Outside Lies Learning

LANDSCAPE ARCHITECTURE AND PRINCIPLES OF EDUCATIVE DESIGN

IslandWood

Mercer Slough Environmental Education Center

Cedar River Watershed Education Center

Jason Medeiros

MLA Thesis 2011 | University of Washington Department of Landscape Architecture

OUTSIDE LIES LEARNING

Landscape Architecture and Principles of Educative Design

Jason Archer Medeiros

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This is to certify that I have examined this copy of a master's thesis by

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and have found that it is complete and satisfactory in all respects,
and that any and all revisions required by the final
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University of Washington

Abstract

OUTSIDE LIES LEARNING
Landscape Architecture and Principles of Educative Design

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Current educational research demonstrates the significance of learning that takes place outside of the classroom, not simply for reinforcing that which we learn in school, but for establishing patterns of motivation and curiosity that enrich our lives for years to come (Bell, et al 2009). This research and critique thesis examines the interplay between learning environment and learner, with the intention of informing the design of informal spaces for education. Lessons learned from empirical research in education and museum design are combined with an analysis of the abundant but less scrutinized literature in landscape architecture. This literature review generates a list of Principles of Educative Design, useful for the creation of learning spaces across many venues and offering general strategies for engaging the mind, sparking curiosity and inviting investigation.

Application of these principles to case studies of three environmental learning centers (ELCs) in the greater Seattle area–Cedar River Watershed Education Center, Mercer Slough Environmental Education Center and IslandWood–revealed patterns of success and challenge in educative design. Several principles exposed shared weaknesses in the designs of the centers. Challenges were evident for the inclusion of both self directed and teacher directed learning opportunities, and balancing free play with protection of the environment. Three principles were identified as 'high performance', offering significantly greater breadth and depth of opportunities to support educational experiences. These 'high performance principles' largely address emotional and cultural connections, the more affective processes of learning. Results encourage further research into educative landscapes and applications for overlap between education, museum design and landscape architecture.

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EXECUTIVE SUMMARY

In his book: *Outside Lies Magic: Regaining History and Awareness in Everyday Places,* John Stilgoe (1998) advises us to look for the seed of inspiration and wonder in the out of doors. This investigation goes a step further in asking how design can help reveal just a little bit more of that magic: what strategies and principles can designers use to help inspire and engage the heart *and* mind? Research shows that significant learning takes place with families and peer groups in between and outside of classrooms. In particular, designed learning places such as museums and zoos support motivation and interest for life long learning (Falk and Dierking 2000, Bell et al 2009). The same studies openly address landscape architects and other designers of the built environment, asking that they weave educational intention into their designs, supporting efforts of learners both in and out of school.

This thesis explores ideas in educative design, the creation of any place built to inspire, to teach with, or to be explored with a learning objective in mind. Learning is defined here in terms of actions to be supported by elements on educative landscapes, illustrated in the Learning Cycle for Educative Design (Figure 2.2). Also proposed are ten Principles for Educative Design (Figure 8.2). Derived from the analysis of theory and empirical studies in three disciplines–education, museum design and landscape architecture–the Principles of Educative Design stand as research based guidelines for the creation and critique of places for learning.

These principles guide the critique of three environmental learning centers in the greater Seattle area–Cedar River Watershed Education Center, Mercer Slough Environmental Education Center and IslandWood–each designed to embody the threads of their educational mission and demonstrating landscape architecture's goals of revealing ecological process and connection to place. Data collection for the case studies involved interviews of members of the design teams and several long term staff members at the learning centers themselves. These,

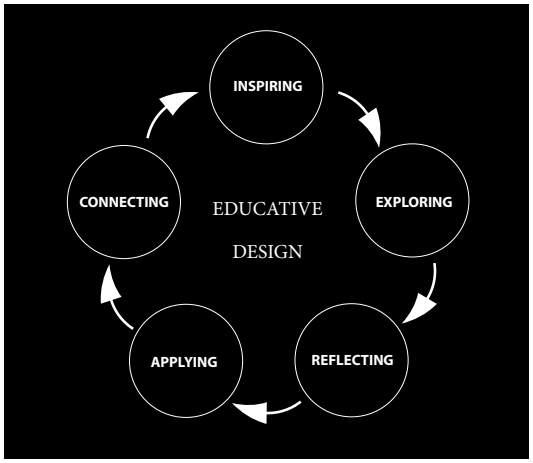


Figure 2.2: Learning Cycle for Educative Design

Inspiring: Experiencing excitement, interest, and motivation to learn about phenomena in the natural and physical world.

Exploring: Manipulating, testing, experimenting, predicting, questioning, observing, measuring with the intent of making sense of the natural world

Reflecting: Deriving general principles, patterns, relationships from observation; 'making sense of'

Applying: Retesting ideas in new situations, trying things out

Connecting: Making meaning, linking ideas with identity, culture, prior knowledge

PRINCIPLE		DESCRIPTION	EXAMPLES
1	**STRIVES TO INSTILL WONDER**	*Provokes positive emotional connection and drive to investigate. Interest extends beyond immediate reaction.*	*Natural Beauty: Butterfly wings* *Power and Awe: Volcanoes* *Magical Phenomena: Magnetism*
2	**PROVIDES MANIPULABLE/ INTERACTIVE ELEMENTS**	*Easily altered by observer to create interesting effect. Allows for prediction/problem solving.*	*Controlling water flow, Changing shadows and shapes, Building & constructing, Gardening*
3	**ALLOWS FOR OBSERVABLE CHANGE/COMPARISONS**	*Distinct differences in variables, possibly revealing cause/effect relationships.*	*Sun Dial, Windmill, Solar cells w/ volt meter, Rain gauge, Ecological processes*
4	**BALANCES CLARITY AND MYSTERY, NOVELTY AND THE FAMILIAR**	*Easily understood educational intent. Easy to navigate, with 'previews' of what's to come.*	*Repetitive themes, Orientation/Interpretive signage, Winding paths, Peakaboo veiws, Landmarks, New takes on familiar ideas*
5	**SUPPORTS SELF DIRECTED LEARNING**	*Visitor can initiate and lead self through discovery. Multiple levels of sophistication.*	*Skate boards and ramps for physics learning, Using familiar situations to extend understanding*
6	**SUPPORTS TEACHER FACILITATED LEARNING**	*Affordances for gathering & presenting. Opportunities for individuals to share. Multiple levels of sophistication.*	*Seating Walls, Amphitheaters, Connections to more abstract or specialized curriculum*
7	**CREATES MULTI-LAYERED EXPERIENCES**	*Diverse, vivid approaches to promote cognitive and embodied learning.*	*Zoo/Aquaria exhibits that extend beyond the animal enclosure:* *'visitor immersion experience'*
8	**INVITES COLLABORATION**	*Affordances for two or more people to observe or explore together.*	*Bird blind with multiple viewing windows.*
9	**INVITES PLAY**	*Free choice, few rules, no pressure to perform. Fun.*	*Playground equipment/atmosphere, Ease of movement/exit/entry between stations or experiences*
10	**PROVIDES SOCIAL/CULTURAL RELEVANCE**	*Connected to larger themes. Significant w/in personal, regional, or global context.*	*Narrative Stories, References to culturally significant or familiar elements, Stewardship opportunities, Family participation*

Figure 8.2: Principles of Educative Design

combined with my own observations and site visits, are used to help refine the Principles of Educative Design and to reveal practical challenges and opportunities in the design of educative landscapes.

FINDINGS

The literature review found clear overlap between landscape architecture and research in education and museum design. The resulting Principles of Educative Design represent a practical tool, bridging these disciplines and providing an empirical basis for the theoretical work in landscape architecture. Application to case studies revealed links between all ten principles and successful aspects of the centers' designs. The study also revealed patterns within the ten principles. Designs of all three case studies struggled with principles 2, 5 and 9 (Figure 8.2), those related most closely with cognitive aspects of the learning cycle (Figure 2.3–Exploring, Reflecting, and Applying). While the principles 1, 4, and 10 (Figure 8.2), associated with affective learning (Figure 2.3–Inspiring and Connecting) demonstrated particularly high performance in support of educative design.

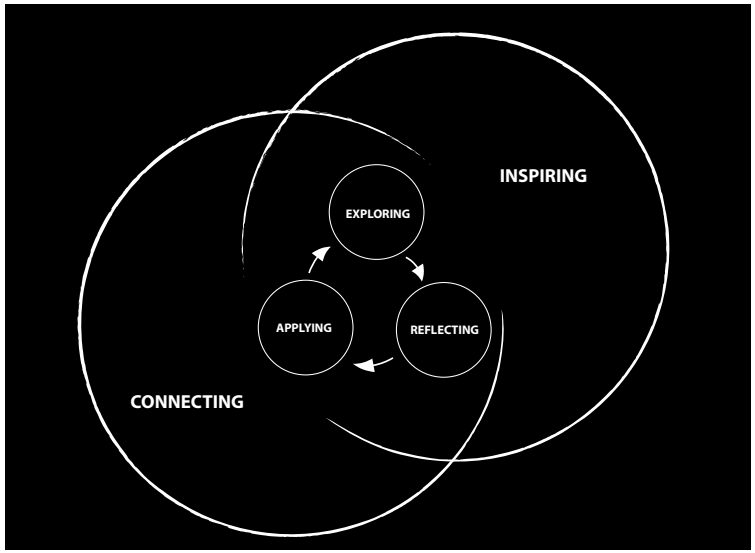


Figure 2.3: Cycles of Affective and Cognitive Learning
Connecting and Inspiring represent cycles of Affective Learning, while Exploring, Applying and Reflecting are activities more closely linked with Cognitive Learning.

These results support prior research in museum literature demonstrating the power of design to foster positive emotional connections and reinforce previously learned topics (Falk and Dierking 2000, Bell et al. 2009). Results also suggest that the designers in these case studies already access several of the high performance principles in their professional philosophies. The efficacy of these principles must not be overlooked; however, significant growth and improvement may result from examination of strategies for supporting more cognitive aspects of learning. This breakdown of challenge and opportunity in the ten principles is further illustrated in the conclusion of this document by summaries of universal challenges and key strategies for success in educative design. Tables 0.1 and 0.2 below give a cursory treatment of these summaries, with a more complete discussion offered in Chapter Eight.

Table 0.1: Universal Challenges for Educative Design
Balancing fragility and public interaction–Too much sharing equals broken toys. High volumes of visitors can damage ecosystems and other fragile elements in an educative landscape. This can restrict access to otherwise engaging and interactive experiences.
Degree of specificity–When does educative design become esoteric design? There can be great challenge in identifying the proper level(s) of sophistication for a given user group. Which details will most efficiently connect with an audience, and which may be wasted?
Competing Messages–Clutter versus communication? Interpretive signage may appear overly didactic, prompting a negative response from visitors. However removal of signs limits the depth of accessible information and self directed learning opportunities.

