in “active experimentation” and starting the cycle again from the beginning (Kolb & Kolb, 2008, p. 10). Contrary to casual and common comprehension, experiential learning does not occur through experience only, or hands-on learning alone, rather, “the ability to discriminate, make meaning, and learn is contingent upon pairing experience and reflection” (Williams and Brown, 2012, p. 121); the experience portion of experiential learning must be part of a larger process. As holistic education traditions suggest, progressive education engages the whole person—head, heart, and hands—and synthesizes theory and practice.

Experiential education can be characterized by learning that draws from the lived or real-world experience of the student and is often described as “learning by doing.” Experiential learning can occur through field trips, research projects, experiments, internships, practicums, and can also include engagement with service, community, or place-based projects; experiential learning engages the development of practical skills, as in building, making, crafting, and gardening. Experiential learning can be understood as learning that occurs through the engagement of the physical self—the hands component of the head, heart, hands triad that is central to the holistic model of education and ecoliteracy. Kumar (2019) explains that “living and learning should be integral to each other. Theory and practice should merge with each other. This is the vision of holistic education. It is a process of learning by doing” (p. 82).

Conventional education tends to model societal values and cultural norms and
generally aims to prepare learners to fit into the world as it is and participate in the existing economy; in other words education functions chiefly to facilitate getting jobs and making money. Through industrialization, globalization, urbanization, and the separation between learning and life, education has come to “privilege and celebrate the mind” (Williams & Brown, 2012, p. 123), consequently reducing the status, value, and dignity of physical work and manual labor (Kumar, 2019; Williams & Brown, 2012). Kumar (2019) characterizes our unfavorable current circumstances in stating that “at the moment, we are conditioned to think that working with our hands is for the uneducated, for those who cannot write computer programs or do intellectual work” (p. 86). Some of the occupations that are most undervalued in the West, and possibly all over the world—growing food, building homes, caring for children and elders—are the most critical to daily existence; meanwhile, craft is relegated to hobby status, with the prevailing capitalist idea being that everything needed (and more) can be imported and purchased. Not only are practical and manual skills useful and necessary, they are “an essential aspect of experience, good thinking, and to the development of the whole person” (Orr, 1992, p. 128). Education today is primarily focused on developing the intellect, not the whole person; it does not prepare people for the labor of living, and students leave higher education without growing, cooking, growing, building, or making skills (Kumar, 2017a). Contemporary education supports capitalism, consumerism, and constant economic growth, not right livelihood, and not sustainability. Devaluing labor and disconnecting people from life-sustaining skills passively supports the maintenance of the dominant Western paradigm. Including skill-building in the curriculum, and reconnecting life and learning through experience, becomes something of a radical act.
Through this lens, (re)valuing labor, and learning to build homes and grow food becomes revolutionary when these life-sustaining skills should be commonplace. Kumar (2019) affirms that physical work and manual labor are deserving of respect, in fact, “hands are our tools of transformation” (p. 86). Transformative sustainability learning suggests that theory is best understood through practice, and experiential learning theory proclaims learning cannot happen through the intellect alone; “experience with the real world teaches us in profound ways. Active engagement, embodied learning, and practical experience are foundational to transformational education” (Williams & Brown, 2012, p. 120), as well as to sustainability education, and ecoliteracy. Garden-based learning, as discussed below, is one example of an educational mode that draws from and engages experiential learning and promotes the development of ecoliteracy.

**Garden-Based Learning**

Garden-based learning (GBL) may include any educational activity that takes place in a garden or farm environment and can be “defined simply as an instructional strategy that utilizes a garden as a teaching tool” (Desmond et al., 2004, p. 20). Lacking a distinct theoretical framework, the practice of GBL typically draws heavily from experiential learning theory (Gaylie, 2009; Subramaniam, 2002); it is characterized as holistic, engages multiple intelligences, embraces interdisciplinary learning, and tends to contribute to transformative sustainability education and ecoliteracy. GBL is place-based and fosters the development of ecological knowledge, whole systems thinking, and ethics of care and stewardship, while also encouraging a sense of community and the development of relationships between students and the more-than-human world. Learning gardens, such as the Learning Gardens Lab where this study was located, and
garden-centered educational opportunities (such as internships) not only support sustainable food production for the communities that they are part of and practical skills for the members of that community, but research shows that GBL also promotes academic achievement and student health and nutrition in populations studied (Desmond et al., 2004; Gaylie, 2009; Williams & Brown, 2012; Williams & Dixon, 2013).

**Garden-Based Learning and Ecoliteracy.** Orr describes the ecologically literate person as one who “has the knowledge necessary to comprehend interrelatedness … an attitude of care or stewardship. … [and] the practical competence required to act on the basis of knowledge and feeling” (Orr, 1992, p. 92). The skills, knowledge, and attitudes nurtured through GBL parallel those vital to ecoliteracy. Capra (2001) describes garden-based learning as “one of the best ways for [students] to become ecologically literate and thus able to contribute to building a sustainable future” (para. 17). Through GBL students have the opportunity to observe and experience ecological systems and natural patterns firsthand. The concept of cycles is understood through the cyclical nature of garden work, the effect of seasonal changes, and the natural pattern of birth, growth, death, decay, and renewal, making students “aware of how we are all embedded in those cycles of nature” (Capra, 2001, para. 8). Through the practice of composting and applying manure and composted materials to garden beds it becomes clear that nature produces no waste, rather, wastes are an integral part of the process of self-sustenance and self-renewal. Once the value of compost is deeply understood, one might even develop a sense of love for it. Companion planting techniques exemplify the collaborative and self-sustaining nature of ecological communities. Biodiversity in the garden, as well as diversity of background, identity, and experience in the student group,
and interdisciplinarity in the curriculum tangibly represent the value of diversity in a multitude of contexts. Planting seeds, then caring for and observing plant growth, can foster a sense of affinity and responsibility while promoting a relationship of care and stewardship. Although students may comprehend intellectually that a seed that is sown in the soil and supplied with water and sunlight will sprout and grow, witnessing the sprouting of seeds consistently evokes a sense of wonder, awe, and joy in the observer. This experience of wonder and affinity, when nourished, can grow into a “sense of kinship with all of life, without which literacy of any sort will not be much help” (Orr, 1992, pp. 86–87). Garden-based learning supports the development of ecological knowledge, ethics of care, and practical skills; the central triad of competencies required for ecoliteracy.

**Nurturing Relationships through Garden Based Learning.** Gardens are inherently collaborative places that nurture reciprocal relationships; “in a garden, food arises from partnership” (Kimmerer, 2013, p. 126). Tending crops, then harvesting, tasting, and enjoying fresh produce can reconnect people with food in a way that transforms and heals relationships with food (Capra, 2001). Working in the garden with annual and perennial food crops promotes an embodied understanding of the local seasonality of our foods, which in turn leads to a deeper comprehension of the impacts of the global food system and personal choices. Not only do freshly harvested fruits and vegetables taste different (many would say better) than store-bought produce, but the act of digging potatoes, for example, turns each tuber into a treasure. Growing food makes it “free” and thus turns what has been commodified and monetized back into what it truly is; a gift of nature, the yield of reciprocal relationships, and the nourishment that all
humans deserve regardless of their economic status. Kimmerer (2013) explains that “a gift creates an ongoing relationship” (p. 26) characterized by gratitude, care, and reciprocity, and suggests that “a garden is a way the land says, ‘I love you’” (p. 123). Within environmental and sustainability education, and perhaps western culture in general, the idea of humans loving the earth has become a somewhat common concept; however, the idea that the earth loves us back is far less familiar. As Kimmerer (2013) describes: “Knowing that you love the earth changes you, activates you to defend and protect and celebrate. But when you feel the earth loves you in return, that feeling transforms the relationship from a one-way street into a sacred bond” (pp. 124–125). Thus, embracing reciprocity and accepting love from the earth is a process that promotes bilateral healing and transformation.

Observing and interacting with more-than-human beings who dwell in the garden environment can serve to promote ecological understanding. Through focusing on the relationships that exist within a given garden students experience the web of relationships through which nature and all beings are interconnected. In order to understand natural systems and develop ecological thinking people must experience nature directly. As Kumar (2019) explains “ecoliteracy occurs when we are in nature. It cannot be obtained from books or TV. … For ecoliteracy, we have to experience Nature for ourselves” (p. 88). GBL can offer students an opportunity to (re)connect with nature, even in an urban campus environment.

While relationships between humans, the land, and more-than-human beings develop through the experience of learning in the garden, relationships within the human community are also enriched through GBL. Experiencing the work of gardening and
farming can impact the way students value food and dignify the manual labor required to produce it. The shared labor of garden work fosters interpersonal relationships and a sense of community, and furthermore, Orr (1992) suggests that “students need opportunities to work together, to create, to take responsibility, and to lead in a community setting without which they are unlikely to comprehend the full meaning of virtue, ecology, or community” (p. 183). Working together toward a shared goal helps to create a sense of community and provides a valuable opportunity for reflection and discussion, while fostering peer-to-peer learning, collaboration, and skill sharing.

**Garden-Based Learning and Skills Development.** GBL can support the development of a student’s practical skills through hands-on agricultural experience while providing the garden as a site for place-based sustainability learning, experimentation with implementing theoretical knowledge, and action. Growing food can be empowering, and can (partially) satisfy the need to “do something” that makes a tangible, local, environmental impact (Gaylie, 2009). Orr (1992) advises that sustainability education must “give greater emphasis to place-specific knowledge and skills useful in meeting individual local needs, and for rebuilding local communities” (p. 146), and Clavin (2012) says that the ability to design, create, and maintain successful “gardens is a skill of considerable importance for surviving and thriving in the twenty-first century” (p. 75). These points have become self-evident as the COVID-19 pandemic continues to accentuate the fragility of the global food system, provoking food shortages, disrupted supply chains, and empty grocery shelves. Chief Lyons (2008) warns that "there will come a time … when only those who know how to plant will be eating" (p. 24).
Beyond the development of increasingly valuable practical gardening and farming skills—and potentially contributing to local, organic food production in the process—GBL “has the power to translate complex theory into practice” (Gaylie, 2009, p. 38), especially in the context of postsecondary education. Learning gardens engage the feeling-self and physical body in tangibly manifesting ideas and relationships previously only conceptualized. Through GBL experience the web of interdependence is made visible and it becomes impossible to “ignore the fact that natural species depend on the earth, and each other, in contexts both large and small, for mutual survival” (Gaylie, 2009, p. 39). As nature regains intrinsic value in the eyes of the ecoliterate student, environmental limits become intuitively evident, and student’s attitudes, values, and beliefs begin to shift; in this light the learning garden becomes a transformative space (Clavin, 2012). Through this expanded ecological awareness, relationships become palpable and students understand that local choices and activities have global impacts on deeply interconnected social and ecological systems; an embodied realization that can profoundly affect behaviors, attitudes, and beliefs. Holistic GBL is an educational mode that combines place-based ecological learning and transformative sustainability pedagogy to create a situation wherein students are not just learning about nature, but learning from nature; not only learning about ecology, but learning ecologically; not only learning about relationships and community, but learning through relationships in community; rather than being about sustainability, the learning itself becomes sustainable and regenerative. This kind of learning supports epistemological and ontological shifts, effectively changing how students understand the world and their place in it. Campus gardens not only promote “biodiversity, organic growing practices, shared decision making and other
eco-centered ideals, gardens help create the social, biological and underlying cultural conditions necessary for authentic sustainability to take place" (Gaylie, 2009, p. 29). In many ways, GBL answers the call for education of a different kind and offers a framework for deeply transformative learning that promotes ecoliteracy and provides an opportunity to engage hope in an active and participatory sense. Knowledge, caring, and practical competence may all develop through GBL, making garden-based education the ideal educational paradigm through which embodied ecoliteracy may develop.