Table 0.2: Strategies for Success
Focus on affective learning
Design to interpret place
Coherence: Simple messages are powerful
Design to be: "*Perforated and Penetrated", "Folding and Unfolding"*
Provide views both out and in
Enable transcendent experiences
Resonate on multiple scales
Tell stories
Capitalize on the novel and the familiar
Create spaces large and small

PREFACE

My path to Landscape Architecture has not been a short one. Most of my professional life I've worked as a teacher, a career I stumbled upon as a graduate student in ecology at UC Berkeley in 1999. I spent the next eleven years using wit, creativity, and my science background to inspire students to explore the world around them, taking them on adventures both within and beyond the walls of the classroom. This thesis work and my time in the University of Washington Landscape Architecture program represent my own exploration into the creation of learning environments, those spaces placed within our everyday experience that speak to our curiosity, call to our sense of wonder, and bring stories to our imagination.

I first began thinking about educative landscapes, as I've grown to call them, as a tool for supporting classroom science education. As a natural extension of my interest in teaching science in the outdoors, I began to imagine designing spaces that would do this with or without the aid of a teacher. At the time I was working for an outreach program called Family Science, a National Science Foundation funded venture dedicated to helping parents support their children's science learning at school and at home. This program was based upon the philosophy that a child's environment outside of school plays a vital role for their success in science education and the development of a lifelong appreciation for learning. This could involve simple support and encouragement from the family, or any breadth of positive experiences that give context and value for future science learning. I imagined educative landscapes as places where this would happen: public spaces where intentionally shaped clues and play structures would prompt science discussions among family and friends and plant ideas that may one day sprout into rich and complex theories.

This concept was exciting for me because it moves the sole onus and ownership of the transfer of knowledge away from the hands of schools and the teacher. Families and students become both learners and teachers. Instead of just receiving information from a teacher or text book, students have a chance to own knowledge, make discoveries, and share them with their families and friends. Such opportunities diversify the learning unit to include small peer groups, families, and the traditional class, creating the possibility for an entire community to show interest and support for science education. This phenomenon is already encouraged and cultivated at institutions such as science centers, zoos and aquaria, places I was lucky enough to frequent as a child. However, these experiences do not come without a price tag and at least in Seattle become largely unattainable to lower income populations due to entrance fees and transportation (Personal Communication, Family Science Director Amy Hale, 2004). I began to envision the placement of educative landscapes on or adjacent to school grounds in poor and struggling neighborhoods as a potentially powerful step towards equality in science education for Seattle Schools.

Part of my work with the Family Science Program was to run the science fair at Aki Kurose, a public middle school that happens to sit adjacent to the thirteen acres of Brighton Park. Seeing an opportunity to

combine the mission of my organization–to share science with families and community–with my thoughts and interests in designing learning spaces, I began fund raising to create Brighton Science Park: a playground for the mind and body (Figures 0.1 and 0.2). I described this as an opportunity for students to 'show off' their knowledge of science with creative designs, and for the community to respond and demonstrate their support for their childrens' science education. The response was remarkable and gained support from the principal, four teachers, district science coaches, the Parks Department, and several community arts and education nonprofits. The project was awarded $100,000 via the City's 2006 ProParks Opportunity fund and $100,000 from the United Parcel Service. It was designed and constructed with the help of 400 community volunteers, 60 students, and the afterschool programs at Aki Kurose Middle School and Graham Hill Elementary.

I mention this project for two main reasons. First, because its design and development raised the questions that inspired this thesis.

Figure 0.1: Brighton Science Park Physics Plaza skate feature

Figure 0.2: Earth on the Planet Track at Brighton Science Park

Second, because it demonstrated the use of the design process itself as a way to generate student learning. The exploration of the design process as pedagogy is a useful and fascinating one. Its power for connecting students to place and providing learning opportunities will be explored later in this volume via the work of Johnson and Skipton (2002), Taylor(1993), and Hart(1997), however its placement within the framework of education theory, a treatment which this concept deserves, becomes too broad for my thesis work here. It is worth mentioning, however, as an entirely different application of the creation of educative landscapes, one that is more process oriented than the equally significant form and object oriented exploration taken by this work.

At Brighton Science Park the bulk of my contribution, aside from fund raising and idea generation was in the charrette process, eliciting information and design ideas from the student population at Aki Kurose Middle School. My primary sources were two science classrooms, one sixth grade, and one eighth grade, for a total of 60 students. I visited

these two classrooms once a week for six weeks, walking them through exploration and mapping of the site, community needs assessments, and eventually designs and models which they shared at the Aki Kurose Science Fair. Every step was intended to reinforce some aspect of the science and geography curriculum taught by the staff supporting the Science Park. Techniques ranged from the simple, such as developing data tables for the community needs assessment or orientation on mapping activities, to the more complex: researching an area of science, creating 3D models demonstrating important principles of the discipline, and identifying how this design would inspire learning in its visitors. The process aimed to develop skills in communication, map making, data organization, and science subject knowledge and inspiration. In the end student work was used to inspire the design, however their involvement was as much a piece of an engaging science curriculum as it was a method to create the park itself.

I was able to exert some influence over the final design of Brighton Science Park, but most of the decision making was in the hands of the Seattle Parks Landscape Architect. Acting as a consultant, I was by no means idle and spent much of my time generating and exploring questions related to the design of the Science Park and educative landscapes in general, some of which were incorporated into the park, and some I continue to ponder and test in this thesis.

A number of my questions related directly to design solutions and school curriculum, specifically subjects I saw teachers struggling with in the classroom. I became particularly interested in how to help learners grapple with concepts of scale, things for which we have little context because they are beyond our realm of experience: the age of the Earth or the vast distances of astronomy. I also began to search for design solutions that allow visitors to experiment, manipulate, and engage with features of a landscape in a way that leaves the same activities open to others. Solutions to this problem can be found in many museum settings and gardens, but become more difficult to apply in settings that are unrestricted and completely open to the public like parks and open spaces. In addition to these, three questions in particular drove my interest in pursuing a Master's in Landscape Architecture, and my formal exploration of educative design:

1. Where is the wonder in design? Are there secrets or principles that help a design spur our imagination and inspire wonder and awe?

2. How can a design capture our curiosity, and drive us to explore, investigate and engage?

3. If learning occurs best when supported by communities, how can we best create spaces where all members of the community can learn? Are there principles for the design of educative landscapes that hold true regardless of age, group size, solo or teacher led investigation?

This thesis represents my attempt to place these questions in a researchable format, pulling on three disciplines of landscape architecture, education and museum design, and taking advantage of access to three local examples of highly designed places for learning: Cedar River Watershed Education Center, Mercer Slough Environmental Education Center and IslandWood. *OUTSIDE LIES LEARNING, Landscape Architecture and Principles of Educative Design* cannot completely answer all of these questions. It does however give form and direction to the discussion of how our built environment can best help the growth and development of the human mind, a topic I believe to be integral if not essential to the quest of all those who pursue great design.

CHAPTER ONE | INTRODUCTION

"Architecture, the built, natural and cultural environment, gives us many messages if we are ready and willing to read them. The material world of our environment represents the ideational world which embodies hidden and obvious messages of math, science, social studies, and art."

Anne Taylor The Learning Environment as a Three-Dimensional Textbook (1993, pg.105)

A better understanding of innate human curiosity, of how and why we learn, is central not only to effective education, but to landscape design as well. Both professions strive to inspire exploration and foster connection with the environment around us. Landscape design and planning stand as a gateway for ecological literacy (Spirn 1998, Howett 1998, Brown et al. 1998), controlling not only our everyday contact with nature, but framing our perceptions of how our built environment interacts with ecological systems (Nassauer 1995, Orr 1993, 1997, Howett 1998). Teachers strive to link abstract academic ideas to the real life environment beyond the classroom, often failing where cultural and economic conditions challenge traditional teaching practices. Informal learning spaces, those outside, in between, and surrounding our classrooms, provide flexible alternatives for teaching, learning, and social growth that are rarely embraced by school curriculum (Bell et al. 2009). Those who design and create our public spaces have a pivotal opportunity to support education in ways that cannot be confined to a classroom, to inspire curiosity and wonder, to reveal the magic that lies locked in the landscape around us.

This research and critique thesis examines the interplay between learning environment and learner, with the intention of informing the design of informal spaces for education. Sharon Stine coined the term *Landscapes for Learning* as the title of her 1997 book, describing outdoor environments for children and youth. Here I introduce the term educative landscape, and explore the subject more broadly as any place designed to inspire, to teach with, or to be explored with a learning objective in mind. These could be places built for teaching–a school garden with areas for teachers and students to gather and share. Or these could be places where visitors explore and discover on their own–exhibit based institutions such as museums, zoos, aquaria, and arboreta. Educative landscapes also take more subtle forms, revealed more casually in unexpected places of everyday infrastructure–roof eaves and awnings that draw our attention to water catchment systems, swales and ponds that belie the yearly pulse and flow of local hydrology, or artifacts left in the land that reveal natural or human made past. Be it through signage, placement in the land, transparent design, or some other quality, these educative landscapes somehow capture our attention, provide tools for investigation, or renew our perception of the world.

The concept of educative landscape is not new to the design profession. All of these examples, some more commonly so than others, regularly come across the studio desks of landscape architects and designers. Certain projects such as schools, museums, and interpretive

centers tend to be in the realm of specialists, however the landscape architect's more universal duty, to design places which embody and reveal their ecological and cultural history, has broad and deep roots in the history of the profession (Jensen 1956, Hester 1980, Spirn 1996, Howett 1998, Nassauer 1995). The idea of using the design of landscape to better connect people with the natural environment is evidenced in the work of Olmsted, Jensen and other regionalists in the early 20th century. In the 1970's, Hester articulated the concept of using design and planning to reinforce, even reengage a community's connection with place and local history (1980). Spirn (1998), Nassauer (1995), Orr (1993, 1997), and others ask us to design not only with ecology, but to reveal it so people may learn about and address society's struggling relationship with nature. The terms 'connect', 'reveal', 'reinforce' all apply here to educative landscapes, to designs that ply our emotions and pull on our psyches in hopes that we will realize more about ourselves and our world from the public spaces in our cities, towns and countryside.

This call to arms to engage the heart and mind with the landscape, in essence to learn, has been long and loud, but how are we doing? Is there research or literature to guide future design for educative landscapes? There is certainly a rich body of educational literature on learning itself, describing how the mind perceives the environment and takes in and processes information (Bransford et al. 2000). However there is less on how the design of the environment itself can influence this process. Museum design is often strongly influenced by education literature (Falk and Dierking 2000, Gutwill2008, Hein 1991); however there is less evidence for education research directly influencing landscape architecture. Research on the design of exhibits and museums has also produced empirical studies of its own and generated discussion on best practices for engaging the minds of museum visitors (Falk 2000, Gutwill 2008, Diamond 1999). Similar studies and critiques on engagement and teaching efficacy are much rarer in general landscape design literature. The 1998 *Eco-Revelatory Design Exhibition*, featured in Landscape Journal, does present an in depth exploration of how design can teach new connections with ecology and nature. Only one of the exhibits, however, Joan Nassauer's "*Urban Ecological Retrofit*", actually provides empirical evidence on the performance of an educative landscape (Nassauer 1995, 1998). The last two decades of the 20th century were marked by extensive interest in perspectives of children (Hart 1979, 1997), particularly in school design (Titman 1994), and the examination of learning and play (Brett et al. 1993, Stine 1997, Moore and Wong 1998). However rarely do these studies in landscape design tie into the parallel literature on education and exhibit design, missing an opportunity to borrow from their perspective and strong basis in empirical research. This thesis aims to take lessons learned from empirical research in education and exhibit design and combine them with an analysis of patterns and philosophy found in the abundant but less scrutinized typologies of learning in landscape architecture. From this literature I generate a list of Principles for Educative Design, useful for the creation of learning spaces across many venues: general strategies for engaging the mind, sparking curiosity and inviting investigation.

This study comes at a time when educational research is demonstrating just how important learning outside of the classroom is, not simply for reinforcing that which we learn in school, but for establishing patterns of motivation and curiosity that enrich and enliven our lives for years to come (Bell, et al 2009). This informal learning occurs with families, in social groups, amongst people of all ages–situations where knowledge

is built via collaboration–making us all learners and teachers alike (Bell et al. 2009; Stine 1997). Parks, landscapes, open spaces, places where people play, socialize and collaborate are all venues for informal learning and this model provides an excellent jumping off point for an exploration of how best to design the educative landscape. The investigation here will link landscape architecture and informal learning primarily in the areas of ecology and science. This connection follows naturally, given the profession's agenda for exploring and revealing ecological process, and science education's interest in demonstration and experimentation for exploring our natural world. A recent publication from the National Academy of Science entitled *Learning Science in Informal Environments: People, Places, Pursuits* (Bell et al 2009) calls for designers, schools, museums, informal educators, and families to work together, as each holds a vital role in the development of science literacy in our society. Given this charge, landscape architects have a particularly interesting and exciting responsibility to aid in the quest for a populace interested, educated and fascinated with science and the natural world.

Following this idea, and as a way of refining and testing this list of Principles for Educative Design, I will critique three designs, each intended to abet and inspire programs for environmental and ecological education in the greater Seattle metropolitan area. These designs are all for environmental learning centers, all of which profess similar missions in watershed and ecological education but posses different modes of interacting with the population (CRWEC School Programs 2010, Pacific Science Center 2010, IslandWood 2010):

- **Cedar River Watershed Education Center**: Visitor drop in and half day programs for 2nd-5th grade groups
- **Mercer Slough Environmental Education Center**: Visitor drop in and half day K-8 school groups
- **IslandWood**: Four day overnight program for 4th-5th grade, conferences, family and adult programs

These particular examples were chosen because their physical form, site planning and orientation attempt to embody the subject matter of their missions with the goal of heightening the learning experience for their visitors. Though some similarities with museums and exhibit driven institutions are evident, these designs are different in that they are largely outdoor, have free and open access, and rely more heavily on metaphor and narratives inherent in their designs than written interpretive material. These aspects allow their lessons to be more easily applied and transferred to an assortment of outdoor and public venues than those strictly applicable to museums, zoos and aquariums. The critique of these designs will take the form of a modified post occupancy evaluation, focusing on interviews with both designers and long term staff members, most having known these institutions since their inception. These case studies are meant to reveal connections between how the design world sees education and how educators see people interacting with their designs. There is an opportunity here to learn not only from the intentions of the designers, but from the evaluation, critique and desires of the teachers that observe these places on a daily basis.

In his book: *Outside Lies Magic: Regaining History and Awareness in Everyday Places,* John Stilgoe(1998) advises us to look for the seed of inspiration and wonder in the out of doors. This investigation goes a step further in asking how design can help reveal just a little bit more

of that magic: what strategies and principles can designers use to help inspire and engage the heart *and* mind? Through examination of literature and examples from three disciplines–education, museum design, and landscape architecture–I propose a working list of Principles of Educative Design. These principles will guide the critique of three environmental learning centers, each designed to embody the threads of their educational mission and demonstrating landscape architecture's goal of revealing ecological process. What begins here is a discussion not only of what makes an educative landscape, but of how these strategies can inform the field of landscape architecture in general. In designing for ecology, in capturing the essence of a place, all designers touch upon the curiosity and wonder we know to be human. They play with shapes and ideas that spur our minds and hearts to make meaning and take pause. Therein lies the magic; this is where the learning begins.

CHAPTER TWO | TERMS AND IDEAS

This chapter explores different aspects of learning, relating this term and other important concepts to space and design. Here, learning is defined in terms of activities, or functions, that a landscape or space can support. Other concepts such as a continuum from formal to informal learning are explored in terms of simple arrangement of space and objects within a landscape. Also discussed are aspects of learning in groups, and the difference between cognitive and affective modes of learning. Finally, in light of new and important terms introduced in this chapter, I revisit the relevance of landscape architecture and my choice of case studies for the investigation of educative design.

DEFINING LEARNING

Learning is a complex term, often defined by theorists in ways too broad or esoteric to be useful in terms of design. George Hein, in an address to the 1991 conference of the International Committee of Museum Educators offers a definition of learning that emphasizes action:

> *"Learning is an active process in which the learner uses sensory input and constructs meaning out of it…..learning involves the learners' engaging the world."*

Like Hein, I've found it useful to focus on learning as a process. In this way the designed environment supports a series of actions or states of being, all related to how we learn and engage with the world. These actions come together to form what I'm calling the Learning Cycle for Educative Design, depicted later in Figure 2.2. The ideas behind this diagram and the choices of activities draw heavily upon experiential education philosophies (Kolb 1984) and the description of informal science education in the National Research Council's study *Learning Science in Informal Environments* (Bell et al. 2009).

The Learning Cycle

The idea of a learning cycle comes directly from literature in experiential education, specifically, the work of David Kolb. Kolb introduced the *"experiential learning model"*, consisting of four activities

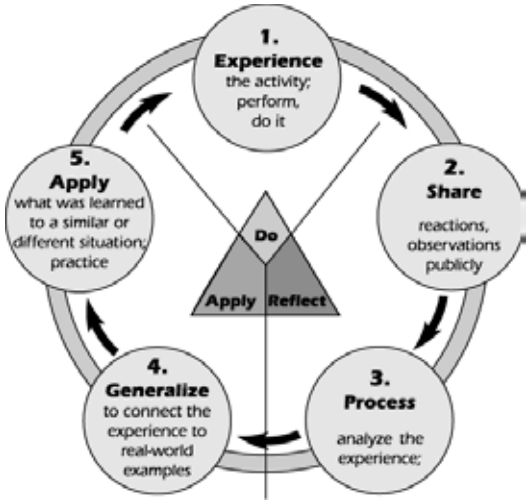


Figure 2.1: 4-H Experiential Learning Cycle
(source: 4-H Website 2010)

that contribute to the gaining of understanding and acquisition of new skills (1984). Kolb was interested in learning that takes place outside of classrooms in learning situations that require physical interaction with materials: the kind of situations one would expect to find on educative landscapes. Often referred to as the learning cycle, his work has become the foundation for a broad range of hands-on education programs, anywhere from 4-H clubs (Figure 2.1) to corporate business training programs. Adaptations of this model range from one to nine steps depending on the goals of the experiential education program. The descriptors of the activities involved also vary based upon program philosophies. The basis for them all however, is a reference to the cyclical aspect of learning, repeating activities which reinforce and inspire further exploration (Smith 1996).

Informal Learning

The comprehensive study *Learning Science in Informal Environments* specifically explores what learners *do* in informal learning environments, making it easier to relate a definition of learning for design (Bell et al. 2009). Based on conversations with scientists, educators, museum specialists and researchers, the authors delineate six *"strands of informal science"*, all of which are dictated in terms of actions:

"Learners in Informal Environments:

1) Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world

2) Come to generate, understand, remember, and use concepts, explanations, arguments, models, and facts related to science

3) Manipulate, test, explore, predict, question, observe, and make sense of the natural and physical world

4) Reflect on science as a way of knowing; on processes, concepts, and institutions of science; and on their own process of learning about phenomena

5) Participate in scientific activities and learning practices with others, using scientific language and tools

6) Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science." (Bell et al 2009, pg.43)

These six strands separate themselves out into two pieces, the first directly related to the learning cycle previously described, the second related to the culture of science and scientists. Strands two and three are distinctly related to *"experiencing"* and *"generalizing"* as described in the 4-H learning cycle, while Strand one presents the ideas of excitement and interest, emotions which would apply to initiating and sustaining the cycle itself. Supporting the mechanics of learning is important, but the motivation for entering the learning cycle to begin with must be considered. Especially in informal learning spaces, how do we design for activities or experiences that open us up, that cause us to wonder or drive our curiosity?

This question of interest and motivation is addressed by Bell et al. in terms of *"affective engagement"* or emotional connection, as opposed to *"cognitive engagement"* involving reasoning and thought (2009). The underlying feelings a learner has about a place, a subject or the circumstances of the experience highly impact not only motivation to learn, but understanding and retention of knowledge as well. The authors specifically rank informal learning spaces above school classrooms as

places supporting *"affective engagement"*. The freedom they allow for learners to dictate what and how a subject is explored, the safety to play and discover without judgment from an authority set the stage for positive emotions and associations that do not necessarily happen for all students in a classroom setting (Bell et al. 2009). The concepts of affective learning and cognitive learning will come up many times in the discussion of educative landscapes, referencing these different modes of engaging with new material and experiences.

The last three Strands of Informal Science Learning relate directly to science as a profession and cultural construct. They describe connecting with the "*culture of science*" through utilization of scientific vocabulary, understanding science as a process, and feeling confident and able to make a contribution as a participant in that culture. Informal environments help in this respect by demonstrating that science learning applies to a wide range of activities in a wide range of environments and social settings. The National Research Council describes the benefits of exposure to science over a wide breadth of experiences:

"....Learning experiences across informal environments may positively influence children's science learning in school, their attitudes toward science, and the likelihood that they will consider science-related occupations or engage in lifelong science learning through hobbies and other everyday pursuits."

(Bell et al. 2009, pg.305)

In this way, exposure to informal learning experiences in educative landscapes builds capacity for learning and appreciating science that transfers from one experience to the next. This capacity grows through inspiration, opportunities to explore and positive emotional connections with science and its role on society.