**Gaps in the Literature**

Research in the field of sustainability education is lacking (Burns, 2011), and studies on ecoliteracy development are almost completely absent from the academic landscape. Orr (1992) suggests that

most research is aimed to further the project of human domination of the planet. Considerably less of it is directed at understanding the effects of domination. Less still is aimed to develop ecologically sound alternatives that enable us to live within natural limits. (p. 151)

While the literature makes it clear that ecoliterate citizens and leaders are vital for genuine sustainability (Capra, 2012; Kumar, 2019; Orr, 1992; Sterling, 2001), empirical research that supports or rejects this claim is limited—a gap in knowledge that becomes more pronounced in the context of adult education. Ecoliteracy studies that do exist are generally focused on primary and secondary (K-12) education (Rigolon, 2012; Singleton, 2015), indeed, even the work of the Center for Ecoliteracy is markedly childhood-education centric. Research particular to ecoliteracy and adults often posits an understanding of ecoliteracy that is inconsistent with the conceptualization attributed to
Orr and Capra used here (Nadiroh et al., 2019), is aimed at comparing and contrasting ecoliteracy and environmental literacy (McBride et al., 2013), defining ecoliteracy (Nichols, 2010), or providing quantitative measurement of existing ecoliteracy (Cutter-Mackenzie & Smith, 2003; Okur-Berberoğlu, 2018; Pilgrim et al., 2007; Pitman et al., 2018) rather than exploring how to develop or achieve ecoliteracy. While the works of McBride et al. (2013) and Nichols (2010) made valuable contributions to understanding of ecoliteracy education, neither study provided empirical evidence.

Research focused on garden-based education could support comprehensive ecoliteracy development, but this field is also preoccupied with K-12 education (Bennett, 2010; Gaylie, 2009; Williams & Dixon, 2013), avoiding adult education almost entirely. Similarly, studies focused on sustainability learning in higher education could support education for ecoliteracy development, but unfortunately these are lacking as well. Burns (2011) states that although there is a shared sense of what sustainability education should look like, there is very little theory or research that explores how to develop or implement sustainability pedagogy that is indeed systemic, connective and ecological. In particular, research that is focused on teaching sustainability at the postsecondary level is very limited and remains rather conceptual. (para. 5)

To end, there is a profound need for empirical research that practically and conceptually supports sustainability education generally, and education for ecoliteracy specifically, at the postsecondary level.

**Summary**
This literature review has explored several of the definitions of ecology that inform and introduce the concept of ecoliteracy. Ecoliteracy, as conceived by Capra and Orr, has been defined, and explained in detail through description of core ecological concepts, foundational perceptual shifts, the application of ecological design, in addition to a framing of systems thinking and holism. In order to develop a framework for the cultivation of ecoliteracy in adults, supporting educational theories and pedagogies have been reviewed, including: Indigenous education, place-based learning, critical pedagogy, transformative sustainability education, experiential learning, and finally, garden-based learning. The literature confirms that adult education for ecoliteracy combines elements of the above educational theories and pedagogies and is optimally situated in a garden-based learning environment. This study sought to provide empirical qualitative evidence that supports adult ecoliteracy development in the context of higher education, and explore how a garden-based internship could support this aim. The following chapter outlines the methods used in this study.
Chapter III
Methods
Purpose of Study and Research Questions

The primary aim of this grounded theory action research study was to empirically explore how the Learning Gardens Laboratory (LGL) garden-based internship program, that I initiated in 2021, could support Portland State University (PSU) student participants’ development of ecoliteracy, practical gardening, and food production skills. The secondary aim of this study was to provide empirical qualitative evidence that adds to the existing body of knowledge around adult ecoliteracy development in the context of postsecondary education. The principal phenomena I studied was the development of ecological literacy and practical gardening skills amongst intern participants. The research questions guiding this study were: 1) What aspects of an LGL garden-based internship most impact participants’ development of ecological literacy? and, 2) How does the LGL garden-based internship program impact participants’ practical gardening skills?

This study emerged as a way to simultaneously meet practical, intellectual, and personal research goals (Maxwell, 2013). Through my experience as LGL’s community based learning coordinator and as a teaching assistant at PSU for capstone and permaculture courses connected with LGL, I repeatedly encountered PSU students who were interested in opportunities to learn how to grow food at LGL; however, such opportunities were limited. Concurrently, I was aware that LGL was seeking ways to connect with more PSU students. In reaction to these observations the multi-part practical goal emerged of actively exploring programmatic shifts that could enable LGL to
increase PSU student engagement, to connect more deeply with those students engaged, and to meet students’ desire to learn to grow food. The intervention of an LGL summer internship program originated from the synthesis of the needs of students desiring engagement with LGL, the needs of LGL as an organization, and an assessment of the resources available. This intervention provided one possible way to address the aforementioned practical goal.

The primary intellectual goal was to address what I identified as a gap in knowledge around ecoliteracy development in adults. While the literature suggested that ecoliteracy development could be supported by garden-based learning, existing research focusing on garden-based adult education is limited (Gaylie, 2009; Okur-Berberoğlu, 2018; Subramaniam, 2002) and empirical research related to adult ecoliteracy education is almost non-existent. The intellectual and practical goals supported personal goals of developing my own ecoliteracy, expanding my understanding of how to facilitate educational experiences that promote ecoliteracy, and conducting an empirical research project for my master’s thesis.

This chapter outlines the methods used in this research study. Following the above description of the purpose of the study and reintroduction of the research questions, I go on to describe my rationale for the methodology employed. The research design is illustrated through a description of the research site and intervention (the internship program), followed by a recounting of the sampling design, recruitment methods, and a description of participants. Methods of data collection and analysis are chronicled before I discuss validity, acknowledge my positionality as the primary researcher, and note some
limitations of the study. To end, I expound on the significance of the study and briefly introduce the next chapter.

**Rationale for Methodology**

As this study was primarily concerned with “the practical implications of the research” (Creswell, 2013, p. 28) it utilized a pragmatic methodology. This approach supported the combination of a qualitative grounded theory design paired with action research. Employing a qualitative approach, this study sought to explore phenomena dependent on the perspectives and experience of the participants (Plano Clark & Creswell, 2005) to generate a deep understanding of how they experienced the internship, and how it affected them, and their ecoliteracy development. Specifically, I used grounded theory methodology in collecting and analyzing the data in order to develop a theory about how education can support ecoliteracy development in adults, and to ensure that the theory constructed originated directly from the data collected (Charmaz, 2006). Practical action research typically “addresses a practical problem in one’s professional practice” (Plano Clark & Creswell, 2005, p. 433) through a small-scale study in context, and as LGL was my place of work, I identified action research as an ideal design for this study. Seeing myself as a practitioner of garden-based education in the role of community-based learning coordinator at LGL, I utilized an action research procedure to solve a practical problem and gather qualitative data that would support and improve the practice and impact of garden-based education at LGL and support ecoliteracy development (Plano Clark & Creswell, 2005). The intervention here was the design and implementation of a summer internship program. Choosing an action research design allowed this study to embody ecoliteracy holistically as the study design itself engaged
the triad of competencies central to ecoliteracy: knowing, caring, and practical skills or action.

**The Research Site**

This study took place at and in partnership with Portland State University's Learning Gardens Laboratory (LGL). As described in Chapter One, LGL is a 4-acre education-focused urban farm, located in the Brentwood-Darlington neighborhood of Southeast Portland. It emerged in 2005 through the visionary work of Leadership for Sustainability Education (LSE) faculty (and others) and exists through a unique partnership between the Portland Public School District, the City of Portland, and Portland State University (PSU) (Burns et al., 2017). The mission of Learning Gardens Lab is to support “academic achievement, leadership development, and local sustainable food systems by providing multicultural, interdisciplinary, intergenerational, and experiential garden-based education for public school students and their families, university students, and community members” (Learning Gardens Laboratory, n.d., para. 2). Program coordination and plot stewardship projects at LGL are led by a team of graduate students from the LSE program with the support of an LSE-faculty coordinator and a dedicated LGL manager. Funding for LGL comes from PSU’s College of Education (which houses the LSE program), as well as from grants and the fundraising efforts of the LGL student-staff and faculty team, which traditionally include events and produce sales.

LGL is primarily a garden-based education space chiefly functioning as a site for the development of sustainability leadership and sustainable food production. LGL offers a weekly garden-based education program for Lane Middle School students facilitated by LSE student staff and hosts the Lane Family Gardens plot where members of the local
community grow vegetables for personal use at no cost. LGL hosts undergraduate service-learning senior capstone courses, and supports LSE graduate students through self-directed LGL internships, community-based learning projects, and weekly volunteer hours where students can fulfill course-required community-based learning requirements.

The Intervention

The intervention in this action research project was an experiential, garden-based summer internship program focused on holistic development of ecological literacy and practical gardening skills and knowledge through hands-on engagement at LGL, paired with supportive weekly readings and reflective and contemplative practices. Participants focused on stewarding organically grown annual food crops, flowers, and herbs in the newly designated, 2500-square-foot, PSU student plot. Since the internship began in mid-June, much of the plot was necessarily already planted when interns arrived in the space. Six 50-foot rows of potatoes had been planted by a volunteer in the previous March; these were slowly harvested by interns and the beds were then replanted with late season annual vegetables. Two rows were empty and ready for interns to add compost and plant, while the remaining five rows had been prepared and planted with summer crops by myself during the previous month. Some of these rows utilized companion planting strategies in which plants are arranged in mutually beneficial groupings, and all rows were capped with flowering plants to attract beneficial insects and pollinators.

Working with the program lead and LGL staff, interns prepared beds, sowed seeds, transplanted seedlings, weeded, irrigated, harvested, and participated in successive crop planting planning. Interns helped weigh and prepare produce for personal consumption,
and for the LGL harvest share veggie box program, as well as for donation to the PSU food pantry.

The internship was held on Tuesday and Thursday mornings, Thursday afternoons, plus occasional Saturday mornings over a period of 8 weeks, from June through August. Each session was scheduled for three hours. Participants were welcomed to join any and all sessions and were asked to commit to at least six sessions in total; ultimately, interns chose when to participate. Interns were invited to read provided texts and engage in suggested mindfulness and reflective practices. Sessions generally began with a short “check in” where we discussed what would be harvested and what other work would need to be completed that day. Sessions were generally filled with the work of harvesting and caring for the plot. Interns often worked together in small groups; at the beginning of the program I worked alongside participants. Although I remained present and available, as interns became more comfortable and skilled with tasks, I stepped back slightly to allow interns to rely on their own knowledge and each other. At the end of each session we naturally circled around the harvest table and reflected casually on the day’s work or on recently provided readings as interns gathered produce to take home. The program was both free to participants and unpaid. While interns could have paid for and earned academic credit for the internship, none chose to do so.

**Sampling, Recruitment, and Participants**

The sampling design for this study can be described as a combination of purposive sampling (Maxwell, 2013) and a process of self-selection by participants. As is common in action research, the population and sample are almost identical (Sutter, 2012), which is to say that all interns participated in the study. Participants were recruited via an
email invitation (see Appendix A) to participate in a garden-based LGL summer internship program and my related research study. The internship program and study were described, including my data collection methods and the possible risks of participation in the study, which were minimal. Students were given the option to participate in the internship and decline participation in the study. The internship was open to all undergraduate and graduate students at PSU, though contacting all PSU students and processing a large number of applications wasn’t possible given time constraints. As such, I chose to directly extend the invitation to specific groups of students I thought might have an interest in the internship program. I shared the invitation with all current and incoming LSE graduate students, all sustainable food systems graduate students, and all undergraduate students who had recently participated in a capstone course based at LGL, as well as the students of a capstone based at another local garden space. I also shared the invitation email with the Student Sustainability Center at PSU and the student-led PSU Committee for Improving Student Food Security, and asked these groups to share the opportunity through their networks. Additionally, I mentioned the opportunity to my neighbor at the time and they submitted an application to join the internship.

I received 11 applications for participation in the internship program, all of which I approved. One person decided not to participate at all, while the remaining 10 opted to join both the internship and the study. I decided that this was an appropriate number of participants based on several factors. First, I understood that “samples tend to be small in action research” (Sutter, 2012, p. 243). Second, as this was a qualitative study, I was interested in exploring participants' personal experiences in depth; a group size of 10
participants felt congruent with the time and space available for this study. Third, 10 is the number of students in a small class at PSU. It is a group large enough to allow patterns to emerge, but small enough that details won’t be lost. Information gathered from 10 individuals would certainly provide data to support LGL programming, and could provide results relevant to situations with characteristics similar to those in this study—namely a campus garden and an optional internship where students could participate free of charge. Finally, the reality was that exactly 10 people wanted to participate.

All participants were PSU students living in the Portland area. Two were incoming LSE graduate students and one was an existing graduate student in the public administration department. The remaining seven participants were undergraduate students, six of whom had participated in a garden-based or LGL related capstone course, and one who was concurrently enrolled in an LGL capstone course. This subgroup of seven undergraduate students represented five distinct fields of study with one each majoring in biology, environmental studies, art history, and community development, while three were anthropology majors. Of the 10 total participants one uses he/him pronouns, two use they/them pronouns, and seven use she/her pronouns. I did not collect any additional information regarding participants’ identities. It should be noted that I received IRB approval prior to beginning the study or internship and gained participants’ written consent to participate in the study (see Appendix E).

Data Collection

Qualitative data was collected through surveys, researcher field notes, and individual interviews. Throughout the eight week internship I made field notes wherein I
reflected on the program, noted observations, and commented on elements I thought were working or needed adjustment or improvement, including notes on what I would do differently were the internship to be offered in the future. Researcher field notes contributed to the richness of the collected data.

The first survey was the online program application (see Appendix B). In addition to several basic organizational questions, it consisted of five primary short-answer questions designed to collect data about students' interest in the program, what they hoped to learn, their existing relationship with the site, previous gardening experience, and current understanding of ecoliteracy. All participants answered this survey.

The second survey was an online survey distributed in the last week of the internship (see Appendix C). This functioned much the same as a program evaluation used in an educational setting and included 11 long-answer questions designed to gather data regarding the internship experience, including: what students liked/didn’t like, what key skills, concepts, and relationships were gained or developed, and their current understanding of ecoliteracy. I also asked interns to comment on the structure of the program, supporting texts and mindfulness practices, and provided space for feedback on LGL staff and program leads, as well as general feedback. Of 10 interns, nine completed this end of program survey, and one did not.

Four one-on-one interviews between researcher and participant were conducted after the internship program concluded. The interviews were semi-structured and each consisted of five questions designed to expand on or deepen understanding around the themes addressed in the end of program survey. One interview took place in-person at LGL directly after the internship concluded, while the other three occurred two months
later via video call. All interviews were recorded and transcribed manually by me. I did not have the capacity to interview all 10 interns so I opted to request interviews with the interns who participated most consistently throughout the 8-week program. Interns were able to choose how many internship sessions they would attend; some interns attended approximately twice per week for 8 weeks (16 sessions), while others attended as few as seven sessions in total. I contacted six interns for interviews and was able to schedule and conduct four interviews. Each interview was approximately 20 minutes long. Prior to beginning each interview I reminded participants of the details of the already signed consent forms, specifically, that they had the option to choose not to answer any question, or to opt out of the study or interview at any time.

**Data Analysis**

I manually transcribed all interviews verbatim. I gathered all interview transcriptions, survey responses, and field notes into spreadsheets which allowed me to see the original data and multiple phases of coding simultaneously. As is customary in grounded theory practice, the coding process included three phases. The initial phase entailed a process of line-by-line coding, combined with occurrences of “in vivo” coding (Charmaz, 2006, p. 55), instances where I noticed a pattern in terms used repeatedly by participants. In this first phase I employed an open coding process (Plano Clark & Creswell, 2005); I stayed close to the data, preserved actions, and compared data with data to generate an authentic summary of what was happening in the data and develop an understanding of what it meant (Charmaz, 2006).

The second phase in grounded theory coding, known as “focused coding,” is more selective than the first phase and aims to condense the data (Charmaz, 2006). As
Charmaz (2006) describes, “through comparing data to data, we develop the focused code. Then we compare data to these codes, which helps to refine them” (p. 60). In this phase, broader themes began to emerge through an iterative process of comparing data sets, developing codes, and then comparing the codes with the original data. In the final phase of theoretical coding I looked for connective patterns, and anomalies, in order to draw constructivist conclusions about the phenomenon from the data. This third phase of coding was highly iterative. As I reviewed the data represented by phase two codes, I noticed themes emerging. I then tested the authenticity of the themes by organizing the data accordingly, comparing data with data, and phase one and two codes with original information. I repeated this process several times with several variations of the thematic categories before arriving at the conclusions described in Chapter Four. In addition, I engaged in the process of creating researcher memos during the coding process in order to reflect on the data and critically question my assumptions.

**Validity**

I employed several strategies to ensure validity in the data. First, I aimed to collect rich data through long-term involvement (8 weeks) and the use of multiple collection techniques (Maxwell, 2013), including surveys, field notes, and individual interviews. Second, I endeavored to minimize my influence on participants' responses by avoiding leading questions on surveys and in interviews (Maxwell, 2013). Third, I acted on Charmaz’s (2006) suggestion to write the literature review after completing the first and second rounds of coding in order to avoid unintentionally “forcing [the] data into preconceived codes and categories” (p. 67) and strived to keep codes close to the data. After each phase of coding, I shared my work with my thesis advisor, H. Burns, for their
review and feedback. I believe that these strategies supported my ability to accurately code the data and gain an authentic understanding of the phenomenon. While the results may not be generalizable, they may specifically support programmatic offerings and education for ecoliteracy at LGL in the future, while also contributing to knowledge about ecoliteracy education in postsecondary learning environments generally.

Limitations of the Study

This study, like all research projects, had limitations. Ultimately, a garden-based internship would align with and occur over a full growing season, if not longer, to allow interns to experience all aspects of garden work and the cyclical nature of the seasons. As this internship and study were located within a higher education institution it was necessary to align the dates of the internship with the academic calendar. This caused the internship to begin after the bulk of high-season planting was complete. Although I initially saw this as an unfortunate circumstance, I came to understand it as a highly educational condition. Land is never a blank slate; we do not own it, and will always encounter existing communities and systems. We must act as stewards, work with what exists, and pass stewardship on to the next generation.

While students could have opted to pay for and receive academic credit for the internship (though none did), the fact that the internship was completely optional and unpaid could be viewed as a limitation. In many ways the ability to participate was something of a privilege as not all students have the financial freedom to dedicate two mornings a week to an unpaid, though free, garden-based internship. In order to create a sense of right relationship and temper this less than favorable aspect, I ensured that interns went home with fresh produce whenever possible. However, the fact that the
internship was unpaid likely prevented access in some cases. In addition, all who chose to join the internship program had some relevant existing knowledge through coursework or life experience, so the data represents the experiences of participants with existing interest and some background knowledge.

**Positionality of Researcher**

Quantum theory demonstrates that the process of observation impacts phenomena observed and that the desires of the observer affect the observed behavior (Wheatley, 1994). As Wheatley explains, “quantum matter develops a relationship with the observer and changes to meet his or her expectation” (p. 35); objectivity is improbable, to say the least. As such, it is important that I, as primary researcher, acknowledge my positionality and reveal aspects of my identity, worldview, and experience that have impacted this study, as well as my relationship with the participants and research project itself.

I am a graduate student in the Leadership for Sustainability Education (LSE) program at PSU, and at the time this study took place, was embedded in the Learning Gardens Lab (LGL) through my role as community-based learning coordinator. Prior to the internship, I had already met some of the participants through LSE, my work at LGL, and my role as a teaching assistant in several capstone courses. To subvert the power dynamics and hierarchy implicit in many student-teacher/facilitator relationships I aimed to foster a collaborative environment where interns and the facilitator acted as co-learners; instead of answering questions, I supported interns in finding their own answers. Instead of giving directions I offered invitations. I have many years of gardening experience and permaculture training; indeed, the garden is a place where I experience a sense of belonging. However, I am not an expert horticulturist, and this is something I
made clear to interns. Gaps in my knowledge provided space for students to explore, experiment, and use their intuition and inherent knowingness.

Through participation in permaculture studies in non-traditional education settings in several different countries and environments, I experienced transformative sustainability learning. I also came to understand that this kind of authentic sustainability education is a vital necessity with limited accessibility. For the sake of humankind and our living world, everyone should have access to education which supports our collective ability to live well on the earth. I arrived at the LSE program with the goal of teaching permaculture in traditional postsecondary education settings. Through my studies and experiences in the LSE program I have come to understand that permaculture is but one dimension of an expansive body of knowledge that is, in essence, ecological knowledge, or ecoliteracy. Thus, my belief in the value of ecoliteracy and love for the garden has impacted this study. My undergraduate degree in fine art and my graduate-level education in the LSE program have been paid for through student loans, a fact which greatly impacts my lifestyle and my relationship with postsecondary education, and as such, has likely influenced this study. I am an able-bodied, white, cisgender, first-generation American woman in my late 30s. My identities impact how I experience the world and how I am perceived, and therefore, have affected this study.

**Significance**

The literature suggests that ecoliteracy supports authentic sustainability and regenerative ways of being through the development of ecological knowledge, perceptual shifts, and learning that is deeply transformative. However, the empirical research to support or contest this claim is limited. While this qualitative study may not yield
generalizable results, it may contribute to existing knowledge on the topic of ecoliteracy
development in adults in the context of garden-based postsecondary education.

This study specifically explores how a Learning Gardens Laboratory
garden-based internship program was designed and implemented for Portland State
University students to best support the development of ecological literacy and practical
gardening or food production skills. Thus, it is an attempt to solve a problem local to
LGL and PSU students through creating a program that could enable LGL to increase
PSU student engagement, connect more deeply with students engaged, and meet student
desire to learn to grow food, while potentially increasing participant ecoliteracy. The
collected data and emergent theories support LGL programing and the development of
ecoliteracy through garden-based learning opportunities for PSU students at LGL. While
I could have conducted a study that gathered theoretical information about what types of
LGL programing might engage PSU students, I was inspired and motivated by the
opportunity to enact change through an action research study. This study represented an
opportunity to learn through experience and action.

Summary

The study design and methods described here were employed to explore the
principal phenomena of PSU students’ development of ecoliteracy and practical
gardening skills through participation in a garden-based internship program at LGL. The
following chapter explains the results that emerged from the data about participants’
experiences in the internship.
Chapter IV

Results

This chapter explores the results and themes that emerged through the grounded theory analysis of the data and how these themes connect with the research questions. First, I address the research question: How does the LGL garden-based internship program impact participants’ practical gardening skills? Then, I discuss the themes that emerged relating to the primary research question: What aspects of a LGL garden-based internship most impact participants’ development of ecological literacy? Finally, I review the internship program itself and relate significant themes that arose through thematic analysis of participant feedback and researcher field notes regarding the design of the program. This third section serves to support the practical goal of actively exploring programmatic shifts that could enable LGL to increase PSU student engagement, connect more deeply with students engaged, and meet students’ desire to learn to grow food.