Learning Cycle–a diagram for educative design

Drawing heavily on Bell et al.'s *"strands of informal science"* (2009), I have developed a Learning Cycle for Educative Design (Figure 2.2). Each of the five activities in this learning cycle represent functions that landscape architects, architects and planners could support through careful and intentional design of space and infrastructure:

- **Inspiring**: *Experiencing excitement, interest, and motivation to learn about phenomena in the natural and physical world.*

- **Exploring**: *Manipulating, testing, experimenting, predicting, questioning, observing, measuring with the intent of making sense of the natural world*

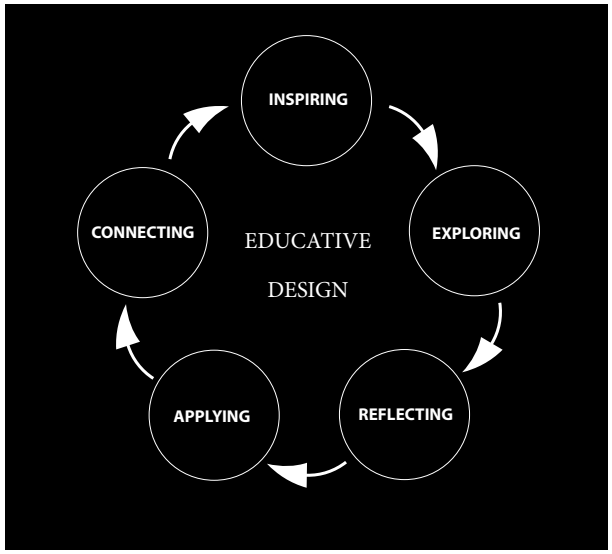


Figure 2.2: Learning Cycle for Educative Design

- **Reflecting**: *Deriving general principles, patterns, relationships from observation; the actual act of 'making sense of'*

- **Applying**: *Retesting ideas in new situations; trying things out*

- **Connecting**: *Making meaning, linking ideas with identity, culture, and prior knowledge*

Though presented in a circle, the activities in this learning cycle may not necessarily occur in this particular order, nor do they necessarily have to happen on the same site. The activities of Inspiring and Connecting may actually be more likely to occur after or before a visit to a educative landscape, as they deal directly with experiences, knowledge, and interests an individual carries with them. They represent the more affective aspects of learning. A visitor's interests are dictated by feelings, associations, and connections they've made before they arrive at a site, and these are also the things they will most likely carry away (Falk and Dierking 2000). Interests will dictate what sort of experiences an individual may seek out in an educative landscape (Bell et al. 2009), and any true inspiration that occurs would motivate the search for similar experiences in the future. These two activities of the learning cycle can operate on large spatial and temporal scales, making them more like meta-cycles that tie into and support the other three: Exploring, Reflecting and Applying.

Representing more of the cognitive aspects of learning, these activities deal more with how we accumulate and test our knowledge, a skill often associated with traditional views of education. Exploring, Reflecting and Applying come directly from Kolb's model and relate together sequentially, whereas Inspiring and Connecting could happen at any point within or outside of this smaller cognitive cycle. For designs where sequencing of visitor access is possible to control, utilizing the relationship between the activities–Exploring, Reflecting, Applying–could contribute to important design decisions, dictating the pace of exposure to new or more complex material.

Also important to note is that not all of these actions need to occur physically on the site, nor may they be immediately measurable or observable, even for the visitors themselves. A robust design will address all of these activities. Some however, like Inspiring and Connecting, and to a certain extent Reflecting, will occur more easily offsite; as research shows that forming deeper understanding and making connections between frameworks of knowledge takes time and often repeated exposure (Falk 2000, Blanford 2000). The difference in spatial and temporal scales for the activities related to affective learning versus those related to cognitive learning is illustrated in Figure 2.3.

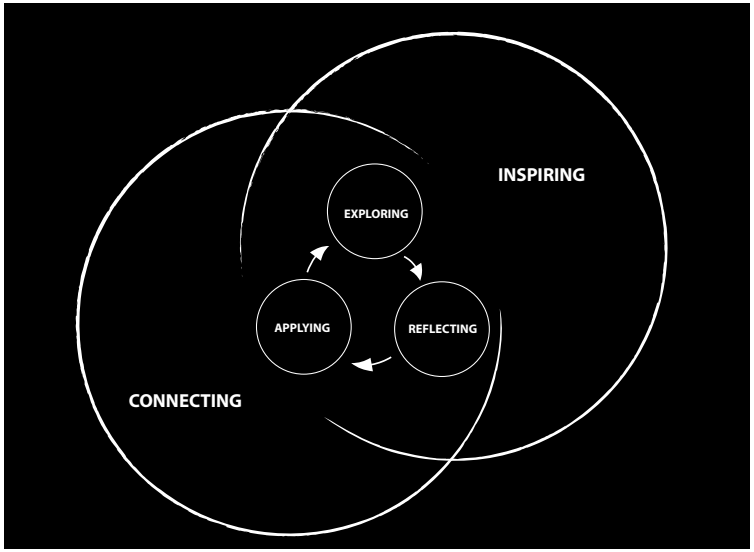


Figure 2.3: Cycles of Affective and Cognitive Learning
Connecting and Inspiring represent cycles of Affective Learning, while Exploring, Applying and Reflecting are activities more closely linked with Cognitive Learning.

An interesting approach may be to envision educative landscapes less as isolated experiences, and more as pieces of a larger network of learning environments. This utilizes the fact that people can learn in almost any space or place in their lives (Bell et al. 2009), and turns the designer into one who helps bridge and make connections between ideas, places, and experiences: between school and home, museum and playground, from formal to informal learning environments. Capturing the meta-cycles of Inspiring and Connecting, the educative landscape becomes both destination and stepping stone in peoples' larger educational experience.

CONTINUUMS IN EDUCATIVE DESIGN

Just as educative landscapes can act as stepping stones, reinforcing ideas across a range of learning environments, they can also create nodes of overlapping social activity, where different groups and settings work together in support of learning and education. A zoo that provides a place for both family and school field trips creates a venue where a student comes in contact with the same material in two different social environments. It is a place where the student can become the teacher, sharing lessons from school, and the family can lend direct social value to these lessons through interest and sharing of their own stories and knowledge. The overlap of different social groups through formal and informal learning at venues such as zoos, aquaria and museums gives these places particular power in bridging cultural gaps between school and family, science and society (Falk and Dierking 2000, Bell et al. 2009).

There is similar opportunity for the design of educative landscapes in parks, school grounds, waterfronts and other public spaces that attract a wide range of social groups. Designers of learning spaces need to be aware of the different factors conducive to learning in different social settings and take advantage of places that provide opportunities for these to overlap and combine. Different learning groups will require different design approaches, following continuums of group size, teacher involvement, and formal versus informal education.

Literature in education, museum design and landscape architecture discuss continuums from teacher directed to student directed learning quite regularly. Bell et al. (2009) distinguish between lessons structured by teachers and those driven by learners (Figure 2.4). This continuum is correlated with degree of choice and the structure of consequences for performance, essentially defining a trajectory from formal to informal education practices. Moore and Wong in their book on the "environmental schoolyard" in Berkeley, CA, describe a similar arc from *"non-formal"* (equating to play) to *"formal education"* (essentially

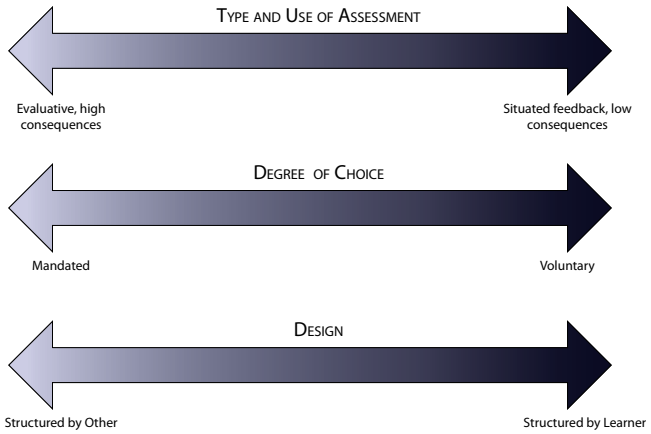


Figure 2.4: Continuum of Learning Environments
Adapted from Bell et al. 2009 Fig 3-2 pg. 47

classroom) based on the amount of teacher direction and prescribed learning outcomes (1997). Falk (2000) describes the same continuum using "free choice" to "teacher directed" as terms to compare museum environments to classrooms.

The implications for the design of learning environments along the teacher/student directed continuum depend largely upon the need to control group dynamics. Formal education and teacher directed activities require–at some point in time–all participants to be focused upon a teacher or a presenter. This type of learning environment benefits from spaces built for presentations, with opportunities for seating and easily defined boundaries. Spatial forms here are all meant to help organize and control the attention of a group. On the opposite end of the gradient, free choice, non-formal or self directed learning environments function quite differently in terms of spatial arrangement. In this case, the space needs to allow for freedom of movement, with multiple opportunities to engage and disengage as dictated by the interest of the user (Falk and Dierking 2000). This will be covered more thoroughly later in the section on museum literature. The important implication here is that different learning programs–teacher versus student directed and those in between–move through spaces differently, and design can heavily influence their success in a given space. This point is summarized by Figure 2.5.

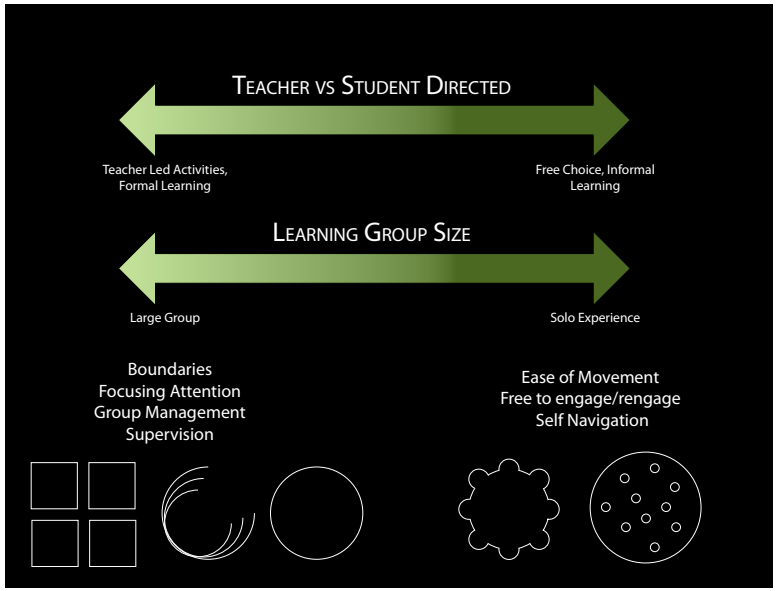


Figure 2.5: Continuums of Educative Landscsapes

Not as commonly discussed in museum design literature or education research is the continuum learning group size (also Figure 2.5). My own work as a classroom teacher has demonstrated the advantages of being able to split a large 25-30 student classroom down into smaller working groups of 3-5. This allows for different discussion dynamics and hands on access to equipment or materials that is just not possible in a larger group. Similarly, standard group size for hands-on learning environments such as outdoor and environmental education programs tends to be 10-15. A common practice in such programs is to split up for solitary reflection time–often referred to as a student's 'secret spot' or 'eagle roost' (personal observation). In the field or in a classroom, teachers like to find places or set up their spaces in a way that affords shifting easily from large to small groups. Design of all educative landscapes can benefit from this strategy, with or without the guidance of a teacher. Spaces for exploring, reflecting, and applying experience can be sized for individuals, couples, families, and birthday parties. Learning happens in different ways with different levels of friendship, closeness and familiarity with those around us (Bell et al 2009). Designers of educative landscapes can create opportunities and promote learning in a wide range of group sizes to enrich our social and mental engagement of the landscape. Table 2.1 outlines, based upon

Table 2.1: Sample Learning Group Sizes		
Group Size (k-12 students)	**Purpose**	**Space**
20-30	Normal class size group	25'x25' room, fire pit, amphitheater
10-15	Outdoor/Env. Ed. group	10'x10' shelter, fire pit
3-5	Small learning group	picnic table, exhibit table, nooks, benches
1-2	Solo/Paired reflection	corners, nooks, trees, window sills, view spots
75-150	All school/ program	amphitheater/ auditorium

my experience in schools, outdoor and environmental education, typical learning group sizes and some structures that accommodate them.

Much of the design strategy mentioned in this section relates directly to the organizing and movement of *groups* of learners. These are essential factors to consider when designing educative landscapes, given that learning in general is strongly connected to language and other social factors found in group settings (Vygotsky 1978, Bell et al. 2009, Bransford et al. 2000, Falk 2000). In the eyes of the designer, other learners should be viewed as part of the educative landscape itself, and the physical form of a space can either encourage or restrict interaction based on the desire for group vs. individual reflection and participation.

LANDSCAPE ARCHITECTURE AND INFORMAL LEARNING

This need for learning places to be two things at once, to be both destination and stepping stone, patch and corridor, makes landscape architecture an interesting and appropriate medium to address design questions in this area. Landscape architecture embraces the design of places with breadth and flexibility, similar to the way researchers define informal learning:

> *"...A great deal of science learning, often unacknowledged, takes place outside school in informal environments–including everyday activity, designed spaces, and programs–as individuals navigate across a range of social settings."*
>
> *(Bell et al. 2009, pg.293)*

Recognizing that learning occurs across such a wide range of social and physical settings lends educational significance to such simple and everyday actions as a walk to the bus stop or a conversation over dinner. Facets in the landscape, in museums, in urban infrastructure that promote questioning, experimenting or simply talking about science are now understood to contribute to all aspects of education (Bell et al. 2009). Though many have pled the case for decades, research now supports the power of learning not just as a class in a classroom, but as a family, an individual, and with peers (Bell et al. 2009).

Testimonials from top ranked science professionals, and a growing

body of research demonstrate the power found in places of informal learning, museums in particular. Leading scientists such as E.O. Wilson (environmentalist and Harvard entomologist) and Isabella Karle (x-ray crystallographer) describe experiences in museums and other informal settings as their original inspiration for following career paths in science (Bell et al 2009). Other research shows that museum experiences increase interest in science careers for young people, especially those at an age when they are defining lifelong interests and aspirations. However, the same research also shows that this impact wanes unless the experience is reinforced within six to eight months (Sachetello and Sawyer et al. 2002 in Bell et al. 2009). This suggests two options for action: get people back into museums, or make more places–more stepping stones for learning–that do the same job. By designing for learning, landscape architects enter into a powerful conversation with the educational community, forming a network to reach science learners in all formal and informal spaces where we live, work, and play.

SUMMARY

In summary, this study is concerned with the design of educative landscapes, those spaces outside, around and in-between traditional teaching venues. The discussion and case studies will not be restricted to, but will focus largely on science learning and environmental education because of their clear connections across the discipline of landscape architecture.

In addition to the five functions of educative landscapes, successful designs need to address a gradient of learning types and user groups, described by the continuums from 'free choice' to 'teacher directed' learning, and from 'solo' to 'group' oriented. This study deliberately avoids narrow examination of one age range, user group or static mode of formal vs. informal education. As will be shown in the literature review and case studies, spaces which successfully serve a range of user groups and learning modes help bridge divides between intellectual cultures (science and society) and social settings (school and family), providing a platform for collaboration and reinforcement of the social value of learning (Bell et al. 2009 and this document 2010). I am less concerned here with what works only for the 5th grade mind, and more so with that which is universal. That which inherently tugs on the strings of human curiosity and pulls us together in pursuit of understanding and making meaning of our natural world.

To this end, the selection of case studies deliberately encompassed sites which address a range of formal to informal learning, from individual to organized group experience. They are similar enough in mission and program to compare. Each addresses issues of ecology and sustainability through the basic concept of the watershed. Each, with varying degrees of priority, hosts organized formal programs for middle and elementary school groups, as well as less formalized adult and family programming. Their designs are meant to be tools for teaching, vehicles for discovery, and platforms for inspiration.

CHAPTER THREE | LITERATURE REVIEW

This chapter is largely literature review; looking for clues in theory and research from education, museum design and landscape architecture on how to best design for an educative landscape. This exploration of the literature, combined with discussions with Associate Professors Nancy Rottle and Julie Johnson of the University of Washington Department of Landscape Architecture (2009, 2010), and reflections on my own personal experience, generated a series of guidelines for the design of informal educational spaces: the Principles of Educative Design. This chapter covers their theoretical underpinnings in literature, and provides further explanation via diagram, example, and precedent. These ten principles form the framework for the critique and comparison of IslandWood, Mercer Slough Environmental Education Center, and Cedar River Watershed Education Center.

Despite the rich precedent in the design of schoolyards and children's learning environments, landscape architecture rarely addresses how the mind processes and develops understanding (Moore and Wong 1997, Stine 1997; Johnson 2000; Titman 1994). Learning is mentioned, but without in-depth references to the mechanisms that allow our minds to grow, develop and broaden. The first section of this literature review attempts to address this discrepancy by exploring education literature and theory in search of a stronger foundation for the design of educative landscapes.

The second section examines a profession expressly dedicated to the construction of learning spaces and places: that of museum design. This field overlaps with landscape architecture in its goals to create physical settings for interaction with concepts and ideas. Unlike landscape architecture, museum design has generated an extensive network of research and resources to improve their success as learning environments. Though the intricacy of the designs allowed by the museum environment may not transfer directly to landscapes, both serve a similar clientele, and, in the case of educative landscapes, have similar missions.

The third section of this literature review addresses the history of educative landscapes in the landscape architecture literature itself. Here I identify ideas and philosophies already overlapping with education and museum literature, and point out gaps where these other two disciplines may lend valuable insight into landscape design.

Each of these sections finishes with a summary of 'take home messages' practical for designers. The final portion of this review explains the Principles of Educative Design, linking them with the 'take home messages' from this literature review and offering practical examples of their application. As these principles encompass concepts inherent to the disciplines discussed in this chapter, some should seem intuitive to professionals operating within these fields. The strength of these principles lies in their ability to bridge and unite expertise from diverse bodies of literature, and at least in the case of landscape architecture, provide much needed grounding in empirical research. The Principles of Educative Design help translate abstract theories in learning and diverse research in museum design into practical guidelines for landscape

architects.

EDUCATION LITERATURE

Learning and the Mind

"Children are both problem solvers and problem generators; they not only attempt to solve problems, but they seek out and create novel challenges…"

Bransford et al. (2000, pg. 102)

The same inherent motivation to learn described by Bransford et al. speaks to the teacher and designer alike. Landscape architects strive to engage visitors in the exploration of a place much in the same way teachers hope to inspire their students. Knowledge about the origins and workings of the mind, the mechanics of why and how we learn, holds a central place in the training of our educators and could become a powerful tool for landscape architects.

Researcher's perception of how we develop understanding and make meaning of the world around us has changed greatly over the last century. Early perceptions of learning were largely concerned with connections between the mind and outside objects. Learning involved trial and error, connecting positive and negative outcomes to different interactions with aspects of the world (Bransford et al. 2000). More recent educational theories recognize that we live in a complex social matrix, and learning is influenced by our culture and what we already know (Bransford et al. 2000, Dewey 1963, Vygotsky 1978, Piaget 1985, Cavallo and Marek 1997). Learning is no longer defined as a trial and error process focused on external rewards, but an internally driven desire to solve problems and explore (Bransford et al. 2000). This current view of learning and education stems from three prominent thinkers: John Dewey, Jean Piaget, Lev Vygotsky. These individuals contributed to the development of Constructivism, a philosophy that has become central to modern curriculum development and museum exhibit design (Cavallo and Marek 1997, Bransford et al. 2000, Hein 1991, Falk and Dierking 2000, Bell et al. 2009). A closer look at the underpinnings of Constructivism reveals its applications for educative landscape design as well.

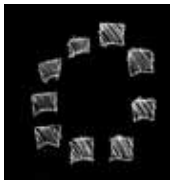
According to Constructivist theory, we attempt to incorporate all new information into our existing frameworks of understanding (Piaget 1985, Figure 3.1). Some information reinforces our existing frameworks, some forces our understanding to change in order to accommodate a new perspective. According to this theory, learning best happens in small increments because our frameworks do not change readily. Information that is too novel, that has no relation to pre-existing knowledge, is often dismissed or ignored as there is no context for our understanding (Piaget 1985). The frameworks described in Constructivist theory are not limited to academic information, but incorporate all we know about ourselves, our culture, society, and what we deem important, and all of these factors influence our motivation to learn (Dewey 1963). Significant points from this aspect of Constructivism include:

- Learning is incremental, it takes time, and repeated exposure (Bransford et al. 2000, Hein 1991).

- Learners approach situations with preconceived notions–oftentimes misconceptions (Bransford et al. 2000).

We understand the world through internal constructs of knowledge.

Ideas which stray too far from our internal constructs are often ignored or overlooked.



New knowledge is based upon that which we already know.

Learning involves changeing our internal constructs of knowledge to incorporate new patterns of information.

Figure 3.1 Constructivist Theory

- New information is quickly deemed irrelevant if it does not fit loosely into our current framework of knowledge and cultural value system (Bransford et al. 2000).

Educators often speak of trying to create *"cognitive dissonance"*, a term used by Piaget (1985) to describe situations that challenge the mental frameworks of a learner. Though one goal of teaching is to expose a gap in students' understanding, the experience must lie close enough to their boundaries of comfort and previous knowledge to be relevant. Designers of educative landscapes have a similar task and benefit from a solid understanding of cultural values and prior knowledge possessed by the learners they wish to engage.

The Social Nature of Learning

The need to connect what is learned with social norms, customs and values, is significant at many different scales. Culture not only refers to broad society, but to a classroom, a small learning group, a family or even two friends. Bell et al. (2009) explain the significance of the family unit in reinforcing and inspiring science education (Figure 3.2). Conversations and encouragement at home support confidence and curiosity at school, carrying over to other learning environments (Bell et al. 2009). Educative landscapes that encourage interaction and exploration on a family level extend this dynamic, possibly reinforcing goals for lifelong appreciation for learning, and increasing motivation to learn in other settings as well.

In a similar manner, service learning projects, where students work in groups on real world applications, create their own cultures that give relevance to activities and information involved. Environmental restoration or monitoring projects are highlighted by Boyer (2006) as powerful service learning tools. In their study, small groups of teenaged

Figure 3.2: Social norms often create motivation for learning.

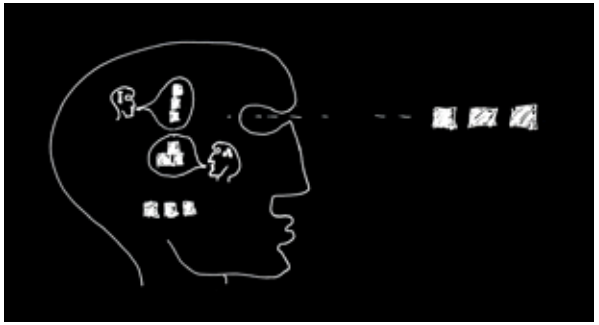


Figure 3.3: Reasoning is essentially an internal dialogue, and is inherently linked to language.

students worked on monitoring coastal eel grass beds. The participatory, group nature of the work created cultural relevance for science and ecology that would otherwise have seemed irrelevant to the students involved. Following this line of reasoning, service learning opportunities on educative landscapes–design, construction, maintenance or monitoring–can provide lessons and cultural connections during the activity. Possibly enhancing the motivation of participants to return, explore and continue to learn in the future.