In this chapter I use the terms “interns” and “participants” interchangeably. The phrases “all interns” or “all participants” are used to refer to the nine of 10 participants from whom I collected data, as one intern did not complete the end-of-program survey. I refer to individual participants with randomly generated initials (such as T. R.) in lieu of pseudonyms, and I use they/them pronouns for all participants. It should be restated here that all interns applied for the program and chose to participate. Minimally, this suggests that all interns had an existing interest in gardening, farming, and/or garden-based education and related bodies of knowledge. The data confirmed that all participants had some existing related theoretical knowledge as all undergraduate interns had participated in a garden-based senior capstone course, excepting the one person who was concurrently
enrolled in such a capstone. The three graduate student participants were enrolled in or entering a thematically related program and had some previous gardening experience.

It is worth noting that my own ecoliteracy and understanding of ecoliteracy developed through this project. Had my ecoliteracy been more fully developed at the start of this study, I may have designed the research questions differently. As ecoliteracy is inherently holistic, practical gardening skills could be discussed as the physical component (hands), of the holistic triad of head, heart, and hands. This was discussed in Chapter Two as the triad of competencies required for ecoliteracy: knowing, caring, and practical skills. The internship-intervention in this study had significant focus on the development of practical gardening skills and knowledge. As I aimed at the outset to specifically explore how the internship would impact participants’ practical skills, I will begin by discussing these results.

**Practical Skills, Experience, and Knowledge**

This section focuses on the secondary research question: “How does the LGL garden-based internship program impact participants’ practical gardening skills?” The initial program application (see appendix B) included a question where applicants were asked to describe their gardening experience; they were simultaneously made aware that experience was not a prerequisite for participation in the program. The data collected through applicants’ answers to this question suggested a broad range of existing knowledge, skills, and experience in the participant group. One intern had little to no gardening experience; one intern had some gardening experience through their undergraduate educational experience; three interns had some home gardening experience (approximately one–two seasons); three interns had some home gardening experience
plus one term/season of experience gardening in an educational or work-related setting; one intern had significant gardening experience including home gardening, horticulture training, and work in a garden-based education setting.

Data collected through the end-of-program survey and participant interviews showed that all participants gained practical gardening experience and understood their related knowledge and skills to have increased over the course of the internship. Data collected through researcher field notes corroborated these results. In week three I noted observing that interns were more comfortable in the space and increasingly able to work independently and complete tasks with little or no instruction from me or LGL staff. Due to the season in which the internship took place, harvesting represented a majority of the garden work interns experienced. Many participants noted an increase in harvesting skills, including practical skills, knowing how much to harvest at any given time, and the order of harvest: leaves are harvested first thing in the morning, followed by flowers, roots, and fruits. Several interns relayed that they gained knowledge around food-safe practices utilized in the process of harvesting, washing, and preparing produce for consumption and donation.

Intern O. P. noted that they learned how to set up a drip irrigation system, while W. Q. expressed that they learned the difference between deep and shallow irrigation practices and were able to apply this learning to their home garden. In this case, W. Q. observed aloud that the plants in our LGL plot were flourishing and wondered what was different in their home garden as it didn’t appear to be as healthy. As we had just hand watered some newly planted seedlings, discussed various watering methods, and measured the depth of water penetration using a finger test, W. Q. considered the
possibility that they may not be watering deeply at home. Knowing that one of three
lengths of drip tape that irrigated our basil bed was short, I suggested we examine the
basil. Together, we noted that the basil plants that were receiving less water were
significantly smaller than the others served by drip tape irrigation. I made a note of this
interaction because it felt like an “ah-ha” moment where learning in one context was
applied in another; W. Q. reported a few weeks later that deep watering less frequently
improved the appearance of health of their home garden.

Many interns noted practical, garden-based skill development and increased
knowledge around crop planning, harvest, irrigation, organic pest management, and
no-till practices. Others mentioned their development of communication skills, leadership
skills, and an increased ability to apply knowledge in other contexts and share their
learning with others. One intern, S. H., experienced something of a transformation in this
regard. As described by S. H.:

Previous to this internship, I had no experience gardening/farming, so the primary
skills I've learned have been centered around harvesting, planting, and
maintenance. I feel like I have a good grasp on how to grow food and teach other
people how to grow food as well.

S. H. stated that prior to the internship the idea of growing food was overwhelming and
they experienced a fear of failure; through the internship experience and continued
engagement at LGL their gardening skills “transformed a lot” (S. H.).

In addition to practical gardening skill development, another yield of the
internship program was food. In this one 50–foot by 50–foot plot, in one summer season,
over 1000 pounds of edible produce was grown, plus dozens of flower bouquets. Interns
took home produce and flowers each week and additional produce was donated to the PSU Food Pantry. Interns expressed gratitude for the take-home produce and several participants shared that harvesting and donating food felt rewarding. The data suggests these practical competencies—which are critical to ecoliteracy—occurred through experience, observation, instruction, and through various relationships. These relationships are discussed in depth in the following section.

**Developing Ecoliteracy Through Relationships: Three Thematic Categories**

In looking at the primary research question—“what aspects of a LGL garden-based internship most impact participants’ development of ecological literacy?”—the overarching theme that emerged through thematic analysis of the data is one of relationships. Learning occurred through relationships, and the central outcome in many instances was development of relationships or relational shifts. Nested within this are three thematic categories: interpersonal relationships and community; relationships with land, place, and more-than-human beings; and the relationship with oneself. In each thematic category I identified learning that occurred (outcomes) and how the learning occurred (process). In many cases the relationship between outcome and process was non-linear; instead of process and structure leading to outcomes, the connections can be better described in systems terms as positive feedback loops where behaviors or events inside the loop reinforced each other and amplified the effect of the system. In fact, it was often difficult to differentiate between outcome and process as they were inextricably linked. Relationships represent both the primary outcome or central learning, and the process through which learning occurred.

*Developing Ecoliteracy Through Interpersonal Relationships and Community*
One of the most ubiquitous and surprising themes to arise from the data was that of community and interpersonal relationships. Almost all participants suggested that one of the most meaningful aspects of the internship was the sense of community they experienced and the interpersonal relationships that developed. Many interns mentioned that the opportunity to connect with like-minded people from diverse backgrounds was valuable to them, while others appreciated the opportunity to connect with peers outside the traditional (or virtual) classroom setting, and multiple participants noted that they experienced a sense of belonging. It is important to restate here that this internship occurred in the summer of 2021 after almost a year and a half of COVID-19-related isolation with primarily remote or online classes. More than one participant expressed that connection with other humans and a sense of community was especially valuable after the long period of isolation. Although the collective pandemic experience may have impacted participants' perceptions in this area, the data implied that this sense of community developed through participants working together, which is relevant despite the potential effect of the pandemic in this context. A. C. described this in saying “we were all working together for the good of the garden, rather than needing to prove our knowledge or critical thinking skills.” L. Z. reflected on their experience and stated:

I felt like [the internship] was about building relationships around what we were doing, … at the end [of the internship] it felt like a really special place where we were all connected in the way that we just did all that work and we got to watch this garden grow and flourish.

I did not expect the process of interns working together and the interpersonal relationships that developed to be so impactful for them, yet this represents one of the
most prominent themes to emerge from the data. Being in relation, developing relational
thinking, and understanding the depth at which all beings are interconnected are all
concepts central to ecoliteracy.

Interpersonal relationships and community development were outcomes of the
internship program, however, relationships were also central to how learning happened.
The data suggested that all participants experienced and appreciated some form of
collaborative learning. Some participants used this phrasing, while others suggested that
they valued the experience of peer-to-peer learning, and the opportunity to learn with and
from each other, from leaders, and in community. Many participants reflected that
meaningful conversations occurred while working together in the garden; I observed this
on several occasions and described these occurrences in my field notes. D. X. described
their experience as follows:

I really like everyone here [in the internship] and I think we have a very diverse
group of students. Everyone has different stories, different backgrounds, and
different natures, but yet we're all here doing this and we all love it. We were all
able to bond over things and we all had such, not just fun, but productive
conversations about our interests, and food, and feeding people.

This quote illustrates Orr’s (1992) suggestion that true comprehension of ecology and
community may occur through the experience of working together in community.

Ecology, and therefore ecoliteracy, are inherently relational. Ecoliteracy development
involves a shift to relational thinking—a shift naturally cultivated through interpersonal
relationship development, community participation, and collaborative learning.
A collaborative learning environment is created, in part, through the relationship between student and facilitator and the role the facilitator plays. The data suggested that participants generally perceived that the interns and I, as the facilitator, participated as co-learners, and participants recognized that those in leadership roles—myself and LGL staff—demonstrated collaborative, non-hierarchical leadership. These relationship dynamics supported interns in being empowered decision-makers. To this end, L. Z. stated that they “liked the way [the internship] was structured. We had freedom to make decisions for ourselves, which sounds silly, you should always have that, but at school sometimes it's structured in a way that doesn't allow that.” S. H. elaborated by explaining: “I thought Shevawn's strategy of leading, but not necessarily being a decision-maker in the trajectory of the plot was a great way to give us some autonomy.” Approximately half of the participants explicitly agreed with these sentiments and stated that they experienced and appreciated a sense of freedom and/or autonomy. This suggests that interns were not just passive recipients of knowledge but were actively engaged in a process of learning, collaborative decision making, and creating change. Participants cared enough to have opinions “about the trajectory of the plot” and developed the capacity to be changemakers in the context of this garden and related community. This speaks to the active nature of ecoliteracy in that ecoliteracy is not only knowledge of ecology, but also the cultivation of attitudes of care, and the ability to take action towards the creation of sustainable communities.

The data suggested that all participants had a positive experience of LGL staff and with me as the program lead. While several interns noted they witnessed high levels of staff dedication, generosity, and kindness, others expressed feeling welcomed and
supported by those in leadership roles. K. F. spoke to this in stating that “everyone at the LGL is amazing … I have always felt welcome and encouraged to participate in this space.” The data analysis revealed that more than half of the participants experienced the internship space as a safe space to take risks, ask questions, and learn. D. X. described me, the program lead, as “easy to talk to and … always ready to answer my questions.” They went on to address me directly in saying: “You created a very safe space for us to ask questions and I didn't feel dumb asking questions; you also had questions so I feel like we all learned from each other.” L. Z. expressed similar sentiments in saying that the program lead “made us feel like we could feel comfortable asking any questions without feeling like we're stupid or looked down upon.” These statements suggest a learning environment that was unintimidating, where facilitator-intern relationships were grounded in trust, care, equality, and mutual respect. These examples demonstrate that the quality of interpersonal relationships in the learning environment can be highly impactful and contribute to the cultivation of ecoliteracy.

Relationship development was not only an outcome of the internship experience; learning that happened within the internship occurred primarily through being in relation. More than one participant reflected that connection with each other was facilitated, in part, by connection to place and the collaborative work of land stewardship during the internship. Having discussed interpersonal relationships as both outcomes and elements in the learning process, the next section reviews the development and impact of relationships with place, the land, and more-than-human beings.

Developing Ecoliteracy Through Relationships With Land, Place, and More-Than-Human Beings
The relational theme extended beyond human relationships; the data revealed that participants' relationships with the land, place, and more-than-human beings changed and developed during the internship. Participants noted not only a connection with place, but also that they learned from the land, from plants, from the relationships between plants, as well as through their own relationships with plants, critters, and the place. In several instances, the findings showed that shifts in understanding and perception occurred that impacted interns' worldview. L. Z. described the internship as an opportunity that gave them “another level of respect for the land and the plants, trees, birds, and bugs and how all of these elements work and breathe together.” This view is an inherently relational, ecological, systems perspective wherein all beings are understood as interdependent and part of a greater whole; it is representative of the knowing component of ecoliteracy. S. H. described how this learning occurred for them:

I think I developed a relationship with the land there [at LGL] by learning from it a lot. I think I learned a lot just from learning how to care for plants and how plants care for each other. I remember learning about companion planting and I was super interested in that. It’s so cool how plants have relationships with each other and can help each other.