The social nature of learning is believed by Vygotsky (1978) to extend deeper than cultural norms set by the groups we live in. His research demonstrates direct links between the use of language and the ability of our mind to reason (Vygotsky 1978, Ash and Wells 2006). According to Vygotsky (1978), reasoning is essentially an internal dialogue, and our ability to reason grows as we learn to use language and attach words and symbols to phenomena in the real world (Figure 3.3). Speech, internal or external, then becomes a necessary part of the learning process, and is even used by modern researchers as a proxy for learning itself. Different types of questions asked by students during learning activities, provide clues for researchers about cognitive thought and the learning process (Bell et al 2009, Boyer 2006).

Vygotsky also theorized that collaboration is often necessary, even imperative, for significant learning to take place (1978). He created the term *"zone of proximal development"* as an area of knowledge or understanding that an individual cannot achieve unless aided by another (Vygotsky 1978, Cavallo and Marek 1997). More specifically, Vygotsky found that learning best takes place in areas familiar but not expert to an individual (Vygotsky 1978, Cavallo and Marek 1997). This narrow zone of vague familiarity is where jumps in understanding best occur but only due to dialogue and interaction with another mind (Vygotsky 1978, Ash and Wells 2006, Figure 3.4)). The significance of this philosophy for educative landscapes lies in creating opportunities for people to interact and discuss shared experiences. This means making sure more than one person at a time can experience, observe or interact with a particular element, and creating spaces to observe and discuss what others are doing.

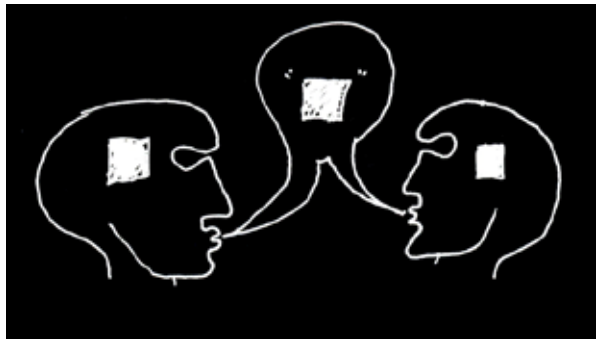


Figure 3.4: Learning is often more successful in collabortive settings.

Embodied Learning and Multiple Ways of Knowing

The educational theorists covered here–Piaget, Dewey, Vygotsky, Kolb–largely discuss learning in terms of information, understanding, and cognition: knowing based on reason and logic. The mid 1990's brought educational research on multiple ways of knowing, embracing understandings that extend beyond the cognitive mind into the realms of emotional and embodied or experienced learning (Yorks and Kasl 2002). This newer, phenomenological approach to learning takes into account the significance of how a place, movement of the body, or experience makes us feel, and how these factors contribute to our ability to remember, desire to return, and motivation to change aspects of our lives (Yorks and Kasl 2002, McClelland et al. 2002). These theories are represented in the definition of affective learning described in the last chapter, and by John Dewey's *"collateral learning"*, the *"formation of enduring attitudes, of likes and dislikes…[essentially] the desire to go on learning"* (Dewey 1963, pg. 48).

In a sense, embodied learning is already a facet of design. Landscape architects, by definition, pay attention to the experience of users as they move through a site. The presence of this discussion in education should be a reminder to designers of the power they command to influence the learning mind; that teaching with the landscape is much more than interpretive signage. Textures, movement, sounds, smells, and ambiance all send messages that can support or detract from the learning experience.

Also expanding the traditional perception of learning is Howard Gardner's theory on *"multiple intelligences"* (2006). Looking at case studies involving selective brain usage, autism, and prodigies, as well as a series of physiological observations and experiments, Gardner identified seven distinct *"intelligences"* used for problem solving in different areas. His first two, *"linguistic"* and *"logical/mathematical"* are favored by our current educational system, and traditional definitions of learning. The other five include abilities in *"music"*, "spatial relations", *"movement"* and *"interpersonal relationships"*. His current work suggests an eighth *"natural intelligence"* that involves connection and curiosity about the natural world (Gardner 2006). The creations of landscape architects–parks, landscapes and open spaces–inherently access multiple intelligences of their users, particularly spatial relations, kinesthetic and natural intelligences. Gardner's work, however, encourages designers to push even harder to increase the different ways users interact with the landscape. Artfully combining access to all of Gardner's intelligences will not only increase the range of personalities interacting with a landscape, but creates opportunities for visitors to discuss different perspectives on a shared experience, enriching opportunities for enjoyment and learning alike.

Curiosity, Wonder and Investigation

> *"Generally: Wonder is the state of mind that signals we have reached the limits of our present understanding, and that things may be different from how they look."*
>
> *Opdal (2001, pg. 332)*

Current theories on education place learning as central to the human condition. Learning, curiosity and wonder are innately part of our psyches, and we continuously look for new and interesting experiences (Opdal 2001, Falk and Dierking 2000, Bransford et al. 2000). The terms curiosity and wonder come up time and again in informal science literature, and

discussions on landscape design, yet they are rarely explored in great detail (Louv 2005, Carson 1965, Stilgoe 1998)

Paul Opdal, in *"Curiosity, Wonder and Education seen as Perspective Development"* (2001), takes a deeper look at these two conditions, stressing important differences between the states of curiosity and wonder. In his words, curiosity is *"…a confident and focused interest to find something out…"(pg. 331)* whereas wonder is *"…the state of mind… where one is struck by the strangeness and peculiarity of the things met." (pg. 331).* According to Opdal, curiosity is a motive to explore within generally accepted frames, while wonder questions the underpinnings of our framework of knowledge. In this way, wonder may be at the heart of all new knowledge as it inherently questions that which is accepted. This is a powerful distinction for designers, implying that curiosity is accessed through that with which visitors may already be familiar; where understanding can increase via logic and reasoning. The gateway to wonder, on the other hand, may be through that which is beyond logic and reasoning, via connection to the emotional and the spiritual.

Though the power of wonder is undeniable, curiosity is a much more well studied phenomenon. The core of these studies rests upon work of Daniel Berlyne (1960). In his text *Conflict, Arousal and Curiosity* (1960) Berlyne examines the kinds of stimuli that prompt investigations and peak curiosity. The most easily translated of Berlyne's (1960) factors that contribute to investigation include:

1. *"Novelty"*: things not yet incorporated into habit or expectation
2. *"Complexity"*: variation in position and composition
3. *"Surprisingness"*: unpredictability
4. *"Incongruity"*: things that don't belong together

In studies with rats, the most powerful of these appeared to be novelty, with complexity the next. Berlyne's further work with rats and human subjects also revealed that a maximum amount of stimulus (novelty/complexity etc.) did not produce the maximum drive for investigation. People appear to be more interested in things they slightly recognize, and tend to ignore that which is usual or that which is too unusual or complex (Berlyne 1960, Chak 2002, Falk and Dierking 2000).

Berlyne also divides the nature of investigation into three categories, describing how people act upon their curiosity, gather new information, and 'figure things out'. The origins of these categories go beyond the detail required here; however, their descriptions offer useful guides for behavior that contributes to learning. In observations on infants and children, Berlyne describes three stages of *"investigatory behavior"*, each building on the last (1960):

1. *"Observation"*: passive, with out moving or changing the object or situation
2. *"Manipulation"*: randomly moving/changing the object or situation
3. *"Experimentation"*: deliberate manipulation for the sake of comparison

These examples offer a hierarchy of obtainable behaviors for designers of educative landscapes to capture in their work. Most experiences in museums, zoos and landscapes allow only for the first level of *"investigatory behavior"*: observation. This offers a limited degree of learning given that Berlyne's theory suggests that truly rich investigations require the learner to engage in all three behaviors. Landscapes that can

support observing, manipulating and experimenting may provide for richer and deeper learning as well.

Take Home Messages–Education Literature

- **People approach every situation with pre-conceived notions.** (Bransford et al. 2000, Cavallo and Marek 1997, Dewey 1963, Hein 1991, Piaget 1985)
- **All new knowledge is built upon frameworks of older knowledge. That which is too unfamiliar is often ignored.** (Bransford et al. 2000, Cavallo and Marek 1997, Dewey 1963, Hein 1991, Piaget 1985)
- **Shifts in understanding take time and repeated exposure.** (Bransford 2000, Hein 1991)
- **We learn better when we share.** (Ash and Wells 2006, Boyer 2006, Cavallo and Marek 1997, Hein 1991, Vygotsky 1978)
- **We learn better when it is socially significant to our friends, family or larger society.** (Bransford et al. 2000, Dewey 1963)
- **Novelty and complexity are fundamental to curiosity, however too much leads to disinterest.** (Berlyne 1960, Chak 2002, Falk and Dierking 2000)
- **Investigation happens at three levels: observation, manipulation and experimentation.** (Berlyne 1960)
- **We learn via mind, body and emotion.** (Dewey 1963, Gardner 2006, McClelland et al 2002, Yorks and Kasl 2002)
- **Wonder lies at the heart of new knowledge while curiosity plays upon that which we already know.** (Opdal 2001)

MUSEUM DESIGN LITERATURE

Learning in Museums–Personalizing the Experience

> *"Increasingly museums can be described as public institutions for personal learning, places people seek out to satisfy their learning needs. One way to characterize the unique and special nature of the learning that occurs in museums is to emphasize the particularly free-choice nature of much, if not most, of that learning. Free-choice learning tends to be non-linear, is personally motivated, and involves considerable choice on the part of the learner as to what to learn, as well as where and when to participate in learning."*
>
> *Falk and Dierking (2000, pg. xii)*

Falk and Dierking (2000) use the term *"free choice learning"* to describe the non-linear, self directed experience at a museum, zoo or other informal learning environment. Learning in these environments is internally motivated (Falk and Dierking 2000), often intensely social (Diamond 1999, Falk and Dierking 2000, Bell et al. 2009), and must be viewed as a piece of a larger educational experience (Falk and Dierking 2000). These realities drive strategies for the physical design of exhibits, as well as a general approach to education that maximizes learning experiences at museums.

It is important to realize that people spend but a brief period of their lives on museum grounds and that any desired learning outcome has to be set in a broader context and time frame. The same could be said for educative landscapes. Learning itself might not even occur at the museum, park or civic space in question, but that doesn't mean the experience won't lead to learning in the future. Diamond (1999) writes that evaluations

which use pre and post tests immediately before and after an experience may not allow enough time for learning to take place. Falk and Dierking (2000) point out that most effective evaluative studies have an immediate component and a much later follow up component 6-13 months after the visit itself. In this way, the learning model for museums is not unlike the learning cycle for educative landscapes, presented in Chapter Two, with smaller cycles of Exploration, Reflection and Application supporting larger cycles of Connection and Inspiration. Educative landscapes and learning experiences are stepping stones, slowly building a network that offers new understanding of the world. Falk and Dierking use this idea to explain that museum exhibits rarely create huge leaps in understanding:

> *"[in museums] one should expect that most learning will be the confirmation and enrichment of previously known constructs and that subsequent experiences will play a large role in what is ultimately remembered and utilized."*
>
> *(2000, pg. 152)*

Given this, museum literature recommends that designers create layered strategies that give visitors opportunities to validate their own knowledge and connect with new information in small increments. Diamond (1999) also clarifies the type of learning that normally occurs in museums. The relatively brief and extremely stimulating museum environment is not conducive to learning in terms of what Diamond calls *"recall"* or *"quiz show"* memory. On the other hand, museums create powerful environments for *"recognition"*, the part of the memory that facilitates making connections and associations. According to Diamond, powerful exhibits help people organize and connect knowledge they already possess, increasing understanding and comfort with material.