A common practice in organic gardening and permaculture, companion planting consists of interplanting crops which benefit each other, thus creating symbiotic and mutually beneficial relationships. A popular example of this method, rooted in Native American agricultural traditions, is the triad of corn, beans, and squash known as the three sisters. These three important food crops support each other when planted together. The corn grows tall and provides a structure for beans to grow up, and the beans in turn...
provide nitrogen for the corn and squash, while squash vines act as a ground cover, suppressing weeds and supporting water retention.

In the LGL plot where the internship took place, I utilized companion planting techniques. For example, in the row of summer squash I also planted sunflowers to attract beneficial insects and pollinators. Beans fixed nitrogen in the soil and climbed the sunflower stalks, while radish acted as natural repellent for pests known to love squash. Participants observed this system, read about companion planting, reflected, and had discussions around this theme. Companion planting mirrors naturally occurring ecological systems and offers tangible examples of the principles central to ecoliteracy, including diversity, flows, cycles, interdependence, and reciprocity. By learning through and about companion planting, participants experienced the garden as a living system.

When asked about the key concepts learned through the internship many interns mentioned permaculture, whole systems thinking, traditional ecological knowledge, interconnection, reciprocal relationships, and that the land and all beings have intrinsic value. Several participants implied that they learned about reciprocal relationships through companion planting and caring for plants. In discussing companion planting A. C. stated: “I really enjoyed revisiting the idea of learning how the plants can benefit each other. I do believe that concept could also be applied to relationships between humans in various situations from work to personal.” A. C.’s statement here reflects learning from nature, from the garden, and beginning to apply ecological patterns of relationship in social contexts. This kind of thinking represents an ecoliterate perspective and a starting place for ecological design where we draw from ecology to design sustainable communities and ways of living. Further, several interns suggested that through
companion planting experience and comprehension they experienced a shift in perspective around ideas of competition and collaboration in nature. As S. H. explained:

I remember always learning in biology classes how it's like survival of the fittest and all these organisms are so individualistic and it's just so not true and I'm learning how much it's not true. Mutual aid is not a human made concept—it's always been there between plants and animals.

This suggests a perceptual shift, a process of learning and unlearning that impacted this participant’s understanding of the nature of the world.

During the internship, we weeded with intention as an educational and relationship-building practice. Instead of removing anything we did not plant, we collectively identified individual plant varieties and interns made choices about whether to pull “weeds,” or leave them be. In my experience, common understanding around weeds in the garden tends to be dualistic and anthropocentric—if we didn’t plant it, then it is a weed; weeds are bad and should all be removed. I believe this to be a misconception rooted in an outdated worldview. While some plants commonly perceived as weeds have invasive tendencies and incredible seed-spreading abilities, many also provide essential functions and are valuable elements of the living system that is the garden. We learned that many of the so-called weeds in our plot were actually amaranth and purslane, both of which are edible. Purslane also functions as a flowering ground cover and is known to draw up nutrients and moisture through its roots, making these available to neighboring plants. The data showed that this experience of intentional weeding proved to be memorable and influential for many interns, and generally increased participants' ability to identify local plants. D. X. explained that one of the
primary skills they developed was “plant and weed identification. I was taking pictures of everything when we first started and writing notes so I could really learn the plants.” Knowing the names of plants in the local environment helps to foster relationships and the sense of connection. As S. H. reflected: “One of the gifts this internship has given me is being able to recognize certain plants outside of the plot at LGL. Whenever I see plants that I recognize I feel more of a kinship and understanding with that plant that I hadn't prior.” In this way, experience and intellectual knowledge supported relationship development, and in turn relationship development supported intellectual knowledge, practical skills, and shifting perspectives. This is a prime example of ecoliteracy development.

In alignment with the holistic nature of ecoliteracy, the data suggested that it was not only that relationships developed, but that the quality of these relationships was of paramount importance to the participants. How participants felt about the space and the work had an impact on their experience and their perception of the outcomes. Many interns expressed a love for the work, others suggested that they experienced a sense of joy and excitement at being in the garden and observing it grow. In numerous cases, participants explained that the place had become special or that they developed love for it. In more than one instance, participants described experiencing a sense of awe or wonder; D. X. shared such an experience: “One of the best moments was when we first harvested potatoes, and everyone was in awe of the little treasures under the dirt.” I had observed this occasion and noted that it had something of a magical quality. Themes of love, respect, reciprocity, hope, and gratitude were prevalent in the data. This suggests that many participants' hearts or emotional selves were engaged; the experience was not
only impactful on intellectual and physical levels, it involved the whole person. These themes are central to the development of attitudes and relationships of care that are key for holistic and transformative ecoliteracy development. D. X. illustrated this concept through recounting their internship experience:

Just having a basic understanding of growing food and food access has changed my entire outlook on life. The common theme for me is appreciation. I am privileged and extremely grateful to have always had access to fresh, healthy foods. What I want most is for every human to have access to good food. A lot of effort is put into growing food, so I have really learned to appreciate where my food comes from, and all of the farmers, big or small, out there doing the work.

Soil is life. The land, the plants and all of the other living creatures are so important. We will be provided with resources as much as we care for the land.

When I'm in the garden I am reminded of the need for reciprocity.

Here, D. X. related that increased understanding—both theoretical and practical—plus self-reflection, affected a sense of transformation of their worldview. This quote implies knowing, caring, a change in the self, and the desire to act and participate in creating change.

This theme of relationship with the land, place, and more-than-human beings emphasized holistic learning. Interns engaged their whole selves and began making connections between garden-based concepts, experiences, and emotions. Further, interns applied their learning in spheres beyond the garden and began identifying other contexts where ecological knowledge could be applied. The development of relationships with place, the land, and plants represents both an outcome of the learning and the process
through which learning occurred. Nested within the overarching relational theme are the thematic categories of: interpersonal and community relationships; relationships with land, place, and more-than-human beings; relationship with self, or intrapersonal relationships. Having discussed the first two, the next section will explore the final theme of relationship with self in the context of the internship experience.

**Developing Ecoliteracy Through Relationship with Self**

The findings suggested a third relational thematic category: intrapersonal relationships and relationships that deal with connections between the self and the world. Several participants mentioned that they felt personally nurtured through caring for the land, an experience that exemplifies a reciprocal relationship of care. Some suggested that the internship experience had impacted their relationship with themselves and promoted personal growth, while others said it helped them to clarify and voice personal needs and values. E. M. spoke to this in stating that the internship “reminded me that what I need most is community, and to be focused on possibilities instead of the bad news.” This statement also reflects a recurring theme of hope, something several participants felt an increasing sense of through their internship experience.

As discussed in previous sections, many participants expressed gratitude for take-home produce. Several participants, however, also suggested that the internship impacted their personal relationship with food. Y. J. shared their experience in saying: “Growing food is really important work when you're trying to repair your own relationship to food and unpack what food means. When you're growing it year round and you're invested in the process it's a lot more difficult to see food as purely fuel; it's so much more than just something that you're eating to get energy throughout the day.”
suggests not only a deepened relationship with food, but an opportunity for mutual healing through gardening.

A few interns related ways in which they recognized a sense of internalized seasonality that developed over the course of the internship and through continued engagement at LGL. As Y. J. explained: “I feel like my summer identity is so different from my other identities because I'm operating from a place of abundance so I can also operate from a place of generosity. I think I'm really mirroring the plants and the seasons in that way.” S. H., who continued to steward the internship plot through the fall, shared their reflection:

During the fall there's not as much to do. It's been interesting to see LGL go dormant, everything is just resting. I've always felt like that's the way humans should be too; I just want to lay in bed all day in the winter time, but I have to go to work, you know, capitalism still exists. I really like to see how nature rests even if humans aren't resting … I really think humans should pick up some of these values that nature has.

Both of these statements are examples of embodied ecology, where participants have begun to see themselves as part of the earth, and as such, are impacted by seasonality in much the same way the garden is. One could argue that this kind of understanding requires connection with one’s intuition. To this end, several interns noted instances where learning occurred through engaging multiple intelligences and their intuitive knowing; they implied that I, as the program lead, validated intuitive knowing and fostered this intelligence through asking participants “what feels right to you?” instead of
just providing answers. Some participants suggested increased comfort with ambiguity and not knowing, while others indicated a personal epistemological shift.

The data showed that many participants gained a sense of empowerment—of increased confidence and ability—through internship participation. Several interns described their experience as inspiring or motivating, while others noted that it initiated, or contributed to, a shift in career goals, life path, or plans for future study. In some of these instances the shift was transformational. L.Z., an art history major, explained that the internship impacted their direction and next steps in life; they said: “I feel like from that [internship] program I now feel this drive to reach out and do more with it. It kinda changed my path … It changed me.” Similarly, A.C. described their experience:

The internship has absolutely changed my relationship with myself, the land around my house and even with my chosen field of study! [My] PSU senior capstone … was really the first piece to the change that has been happening in my life, and being at LGL has absolutely supported those changes and encouraged my own personal growth and challenged my academic and personal goals. I suppose my path in life will become more dedicated to the stewardship of the land and the possible healing it could provide for each person!

The way that these participants, and others, described their experiences suggests that the learning that occurred through the internship had transformative qualities. Interns experienced shifts in perspective, changes in how they viewed themselves, their place in the world, and their personal future visions. While not all interns shared experiences that implied transformation, all suggested that the internship was impactful in some favorable
way. The findings inferred that many interns’ ecoliteracy developed through this internship experience.

In the next section, I review the structure and design of the internship program itself and relate significant findings that arose through thematic analysis of participant feedback and researcher field notes. This review serves to practically support future iterations of this program.

**LGL Internship: Program Design and Structure**

The results indicated that participants had an overwhelmingly positive internship experience; many expressed gratitude for the program. Several interns conveyed a desire for continued involvement with LGL and for the program to continue. The internship structure was somewhat flexible. Sessions were offered two mornings per week, plus one afternoon weekly and several Saturday mornings; participants were welcomed to join any and all sessions and were asked to commit to at least six sessions. While interns generally appreciated this flexibility in the schedule, many also voiced a desire for more consistency in cohort attendance. I believe this desire correlates with interns’ appreciation of the sense of community that developed through the program. I noted that attendance was generally somewhat low. One person attended each Saturday session, one participant joined the weekly afternoon session, and morning sessions generally had three to six (of 10) interns in attendance. One Saturday session and one afternoon session had to be canceled due to extreme heat, and I noted that many afternoons felt too hot for outdoor work.

As this program was an unpaid internship for which no participants had opted to earn academic credit, I aimed to create a flexible structure that could function similarly to
a course, but with fewer requirements. Instead of requirements, I provided invitations. The data revealed that while interns generally appreciated the relaxed atmosphere, and offered positive feedback on the structure in general, there was also a prevalent desire for increased structure. Participants suggested adding an online platform where interns could connect and have discussions. I had imagined including this but the internship developed quickly and due to time and institutional constraints I was unable to provide this in the time available.

Interns were invited to participate in mindfulness practices such as sit-spots or walking meditation, as well as reflective journaling. These were introduced as supportive practices and discussed at the beginning of the internship. While I verbally reminded participants on a few occasions about these practices and suggested interns plan to spend a little time with these practices before or after the internship activities, I did not schedule a specific time within internship hours for these practices. The data suggested that although many participants practiced mindfulness casually, many did not fully participate in the suggested practices due to lack of structure around the inclusion of these practices. Several interns suggested that they appreciated the inclusion of these practices, and adding dedicated time for mindfulness and reflection would support their engagement. However, mindfulness came up frequently in the data as both a process that contributed to participants' learning, and as an outcome of their engagement. One intern said that they fully engaged in the suggested mindfulness practices and had a highly introspective experience.

Likewise, interns were provided with materials to read. These were provided weekly via email and included both theoretical works on the topics of ecology,
ecoliteracy, and permaculture, as well as practical information such as a local weed guide, planting calendar, and companion planting guides. Again, I invited participants to read these materials; I did not articulate it as a requirement. The data showed that overall, participants enjoyed the texts provided and remarked that they were “approachable, impactful, informative” (D. X.) and “thoughtfully chosen” (O. P.). However, several interns suggested that they did not fully engage with readings due to lack of structure and accountability. While we discussed readings casually, we did not designate time for formalized reading discussion each week; several participants remarked that regular, facilitated discussions could be impactful and potentially increase their participation.

Participant feedback about the internship structure and components generally mirrored my own field notes. Overall, I feel the program was successful in this first iteration. The collected data provided information that could only serve to make the internship stronger and support development of LGL programming that facilitates increased connections with PSU students through opportunities for students to learn to grow food.

**Summary**

This chapter has explored the findings and themes that emerged through grounded theory analysis of the data. The central theme of relationships was examined through the thematic categories of interpersonal relationships and community; relationships with land, place, and more-than-human beings; and relationship with the self. Within these categories, findings emerged that revealed that holistic learning took place. Learning was relational, intellectual, practical, experiential, and engaged the emotions and intuition. The findings suggested that the learning that occurred supported holistic ecoliteracy
development. These outcomes and conclusions are discussed in depth in the following chapter.
Chapter V

Discussion

This chapter summarizes key findings from the study and connects these with both the research questions and the reviewed literature, in terms of ecoliteracy and educational theory and practice. Here I make specific recommendations related to potential future iterations of the Learning Gardens Lab (LGL) internship program, or similar programs, as well as general recommendations for next steps and further research, before offering a conclusion to the study.

The purpose of this study was to explore how a garden-based internship program could support the cultivation of participants’ ecoliteracy and practical gardening skills. The research question “how does the LGL garden-based internship program impact participants’ practical gardening skills?” was answered fairly simply: interns learned through the experience of doing. The findings made it clear that participants developed practical gardening skills through active participation in the stewardship of a food-centered plot at LGL. Participants who entered the 8-week program with little to no gardening experience left the program feeling able to steward edible crops and share this knowledge with others. Addressing the primary research question, “what aspects of a LGL garden-based internship most impact participants’ development of ecological literacy?” necessitates the in-depth discussion that follows here.

Developing Ecoliteracy Through Relationships: Three Thematic Categories

The primary theme to emerge from this grounded theory study and analysis of the data was that of relationships. Three distinct but interconnected thematic categories arose, suggesting outcomes of, and learning that occurred through: 1) interpersonal relationships
and community; 2) relationships with land, place, and more-than-human beings; and, 3) relationship with the self. In discussing each thematic category, I identify learning that occurred as related to ecoliteracy, and how the learning occurred in relation to the educational theories and pedagogies that have been outlined in Chapter Two. As this was a grounded theory study, the results emerged directly from my analysis of the data.

The relational themes mirror ecoliteracy, since relationships and relational thinking represent the core of ecoliteracy. Orr (1992) describes ecoliteracy as “the quality of mind that seeks out connections” (p. 92) and Capra (2009) suggests that “in order to become ecologically literate we need to think in terms of relationships, in terms of interconnections, patterns and context” (para. 11). The findings suggest that relationship development was the primary outcome of the internship. This did not occur through intellectual learning about relationships, but rather, participants learned through the experience of being in relationship. In this way, the internship program modeled and facilitated a process of reconnection. This is to say that learning was ecological—it occurred through relationships in context. As Orr (1992) describes it, “the ecologically literate person has the knowledge necessary to comprehend interrelatedness, and an attitude of care of stewardship. Such a person would also have the practical competence to act on the basis of knowledge and feeling. Competence can only be derived from the experience of doing” (p. 92). These competencies developed through the internship experience and are described in the following sections.

**Developing Ecoliteracy Through Interpersonal Relationships and Community**

The data suggested that one of the most meaningful aspects of participants’ internship experience was the sense of community and interpersonal relationships that
developed through internship participation. Community development is central to sustainability and ecoliteracy development. As Capra (2009) describes it, sustainability is not an individual property but a property of an entire web of relationships. It always involves a whole community. This is the profound lesson we need to learn from nature. The way to sustain life is to build and nurture community. (para. 10)

Thus, nurturing interpersonal relationships and developing community can be viewed as accessible starting points for the cultivation of ecoliteracy. Ecoliteracy development involves a shift to relational thinking—a shift naturally cultivated through interpersonal relationship development, community participation, and collaborative learning.

The findings suggest that internship participants created a mutual sense of community through working together. This fact exemplifies Orr’s (1992) assertion that true comprehension of ecology and community occurs through the experience of working together in community. Diverse groups working together for a shared goal not only mirrors ecological communities but can also create, in participants, a sense of empowerment, ownership/belonging, and hope, while supporting the practical and active element of ecoliteracy: the ability to collectively solve problems and create sustainable communities.

While interpersonal relationships, or participants’ connections with each other, were facilitated, in part, by their connection to place and the collaborative work of land stewardship, the program design and behaviors of LGL staff and myself as the program lead, supported this. Participants noted that those in leadership roles were warm, welcoming, caring, and demonstrated collaborative leadership. With this behavior, LGL staff and I set the tone for the internship, and the relationships that developed therein.
In alignment with place-based and transformative learning theories, I aimed to position myself as a co-learner, rather than as a power-yielding expert. To facilitate transformative learning, Baumgartner (2001) suggests that “instructors relinquish some of their authority” (p. 20). Similarly, in place-based education, "teachers … act as experienced guides, co-learners, and brokers of community resources and learning possibilities" (Smith, 2002, p. 593). Thus, I crafted my role as one of support and collaboration. I demonstrated that it was acceptable to not know through acknowledging when I didn’t have answers to interns’ questions and directing participants to available sources of information, such as LGL staff, other internship participants, books, seed packets, and interns’ own intuition. Thus, we learned together. The data implied that this practice helped to create a learning environment grounded in openness and trust, where participants felt safe enough to take risks and ask questions. These conditions, according to Mezirow, are critical to transformative learning and promote “participation, collaboration, exploration, critical reflection, and feedback” (Baumgartner, 2001, p. 20). In addition, not having all the answers reinforced my position as a co-learner in a learning community where, rather than memorizing facts, meaning was made collaboratively. A collaborative, transformative learning environment supports the perceptual shifts which are central to ecoliteracy development.

After interns were comfortable in the space, I excused myself from decision-making regarding the trajectory of the plot and transferred the power of decision making to participants. The data showed that this practice was highly impactful. It supported participants’ relationships with each other, fostered their sense of ownership/belonging, and promoted interns’ sense of agency, freedom, and autonomy, all
of which work to support transformative learning (Baumgartner, 2001). As discussed in Chapter Two, ecoliteracy development is a transformative process centered in perceptual shifts and the cultivation of a triad of competencies. As such, engaging transformative pedagogy was critical to the internship design, an element which was highly impactful, as the findings suggest. Developing a sense of agency is critical to active ecoliteracy as “agency is the ability to exercise choice and live according to deeply held values” (Clavin, 2012, p. 74). Agency, or the ability to act, paired with ecological knowledge, and caring, constitute ecoliteracy.

Within the context of the garden, learning is an experiential and “social process: learners, educators and members of the local community all learn from each other and from interaction with the built and natural environment” (Clavin, 2012, p. 71). During the internship, learning occurred not only through human relationships and community, but also through interaction with the natural environment and the non-human community. 

**Developing Ecoliteracy Through Relationships With Land, Place, and More-Than-Human Beings**

The data revealed that participants' knowledge of and relationships with the land, place, and more-than-human beings shifted and deepened during the internship. Participants noted not only that they had developed a connection with the place, but also that they came to love the garden and the work of stewardship. Interns learned from the garden and began applying this knowledge in social spheres and other dimensions of their lives. Participants developed ecological knowledge, attitudes of care and stewardship, and practical skills—the triad of competencies which constitute ecoliteracy.
Developing Attitudes of Care. Within the theme of relationships with land, place, and more-than-human beings it is especially difficult to differentiate outcomes from process. It is clear that participants developed a relationship with the garden and learned through this relationship. Through the experience of tending the plot and caring for the plants within, interns developed not only practical gardening skills, but a relationship with the garden—the place became special to them.

There was a general feeling of awe and excitement at the beginning of each internship session as participants observed the growth of plants in the plot. Orr (1992) suggests that “ecological literacy is driven by the sense of wonder” (p. 86). This experience of awe or wonder, sometimes referred to as “biophilia,” is centered in the emotions, and suggests an affinity for, and kinship with, the natural world (Clavin, 2012; Orr, 1992). Clavin affirms that this kind of relationship emerges as “learners begin to love the site and the unfolding structures, plants, and wildlife within it” (p. 72). This is where ecoliteracy, and indeed sustainability, begins. Rather than inundating students with facts about environmental crises and expecting this to motivate them to find solutions, students must first have “an opportunity to bond with the natural world, to learn to love it and feel comfortable in it, before being asked to heal its wounds” (Sobel, 1996, p. 10). The findings imply that the internship experience fostered participants’ sense of love for the garden and the natural world. This relationship of care is central to the cultivation of ecoliteracy.

Gaining Knowledge. The findings implied that the primary conceptual learning that occurred through the internship included: permaculture concepts, whole systems thinking, traditional ecological knowledge, interconnection, reciprocal relationships, and
that the land and all beings have intrinsic value. While the provided readings contributed
to knowledge development, the data suggested that experiential learning was most highly
impactful. I posit that it was the combination of theory and practice that most affected
learning in this context. Companion planting and weeding offer the most illustrative
examples of how this learning occurred.

The practice of intentional weeding was a process that impacted participants’
knowledge of and relationships with more-than-human beings. Through collaboratively
learning about the “weeds” (also known as “volunteers”) growing in the plot, the
individual properties of these plants, and the functions they served as an element of the
living system (the garden), interns were able to make informed decisions about whether
they were beneficial to the system, were edible or medicinal, and ultimately decide
whether to remove or leave them. Not only did interns’ plant identification skills
increase, but some participants noted a relationship or increased sense of kinship with
plants they encountered out in the world and were able to identify.

Through incorporation of the theory and practice of companion planting,
participants experienced the garden as a living system. Participants observed the
companion-gardening system present in the internship plot, read about companion
planting, reflected, and had discussions around this theme. Companion planting
techniques exemplify the collaborative and self-sustaining nature of ecological
communities; interns noted that they learned about reciprocal relationships through
learning about the way plants support each other. In some cases this supported a
perceptual shift as participants came to understand that nature works in collaboration,
rather than competition. Several interns began making connections between the
ecological patterns of relationship that they observed in the garden and social or organizational systems. As companion planting mirrors naturally occurring ecological systems, engaging this planting method can support the development of ecological thinking and the ability to draw from ecology to design sustainable communities and ways of living. The findings in this area suggested that the internship experience fostered ecoliteracy development in participants through the cultivation of ecological knowledge.

**Developing Practical Skills.** As was mentioned at the beginning of this chapter, the data suggests that all internship participants’ practical gardening, stewardship, and food production skills increased through participation in this program. The literature, as discussed in Chapter Two, makes it clear that gardening skills and skills which support a community's ability to meet its needs locally and sustainably are “of considerable importance for surviving and thriving in the twenty-first century” (Clavin, 2012, p. 75). Indeed, Chief Lyons (2008) cautions that "there will come a time … when only those who know how to plant will be eating" (p. 24). While these skills are of profound importance, they are not the only practical skills that were cultivated through the internship program. Interns also developed leadership skills, practiced working collaboratively within a diverse group, and developed skills of observation. Ecological knowledge, relationship with place, and skills of observation come together to promote the ability to apply ecological concepts in spheres beyond the garden; to learn from nature and apply this learning in the design of sustainable communities, just social systems, and regenerative ways of living. This represents the third tenant of ecoliteracy, the “practical competence to act on the basis of knowledge and feeling” (Orr, 1992, p. 92).
The development of relationships with place, the land, and plants represented both an outcome of the learning and the process through which learning occurred. Gardens are inherently collaborative places that nurture reciprocal relationships; “in a garden, food arises from partnership” (Kimmerer, 2013, p. 126). The theme of relationship with place, land, and non-human beings emphasized holistic learning as interns engaged their whole selves and began making connections between garden-based concepts, experiences, and emotions. Evident in the examples outlined above, garden-based learning “has the power to translate complex theory into practice” (Gaylie, 2009, p. 38), and tangibly manifest ideas and relationships previously only conceptualized. Through the garden-based learning experience, the web of interdependence is made visible and it becomes impossible to “ignore the fact that natural species depend on the earth, and each other, in contexts both large and small, for mutual survival” (Gaylie, 2009, p. 39).