Given the brief and intermittent nature of museum visits, the literature also recommends building brief but intense experiences, utilizing emotion and open ended activities (Bell et al 2009, Falk and Dierking 2000). Falk and Dierking (2000) prescribe *"boundless experiences"* that beg to be revisited, either in actuality or in conversation and imagination: learning opportunities one would take home and talk about over dinner. Bell et al. (2009) and Falk and Dierking (2000) stress the significance of finding an emotional connection for solidifying the learning process, but they give few actual examples of how this is done.

Falk and Dierking (2000) do discuss how varying aspects of the environment will influence visitor curiosity: using shape and mass to create tension or stability and alternating patterns of balance, imbalance or texture. They also mention how people are attracted to either the very large or the very small, explaining how spaces can be arranged to emphasize this dichotomy. Color is discussed in more detail, specifically studies that link colors with how people perceive temperature in the environment. They cite a 1976 study (Porter and Mikellides) placing people in different colored rooms and allowing them to adjust the thermostat to a comfortable temperature. When placed in a blue room, people needed to keep their thermostat four degrees warmer than when they were in a red room. Falk and Dierking cite this as evidence for the power of color on the human psyche, but unfortunately do not refer the reader to more demonstrative examples one might find on the museum floor. In summary, Bell et al. (2009) and Falk and Dierking (2000), promote a shot-gun approach, suggesting designers attempt to stimulate a wide range of emotion in ways that reach multiple user groups.

More useful, particularly for the design of educative landscapes, is Falk and Dierking's discussion of how spatial organization affects learning (2000). Designs that enable visitors to group information into

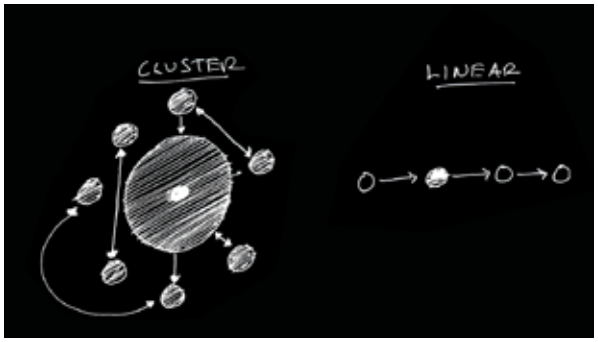


Figure 3.5: People prefer to navigate information clustered into main ideas.

chunks help visitors organize and remember concepts and facts. In a similar manner, studies with museum signage showed that organizing exhibits in clusters of similar themes, with a few simple signs, was more effective than linear arrangements with more detailed signs. The clustered approach utilized one sign that explained a big picture concept, and each related exhibit nearby was labeled only with a title and a small subheading. Falk and Dierking (2000) contend that the physical clustering made the conceptual relationships between the exhibits more explicit than if they were arranged in linear fashion (Figure 3.5). The clustered exhibits improved both the amount of time visitors would spend at the exhibits and the retention of both large ideas and smaller details. Falk and Dierking compare these results with Falk's own research showing that people seldom if ever move through exhibits in a linear fashion, even if they are arranged as such. Applying these ideas to educative landscapes, educational installations need to be laid out in a manner that allows people to engage and disengage freely, in Falk and Dierking's words with *"multiple entries and exits"* (Figure 3.6). Likewise, ideas presented should be physically clustered by concept. This may be difficult along linear interpretive trails; however, the example of chunking or clustering ideas still holds. A hierarchy of signs, big ideas with more information followed by simple labels may work best (Falk and Dierking 2000).

Simply transmitting and organizing information are not the final goals for most museums, nor are these objectives necessarily central to motivating people to learn. Museum literature also stresses the fact that people are choosing to patronize museums as a form of recreation. In this light, museum designers must recognize that visitors are often looking for a social experience and, to a certain degree, entertainment. These factors actually enhance the educative power of these institutions.

The Exploratorium, a San Francisco science museum established in 1969, embraces play as a mechanism for learning. Founder Frank Oppenheimer liked to refer to the fact that you can't flunk out of a museum, emphasizing the freedom of the low consequence environment in the Exploratorium that promoted play and experimentation (Cole 2009). Falk and Dierking (2000) invoke play as essential for learning in free choice environments as well, but also stress stories and opportunities for theatrics as powerful techniques for visitors to own information

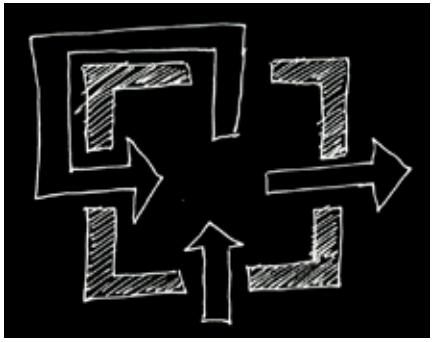


Figure 3.6: Making exhibits with *"multiple entries and exits"* (Falk and Dierking 2000) allows people to choose how and when to engage.

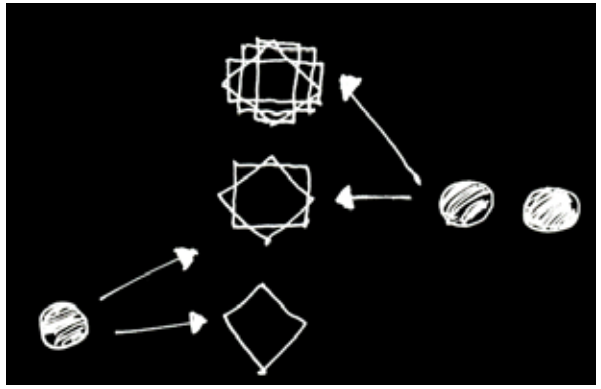


Figure 3.7: Varying layers of challenge and complexity encourage multiple users and enable both teaching and learning

and culturally connect with material. Bell et al. (2009) also describe performance type opportunities as important for attracting others to participate and experiment within a given exhibit.

The intense social nature of the museum environment often dictates when people engage, and how long people stay at exhibits. Often, they will leave simply because they want to catch up with a peer group or family member (Gutwill 2008). This is one reason to design exhibits with layers of varying complexity, and many different points of entry, in order to encourage groups of different ages, abilities, and interests to use them simultaneously . This allows individuals to engage at a comfortable level of material, and also gives them the opportunity to work alongside someone who can help them learn even more; in the words of Vygotsky, to work in their zone of proximal development (Falk and Dierking 2000, Figure 3.7).

Comfort, Orientation and Expectation

"We can experience any place because we've all received, as part of the structure of our attention, a mechanism that drinks whatever it can from our surroundings...For this perception to emerge, we need a place that seems safe, where the information presented to each sense is complex but not overpowering."

Hiss 1991 from Falk and Dierking (2000, pg. 113)

A large piece of museum design literature focuses on the visitor's comfort, expectations, and ability to easily find their way (Falk 2000, Hood 1993, Kaplan et al. 1993). Motivation for this research comes largely from the observation that certain groups of visitors will return to museums over and over, regardless of conditions, and others will only visit once or rarely (Kaplan et al 1993, Hood 1993). Looking at this second group, researchers link the lack of interest in museums to difficulty in wayfinding and orientation, and pre-conceived notions of what happens at museums (Kaplan et al 1993, Hood 1993). Solutions for increasing visitor comfort levels range from providing more furniture and drinking fountains (Hood 1993) to marketing schemes aimed at shaping visitor expectations (Falk and Dierking 2000).

Though signage is often inherently necessary, a poor building design can easily ruin a well constructed map (Falk and Dierking 2000). In their book *Learning from Museums: Visitor Experiences and the Making of Meaning* (2000), John Falk and Lynn Dierking point out that most people who visit museums don't use maps at all, citing a 1999 study where 85% of visitors to the California Museum of Science chose to navigate on their own (Falk and Amin 1999). They argue that people begin mentally mapping an area as soon as they enter, and utilize spatial cues before they even read a sign.

Using the landscape and surroundings to aid in wayfinding is not a new concept in landscape architecture, and features heavily in Kaplan, Kaplan and Ryan's text *With People in Mind: Design And Management*

Of Everyday Nature (1998). This book was written specifically for an audience of landscape architects, however the work of the Kaplans in environmental psychology is also heavily referenced in museum literature (Falk and Dierking 2000). Falk and Dierking's exploration of wayfinding largely mirrors Kaplan et al.'s descriptions, however they make reference to an earlier publication from Caine and Caine (1994) that offers a slightly different view.

Both groups of authors place an emphasis on the need for clear landmarks to ease navigation and discuss the power of mystery, created by offering small previews of what is to come. Caine and Caine, however, utilize the term *"expectation"* referring to an anticipated experience of emotional or otherwise significant value. Their study examined the rates at which people compose mental maps of an area, finding that the novelty of landmarks and the degree of expectation affected this ability the most. In their explanation unique features stand out as navigation points in our brains, while the expectation of an interesting or beloved experience drives us to go forward. Kaplan et al.'s studies addressed what draws people into different landscapes, but revealed people's preferences without the pressure of an end goal or original expectation. Their research utilized still photographs, asking participants about preferences in terms of comfort, fears, and ease of navigation. Kaplan et al.'s work seems to apply best to those who wander the landscape for the sake of the journey, while Caine and Caine emphasize the power of great expectations for the journey's end.

Falk and Dierking summarize the ability of people to map out and navigate a space in relation to three factors: expectation, the presence of mystery, and clear landmarks. Both of these last two factors depend to a certain degree on a balance between the novel and the familiar. Landmarks must be novel enough within the context of the landscape to be memorable, and mystery must be obscure enough to warrant further investigation. Research on novelty, however, warns against excessively new experiences and environments, as they tend to restrict learning (Falk and Dierking 2000, Bell et al. 2009). Landmarks must remain familiar enough to be appealing, and mysteries must provide enough of a hint to appear solvable. An optimum level of novelty will enhance the learning process and the ability and motivation to wayfind (Falk and Dierking 2000).

The idea of expectation also works its way into Falk and Dierking's argument that the museum experience needs to start before the visitor arrives (Falk 2000). Though this has less to do with the physical design at the museum site, it can shape a visitor's reaction to the site when they arrive (Falk 2000). Also known as the concept of the *"advance organizer"*, developed by psychologist David Asubel, learners learn better when they have an idea of what to expect. Falk's own research supports this, finding better success reaching adults and children alike on field trips, in museums, zoos, and aquaria when a big picture orientation has been used. He explains that people often have a certain expectation or mental map of an experience before they engage. If the results are too far off the initial expectation, less enjoyment and less learning occurs (Falk 2000). Applied to educative landscapes, the advance organizer could be something that summarizes the big picture with a map, a sweeping view of the area or a demonstrative or metaphorical art piece.