The internship was garden-based, place-based, and experiential and while also engaging related learning theories and pedagogical practices. In addition, the outcomes were supported by modeling, both in terms of what was present in the garden and my behavior as the facilitator: I love gardening and being in the garden; enthusiasm can be contagious. I often feel excited when I observe seeds sprouting and plants growing, and I chose to share this excitement with the participants. While waiting for interns to arrive for each session, I wandered the plot observing. As participants arrived, they would join me in observing, sharing what we noticed, and considering possible factors contributing to observed phenomena. I demonstrated respect for plants, talking to and about them as I would friends; I congratulated them on their growth, apologized when I accidentally stepped on them, and thanked them while harvesting. These practices themselves may
appear trivial, but they speak to something greater. Palmer (2007) suggests that teaching “emerges from one’s inwardness” (p. 2); in essence, “we teach who we are” (p. 1). Brown (2017) describes this concept using a fractal analogy and says “I am a cell-sized unit of the human organism, and I have to use my life to leverage a shift in the system by how I am, as much as with the things I do” (p. 54). These ideas have had a huge impact on the way I view teaching and learning, and being in the world. I believe that what I do is important, and how I do things, how I behave, and how I feel is as important. As a facilitator, I aim to bring my whole self to the learning setting and to embody the concepts I feel passionately about. I believe that who I am and how I showed up during the internship impacted participants’ experience and the learning that occurred; the data corroborates this belief.

**Developing Ecoliteracy Through Relationship with Self**

This third relational thematic category is focused on intrapersonal relationships and relationships that deal with connections between the self and the world. This theme includes shifts in ways of knowing and instances of transformation.

The findings implied that some participants experienced a sense of reconciliation of their multiple ways of knowing through their internship experience. During the internship, instead of positioning myself as the holder of knowledge, I aimed to foster participants’ (re)connection with their capacities of intuition, feeling, and sensing. If interns had questions, instead of directly providing answers, I often asked “what do you think?” or “what do you feel is right?” More often than not, participants already had an answer, or at least a partial answer and we were able to find the information together. Several interns noted that engaging intuition in this way was meaningful, that they
experienced gardening to be an intuitive practice, and some achieved a greater level of comfort with not knowing.

If we understand that humans are inherently whole it follows that education, as the root of the word suggests, should be a process of “bringing out” or “leading forth.” As humans have a long history of living well on this earth, sustainability education could be seen more as a process of remembering than of learning new ways. As Harding (2012) explains:

It was C. G. Jung who pointed out that we gain reliable knowledge by means of the four modalities of thinking, feeling, sensing and intuition. Perhaps the reunification we are seeking will take place when we educate our students to consciously cultivate their ability to think in tandem with their other three ways of knowing. (p. 92)

As discussed in Chapter Two, “the patterns of the universe repeat at scale. …what we practice at a small scale can reverberate to the largest scale” (brown, 2017, p. 52). This suggests that reconnecting parts of the self can have a ripple effect and initiate a pattern of reconnection; changing ourselves changes the world.

In the recent past, through attending Schumacher College, I’ve had the privilege of participating in small group lectures and teaching sessions with some prominent ecological thinkers—many of whose works I have cited in this paper—such as Harding, Kumar, Orr, and Sepie. At the end of each lecture someone inevitably asked a question that was equivalent to “so what do we do?” I noticed a pattern emerging in the responses, and my takeaway was a threefold answer: First, reestablish your relationship with nature and support others in doing the same. Second, reconnect with your own intuition and
multiple intelligences. Third, don’t waste time trying to change the minds of people who
don’t want to evolve. The first two of these, at least, are central to ecoliteracy.

Findings suggested that at least four of the nine interns from whom I collected
data experienced personal transformation through the internship experience. As these
were individuals who chose the internship, I can only assume they were open to changing
their minds; I do not imagine that the process of transformation began with participation
in the internship, but it certainly propelled the transformation. In three of these cases,
participants stated that their internship experience impacted their life path, future study,
and/or career goals. This means that there are four (if not 10!) recent college graduates
out in the world, passionate about gardening, the environment, sustainable food systems,
and social justice, pursuing careers and/or further education. And they are ecoliterate.
They have ecological knowledge, attitudes of care, and the practical skills needed in
order to be effective change agents. As Orr (1992) explains, “ecology, like most learning
worthy of the effort, is an applied subject. Its goal is not just a comprehension of how the
world works, but, in the light of that knowledge, a life lived accordingly” (p. 87). These
instances of transformation are examples of people applying ecological knowledge in
their lived experience and how they design their lives.

In this thematic category it is difficult to connect specific outcomes to a distinct
singular process. Outcomes here appear to be cumulative, holistic, and connected with
the internship experience as a whole rather than one part of the learning process. The data
suggests that participants appreciated the flexible structure of the internship and the
relaxed atmosphere of the learning environment. Kumar (2019) describes learning as:
A process of discovery which comes about when the learner is engaged and fully involved with her experience. For this to happen, there needs to be a relaxed atmosphere, where the learner doesn’t feel any pressure, where he or she has the opportunity to learn at their own pace, and where the slow and simple activity of learning is celebrated. … Learning is a process of self-realization. (p. 87)

This description of learning aligns with and illustrates the internship program. Rather than requirements, interns were offered invitations. As the program lead, I did not tell interns what to do, but provided suggestions paired with my rationale; everything was open for discussion. Rather than rigid structure I created a flexible structure which we collaboratively adjusted as needed. Interns were welcomed to participate in tasks as their bodies allowed, and to pass on any task or activity that wasn’t right for them at the moment. In spite of, or due to, the relaxed atmosphere, necessary work was always completed, and over 1000 pounds of food was harvested from the 2,500 square foot plot over the summer season. In addition, interns left the program more hopeful than when they began. Having discussed the three relational themes in connection with ecoliteracy and the reviewed literature, next steps and specific recommendations are suggested in the next section.

**Recommendations**

**Recommendations for the LGL Internship Program**

The findings of this study suggested that the LGL garden-based internship program was an effective mode of supporting participants’ development of ecoliteracy and practical gardening skills in the context of postsecondary education. Through my experience of designing and leading the internship, the process of analyzing the data, and
writing this document, my ecoliteracy also expanded. Drawing from this knowledge and experience, as well as collected data, I would likely make a number of adjustments to the program design for future iterations. I would aim to increase the structure of each session while maintaining a relaxed atmosphere. I would offer readings, reflection, group discussions, and mindfulness activities as invitations, but would designate time and space within the program to support these practices. I would likely reframe the amount of participation required and ask participants to plan on attending two mornings per week. In an ideal scenario, the program would be longer and span a whole growing season, if not an entire year.

As this was a grounded theory study I have focused on findings that emerged from the data. I would like to draw attention here to a few elements which are central to ecoliteracy but were largely absent from the findings, specifically traditional ecological knowledge and critical thinking as related to critical pedagogy. Indigenous wisdom and traditional ecological knowledge are central to ecoliteracy, indeed many Indigenous peoples have demonstrated culturally embodied ecoliteracy and the ability to live well with nature. Indigneous lifeways and teachings, in many cases, model sustainable human-environment relationships and demonstrate that there is another way of living, and of being in relationship, which is truly balanced and regenerative. While I included concepts from the work of Native American ecologists and educators such as Donald, Cajete, Kimmerer, and others in Chapter Two, I did not highlight these works in the internship itself. Thus, these teachings were not prominent in the findings.

In general, assigned reading was light during the internship and little time was dedicated to reflection and discussion. This is the primary adjustment I would make to
future iterations of the program. Critical pedagogy promotes critical thinking and the
shifts in perspective which are central to the cultivation of ecoliteracy. I believe that
interns would be better equipped to critique dominant systems, dismantle systems of
oppression, and adopt new worldviews should critical reflection and discussion have been
a more prominent part of the internship program. Were I to lead the internship again I
would prominently feature Indigenous voices such as Kimmerer and Nelson, and
intentionally engage critical pedagogy through critical reflection and discussion. As
action research is iterative, future iterations of this internship would further develop not
only the data as related to the cultivation of ecoliteracy, but also the program itself as an
LGL offering.

Recommendations for Further Research

This study highlighted the lack of and need for empirical research in the field of
sustainability education and around learning that supports the cultivation of ecoliteracy in
higher education settings. Further research is needed to explore how education can
promote the cultivation of ecoliteracy in adults. Specifically, an increase in shared
knowledge is needed around curriculum design and pedagogy that promotes ecoliteracy
and sustainability, as well as a deepening in understanding around garden-based learning
in post secondary settings. However, knowing “something of the speed of the crisis that is
upon us” (Orr, 1992, p. 93), I vehemently suggest that research in this field be centered in
action, not confined to theory. Action research stacks functions, to use a permaculture
concept, and in the context of cultivating ecoliteracy through garden-based learning, the
potential yields are numerous. Not only may knowledge be generated that contributes to
the field of ecoliteracy and sustainability education, students may also gain practical
gardening skills and develop ecoliteracy while producing edible crops, activities which contribute to the development of sustainable food systems, and ultimately feed people.

**Recommendations for Ecoliteracy Education**

I implore educators working at all levels of education in all disciplines to bring an ecoliterate perspective to their practices, and, ideally, to lead students outside, into nature and into the local community. While I agree with the aforementioned sentiment that time and resources need not be spent attempting to change the minds of those with no desire to change, I also recall one intern stating that the LGL internship was something that they did not know they needed, but in the end, it impacted their life path. This statement lingers with me and suggests that even those not drawn to gardening, ecology, or sustainability studies can benefit from exposure to related concepts and experiences. Further, as the ecological, environmental, economic, and social problems we collectively face are complex and interconnected, so are the solutions. Ecoliteracy is necessary for all individuals in all fields; education for ecoliteracy must become ubiquitous in education at every level.

The results of this study conclude that ecoliteracy can be cultivated in adults through holistic garden-based learning. The cultivation of ecoliteracy is supported by the development of relationships in the three thematic categories that emerged through analysis of the data. First, interpersonal relationships and community development may be facilitated through engaging a cohort model, incorporating project-based group work, fostering collaboration, and promoting student decision making. Second, learning from nature and through relationships with place, land, and more-than-human beings may be supported by garden-based learning, the development of ecological knowledge and
observation skills, as well as through fostering attitudes of stewardship and care in the learning environment. Third, (re)establishing intrapersonal relationships, most notably the reintegration of the “four modalities of thinking, feeling, sensing and intuition” (Harding, 2012, p. 92) may occur through validating learners' intuition and ways of knowing beyond the intellectual. For education to promote sustainability it must be sustainable; ecological learning occurs in context and through the experience of being in relation. Thus, the learning environment and role of the facilitator are of paramount importance; both must model the central concepts of ecoliteracy. Ecoliteracy development is supported by place-based experiential learning, critical pedagogy, and transformative sustainability education theories. The central competencies of ecoliteracy—knowledge, caring, and practical competence—may develop through experiential, garden-based learning supported by related conceptual learning. Thus, garden-based learning offers the ideal educational paradigm through which transformative ecoliteracy education may occur.

**Conclusion**

This study was an exploration of ecoliteracy development through garden-based learning in the context of higher education as facilitated by the intervention of a new internship program at Portland State University’s Learning Gardens Laboratory. The results of this study established that relationships and relational learning are critical to the development of ecoliteracy in adults. The cultivation of relationships—interpersonal, intrapersonal, and with more-than-human beings—represented the central outcome of the internship and the primary process through which learning occurred. Further, ecoliteracy development was fostered through holistic learning, where theory and practice were
interwoven, and interns’ emotions and intuitive capacities were engaged. While these results emerged directly from the data, they also represent a logical conclusion: Ecology is inherently relational, and ecoliteracy is holistic—simply described as the combination of knowing, caring, and practical abilities. These competencies were cultivated through the internship program. In addition, the data concluded that all interns experienced an increase in practical gardening skills. The results of this study aligned with the literature and confirmed that learning gardens are indeed transformative spaces (Clavin, 2012) that support the cultivation of ecoliteracy (Capra, 2001; Gaylie, 2009; Subramaniam, 2002).
References


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A holistic framework from the places in which we live.


Appendix A: Recruitment Email

Learning Gardens Lab Summer Internship Program: Ecoliteracy and Food Production

Program Description

This 8 week summer internship will take place at the Learning Gardens Lab (LGL) in southeast Portland (6745 SE 60th Ave, Portland) over the weeks of June 22nd through Aug 14th, 2021. This experiential, garden-based summer internship program is focused on holistic development of ecological literacy and practical gardening skills and knowledge through hands-on engagement at LGL supported by weekly readings and reflective and contemplative practices.

Interns will steward beds in the PSU student plot, working in pairs with support from program leads to develop understanding about how to care for and harvest their crops, and to design and implement a planting plan for fall harvest and overwintering crops. The veggies, herbs, and flowers grown in this plot will be harvested by interns on Tuesday mornings - we’ll wash produce and prepare a donation for the PSU Food Pantry, plus small shares for participants to take home.

As daytime temperatures can be high in the summer, group work times supported by program leaders are scheduled for Tuesday mornings (harvest day), Thursday mornings, Thursday evenings, and alternate Saturday mornings. Interns must be able to commit to joining at least one Tuesday or Thursday work time for at least 6 of the 8 weeks of the program. Additionally, interns may care for their plots independently during other regular LGL volunteer hours and may have the option to continue stewarding their plots through the summer by joining LGL volunteer hours. All tools, seeds, and starts will be provided by LGL as available.

In addition to hands-on plot stewardship, interns will be invited to deepen their learning/participation by keeping a garden journal, developing a weekly garden-based mindful observation practice, and engaging with (short) weekly readings, reflective writing prompts, and casual discussion.

Participant information

This program is open to all PSU students. Gardening/farming experience is not required. This internship is unpaid and there is no fee to participate. As is, this is a non-credit internship, though credit may be possible with approval. If you are interested in earning PSU credit for this internship please make a note of this on your application.

Space in the program is limited. Depending on the level of interest, priority may
be given to students nearing graduation. Priority will also be given to students able to commit to joining at least one Tuesday or Thursday work time for at least 6 of the 8 weeks of the program (June 21 - August 15). If you are interested in participating but none of these days/times work for you please apply and note your availability. Please apply using this form (link here) and reach out to Shevawn@pdx.edu with any questions.

Covid Considerations
Learning Gardens Lab follows PSU policies regarding Covid-19 and student engagement. At this time, masks and physical distancing are required during participation at LGL, and all activities take place outdoors.

Research Component
This program will be led by Shevawn Armstrong as part of a master’s thesis research project, with support from the LGL staff members and Lab Manager Luke Maurer, as well as the LGL faculty coordinator, Heather Burns. Shevawn is a student in the Leadership for Sustainability Education program and is the Community-Based Learning Coordinator at LGL. This iteration of an LGL internship program was designed as the action (or intervention) portion of a grounded theory action research study, which is currently pending approval from PSU through the IRB and Return to Research application processes. Should the study be denied approval, the internship program will go on without the research component. As is typical of an action research study, both the internship program and related research will be led by Shevawn, with oversight from Heather Burns and Luke Maurer.

To support the research, interns will be asked to complete a short survey with open-ended questions about their internship experience towards the end of the program. Interns may choose to answer these anonymously. Interns may also be invited to participate in a short one-on-one interview with Shevawn. Researcher observations will also be collected, and participant program applications may add to the data with participants’ consent. Collected qualitative data will be used in a master’s thesis and could be published academically or otherwise. Participants will be asked to review and complete research consent forms, which will outline data collection methods, as well as the right to withdraw consent, in greater detail. Your part in this study is voluntary. You do not have to take part in this study, but if you do, you may stop at any time. You have the right to choose not to take part in any study activity or completely stop at any point without penalty.
Appendix B: Program Application

Learning Gardens Lab Summer Internship Program: Ecoliteracy and Food Production

Name:

Pronouns:

Email address:

PSU Program:

Expected graduation date:

Why are you interested in this program?

What do you hope to learn through this summer internship experience?

What does ecoliteracy mean to you?

Briefly describe any previous engagement with Learning Gardens Lab:

Briefly describe your gardening/farming experience (none is okay!):

What fruits or vegetables would you love to grow (and/or eat)?

Which group work sessions would you join? (check all that apply)

- Tuesday mornings [ ]
- Thursday mornings [ ]
- Thursday afternoon/early evening [ ]
- Alternate Saturdays [ ]

Notes on availability:

Is there someone also applying to the program who you’d like to be partnered with?

Do you have any questions or concerns?
Appendix C: End of Program Survey

Learning Gardens Lab Summer Internship Program: Ecoliteracy and Food Production

1. Name (optional):
2. What did you like about this internship and/or what did it mean to you?
3. What are the key concepts that you learned through this internship?
4. What are the primary skills that you learned through this internship?
5. What does ecoliteracy mean to you?
6. Has this internship affected your relationships with LGL, the land, humans, or more than human beings? Please explain:
7. Please comment on the structure of this internship program:
8. Please comment on the texts that were chosen for this internship:
9. Please comment on the supporting practices included in this internship program, such as your weekly garden-based mindful observation practice, and reflective writing:
10. Please share any feedback about program leads and/or LGL staff:
11. What suggestions do you have for the LGL internship program?
12. Do you have any additional comments or feedback?
13. Are you open to answering follow up questions in an individual interview with Shevawn?
Appendix D: Interview Questions

Learning Gardens Lab Summer Internship Program: Ecoliteracy and Food Production

1) Tell me about your internship experience: (including what worked for you and what was challenging or didn’t work for you)

2) Describe a few of the relationships (with place, humans, or more than human beings) that changed or developed over the course of this program:

3) How has your gardening knowledge and skills changed during this internship and what do you think impacted these changes? Can you tell me a story that highlights what you learned about how to grow food?

4) How would you describe your own ecoliteracy? How has your ecoliteracy evolved over these 8 weeks? Is there a story or situation that highlights this?

5) What suggestions do you have for the LGL internship program?
Appendix E: Consent to Participate in Research

Project Title: Learning Gardens Lab Internship Program: Ecoliteracy and Food Production

Population: PSU student interns at LGL/survey & individual interview

Researcher: Shevawn Armstrong, Education Leadership & Policy, PSU

Researcher Contact: shevawn@pdx.edu / 971-276-7776

You are being asked to take part in a research study. The box below highlights the main information about this research for you to consider when making a decision whether or not to join in the study. Please carefully look over the information given to you on this form. Please ask questions about any of the information you do not understand before you decide to agree to take part.

Key Information for You to Consider

Voluntary Consent. You are being asked to volunteer for a research study. It is up to you whether you choose to take part or not. There is no penalty if you choose not to join in or decide to stop your involvement. You may choose to participate in the internship and not participate in the research.

Why is the study being done? The reason for this research is to better understand how a Learning Gardens Laboratory (LGL) garden-based internship program can be designed and implemented for PSU students to best support the development of ecological literacy and practical gardening/food production skills.

How long will it take? Your participation should last the duration of the LGL internship (eight weeks: June 22 - Aug 14, 2021, 3 to 9 hours per week as your schedule allows), plus the possibility of an additional 3 months for optional follow-up questions.

What will I be expected to do? You will be asked to participate in the LGL summer internship program and complete a survey and optional interview about your experience. The internship includes hands-on gardening (you will likely plant seeds and starts, spread compost/mulch, remove weeds, harvest vegetables and flowers), as well as weekly reading, reflective writing, and garden-based mindful observation practices. No individual task is required and all participation is voluntary.

Risks. Some of the possible risks or discomforts of taking part in this study include the possible discomfort of talking about your experience in the internship program, the risks of invasion of privacy and loss of confidentiality and mild inherent risks of light physical exertion related to gardening. This study is low risk.

Benefits. Some of the benefits that may be expected include increased knowledge and practical gardening skills, as well the benefits of time outdoors and growing and eating fresh produce.
What happens to the information collected?
Information collected for this research will be used to support the evolution of the LGL internship program, as well as being used in a master’s thesis, which could be published academically or otherwise. Identifiable information (such as participant’s names) will not be included.

How will my privacy and data be protected?
We will take measures to protect your privacy including the use of participant codes to label data instead of using names, keeping a separate list of code-to-name match-ups, and not collecting unnecessary identifiable data. Despite taking steps to protect your privacy, we can never fully guarantee that your privacy will be protected. Individuals and organizations that conduct or monitor this research may be permitted access to inspect research records. This may include private information. These individuals and organizations include the Institutional Review Board that reviewed this research.

What if I want to stop my part in this research?
Your part in this study is voluntary. You do not have to take part in this study, but if you do, you may stop at any time. You have the right to choose not to take part in any study activity or completely stop at any point without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to join in will not affect your relationship with LGL, the researchers, or Portland State University.

Will it cost me money to take part in this study?
This internship program is open to all PSU students and there is no fee to participate. All tools, irrigation supplies, amendments, seeds, and starts will be provided, as available at LGL. Participants are responsible for their own transportation to and from LGL.

Will I be paid for being in this research?
This internship and related research are unpaid, though a small weekly share of the produce harvested through participant efforts will be made available for each to take home (subject to availability and pickup logistics).

Who can answer my questions about this research?
If you have questions, concerns, or have experienced a research related injury, contact the research team:

Shevawn Armstrong
971-276-7776
shevawn@pdx.edu

Who can I speak to about my rights as a part of research?
The Portland State University Institutional Review Board (“IRB”) is overseeing this research. The IRB is a group of people who independently review research studies to
ensure the rights and welfare of participants are protected. The Office of Research Integrity is the office at Portland State University that supports the IRB. If you have questions about your rights, or wish to speak with someone other than the research team, you may contact:

Office of Research Integrity  
PO Box 751  
Portland, OR 97207-0751  
Phone: (503) 725-5484  
Toll Free: 1 (877) 480-4400  
Email: psuirb@pdx.edu

Consent Statement
I have had the opportunity to read and consider the information in this form. I have asked any questions necessary to make a decision about my taking part in the study. I understand that I can ask more questions at any time.

By signing below, I understand that I am volunteering to take part in this research. I understand that I am not waiving any legal rights. I have been provided with a copy of this consent form. I understand that if my ability to consent for myself changes, either I or my legal representative may be asked to provide consent before I continue in the study.

I consent to join in this study.

<table>
<thead>
<tr>
<th>Name of Adult Participant</th>
<th>Signature of Adult Participant</th>
<th>Date</th>
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Researcher Signature (to be completed at time of informed consent)
I have explained the research to the participant and answered all of his/her questions. I believe that he/she understands the information described in this consent form and freely consents to participate.

<table>
<thead>
<tr>
<th>Name of Research Team Member</th>
<th>Signature of Research Team Member</th>
<th>Date</th>
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</thead>
</table>