Unless the design is part of a well funded institution such as a museum or arboretum, providing marketing for educative landscapes in the traditional manner may not be realistic. Most projects will likely rely upon word of mouth, non-profits or school or city park websites. In this

Table 3.1: Constructivist Exhibit Design Philosophies Taken from Hein (1991)
1. Combine Activity and Meaning: Learning is an active process that must engage the mind. Learning through motion and physical activity is valid, but only when we mentally attach meaning and relevance to the motion.
2. Help people learn how to learn: Museums must take care to present information in a way that is accessible to all, or help people learn how to organize the information. For example not everyone understands how to read a timeline; an exhibit should start with shorter examples before showing a millennial chronology.
3. Learning is a social activity: In Hein's words "We need to ask- what have we built into the exhibit that encourages visitors to discuss, to share, to find out together. Has the architecture and the exhibit arrangement encouraged discussion?"
4. Engage in as many ways as possible: "It is important for exhibits to provide different kinds of entry points, using various sensory modes, different kinds of stimuli, to attract a wide range of learners." Visitors with little or no prior knowledge are at a great disadvantage, and must be creatively engaged or helped along.
5. Appropriate Complexity: People learn best when stretched just barely beyond their range of knowledge and ability, especially with the help and guidance of others. Does the exhibit offer entry points at multiple levels of understanding? Are there opportunities to extend those levels beyond entry?
6. Time and Reflection: "Finally there is the issue of time to learn, time to reflect and time to revisit an idea. Museum educators have grappled with this problem and find it a particularly challenging one, since our audiences are free to come and go, and large fractions of them are tourists who many never return. Museum galleries are not designed as places to linger, despite our desire to have visitors spend more time there…. What do we do for the visitors who wish to stay with a topic longer? How have we organized our museums to accommodate them? To what extent have we provided additional resources (in addition to items which we are eager to sell to them in the nearby shop) that can satisfy the interested visitors' concerns that arise on the next day or a week after the visit?"

case, openly pursuing multiple strategic partnerships with local schools, museums, and other educational institutions would be beneficial. Also, creating something as simple as a demonstrative name may change how visitors approach the site, and how it travels by word of mouth. Projects such as the SEA streets, 110th Cascades, and the Thornton Creek Water Quality Channel in Seattle all have names which allude to their functions as demonstrative and visible storm water mitigation systems. In Portland, Oregon, SW 12th Avenue, 10th@Hoyt and Siskiyou Street also have merit as projects that demonstratively capture and reveal storm water (Echols and Pennypacker 2008), while their names unfortunately capture and reveal much less.

Lessons from the Exploratorium

"A large part of the play of children involves using common physical and cultural components of society in a context that is divorced from its primary purpose. It is through such inventive and repetitive play that they learn to feel at home with the world. In this fashion our exhibits are also playful....In exhibits that are obviously intended for play, exhibits that themselves use props divorced from their original context, all manner of lovely things are discoverable, even by the people who invent them."

Founder of the Exploratorium, Frank Oppenheimer 1972, pg 982

When it opened in 1969, the Exploratorium science museum in San Francisco operated more like a park than a museum. Founder Frank Oppenheimer fondly recalled the days when admission was free for everyone, and students playing hooky from local high schools would consistently wander through the exhibits (Cole 2009). Though it now charges for entry, the museum continues to target no particular age range, instead choosing to play with patterns of perception and appeal to the universal curiosity in all of us (Cole 2009). It remains one of the only museums in the nation to consistently attract teenagers, and has become an example and model for exhibit design around the world (Cole 2009,

Hein 2001). The Exploratorium's success could be attributed largely to founder Frank Oppenheimer's exuberant and tenacious commitment to play and experimentation (Cole 2009). As an institution it is as much about providing an interesting and playful experience for the visitor as it is serious about experimenting with new and creative ways of teaching and learning (Oppenheimer 1972). Frequently, an exhibit will be left out on the floor unfinished, just so Exploratorium staff can observe and learn from the creativity of their visitors (Gutwill 2008)!

More significantly for the field of design, the Exploratorium recognizes aspects of its experience that overlap with educational theory, Constructivism in particular, and uses this aspect to drive exploration and development of new exhibits (Hein 1991, Gutwill 2008). Though not the first, the Exploratorium illustrates well what has become a large trend in museums since the 1980's: the use of educational research and rigorous self evaluation to drive the design of spaces for learning (Gutwill 2008, Bitgood and Loomis 1993). In my searches, a similar awareness of learning theory and dedication to self evaluation is not present in other design disciplines, and an examination of philosophy and research in museum design holds many pertinent messages for this exploration of educative landscapes.

The Exploratorium's Institute for Inquiry (IFI) offers resources to other museums and institutions devoted to science learning in the form of workshops, publications, research and scholarly articles. Two such articles, one by Hein (1991) and one by Roschelle (1997) summarize well the opportunities and challenges for museums offered through the lens of Constructivist learning principles.

Hein (1991) clearly outlines six recommendations for the field of museum design based in Constructivist thinking. Summarized in Table 3.1, these recomendations largely address the use of past knowledge to build new understanding and learning as a social endeavor. Somewhat new is Hein's reference to helping people learn how to learn. Hein reminds us that just as our minds have frameworks for factual knowledge, learning is a framework as well (1991). Those of us entrusted to teach, via design or otherwise, must realize that our audience is also learning how to learn in the experiences we create, and Hein calls for careful organization and sequencing of the introduction of new ideas.

Hein is also looking for ways to connect museum experiences in between and after visits, at one point describing a support system outside of museum and school environments. Museums and other free choice learning environments rarely hang on to visitors long enough to offer time for true reflection on the experience. Hein argues for ways to extend the museum experience beyond the confines of a single visit. Hein is to a certain degree making a case for educative landscapes, placing additional gestures and inspirations for learning in common places outside and around museums and learning institutions. Unfortunately, Hein is unable to offer many examples of practical solutions, and a more robust list of solid demonstrations of his principles would be helpful.

Also issued by the Exploratorium, Jeremy Roschelle's 1997 article *"Learning in Interactive Environments: Prior Knowledge and New Experience"* outlines challenges for museum designers, many of which sound more like warnings:

> *"Dramatic conceptual change is a slow, unpredictable, and difficult process. It is thus inappropriate to expect deep conceptual change to occur predictably, in a single or short series of visits."*
>
> *(pg. 49)*

Roschelle actively reminds designers that learning is a long term process, and a visit to a museum is inexorably a short term part of that cycle. He argues that designers should seek to refine prior knowledge and understanding, and be wary of attempting to instill new ideas of their own. He also warns that learning comes via conversation and interaction within a community of learners, and designers must allow space and time for such interaction to take place. While a good reality check for expectations in educative design, points made by Roschelle ,like those of Hein, offer few examples of good solutions. These warnings are based in research, however they do not suggest positive alternatives.

A more recent Exploratorium publication by Joshua Gutwill (2008) provides more practical examples, offering insight into the Exploratorium's exhibit design philosophy. During the 1990's the Exploratorium experienced a push to further embrace Constructivist principles in their exhibit design. This change was largely inspired by the observation that certain exhibits would hold visitor attention considerably longer than others. Investigation into what became known as *"Active Prolonged Engagement"* (APE) turned into a comprehensive evaluation of twelve exhibits seemingly unique in their ability to hold visitors fascination. The significance of this observation shifted the emphasis of evaluations. Instead of focusing on the intellectual content imparted by an exhibit, evaluations became structured around the behavior elicited in the users. This was distinctly different from the prior philosophy of *"planned discovery"* wherein exhibits carried a prescribed method for exploration and end point for investigation. Instead, the lack of a clear endpoint became more desirable, with visitors defining the length and nature of their experience. The APE exhibits allowed people to create and answer their own questions with little or no prompting from text or graphics. They created a stage for true self-led investigation.

The different APE exhibits were grouped based on four different behavior types, each connected with a different strategy for capturing and holding users' attention. Four of the twelve exhibits have potential for use in the public landscape, and are described in Figures 3.8-3.11. Many of the exhibits contained small moving parts, were particularly fragile, or required specific technologies, making them less appropriate for outdoor or large scale public display. The behaviors they inspire, however, are excellent touchstones for designers looking to bring active prolonged engagement onto educative landscapes:

- **Exploration**–Testing the limits of a particular phenomenon, not necessarily to figure it out, but simply for sheer visceral fascination. Making patterns on spinning discs of sand, and launching beach balls on jets of water or air are examples of exploration activities (Figure 4,5).

- **Observation**–Manipulation of a particular phenomenon, not necessarily to test the extremes, but to produce subtle, mesmerizing variations in detail. Experimenting with flow forms on water surfaces (Figure 6) and watching patterns in developing ice crystals are classified as observation activities.

- **Investigation**–Manipulation with the intent of figuring out, problem solving or explaining a phenomenon. Gutwill includes several of these, all of which seem difficult to apply directly to outdoor or intensely public settings. They included rolling discs of different masses/sizes and experimenting with circuit boards.

- **Construction**–Creative making/problem solving with function in mind. Construction exhibits included the making of mobiles (Figure 7), assembly of 3-D geometric shapes, and building with blocks atop a vibrating surface.

In addition to recognizing significant behaviors, the APE investigations revealed certain patterns that appeared to support the success of these exhibits. First and most significantly, visitors reported the APE exhibits were more open-ended and allowed for continuation without definite endings or sets of directions (Gutwill 2008). This allowed visitors to dictate their own level of complexity and involvement. These exhibits were able to connect with users possessing differing levels of prior knowledge and engage within their prime zone of proximal development. Second and also significant, the investigators found great increases in engagement at exhibits with multiple stations (Gutwill 2008). People were inspired by watching others, enjoyed sharing, and didn't worry as much about using the exhibit while others had to wait their turn (Gutwill 2008). Great success was obtained by placing three stations in a triangular configuration, allowing participants to watch what the others were doing (Gutwill 2008). Similarly, visitors at construction based exhibits would often leave their work on display, offering examples and inviting the next visitor to the station (Gutwill 2008). Investigators also noted exhibits that encouraged theatrical displays and large body movements were effective in engaging the participation of others. In these ways, the APE exhibits seem to take advantage of the social dimensions of learning, while still allowing for individual control of the experience.

In conclusion, the lessons found in the Exploratorium literature do not seem too far removed from philosophies already associated with good landscape design. Play and opportunities for creative problem solving are forefront in Nicholson's *"theory of loose parts"* (Nicholson 1971). Open ended spaces for people to manifest their own program and culture are forefront in urban design theory (Wall 1999, Kirshenblatt-Gimblett 2008), and the benefit of person to person interaction in public

A thin layer of sand sits upon a large spinning turn table. Tools, fingers and hands applied to the sand create rythmic patterns. Variations in the speed of the turn table and application of tools creates limitless geometric desings and effects.

This exhibit was originally built with one turn table. Increasing the number to three provided space for multiple users, exponentially improving its engagement potential

Similar applications of moving discs on the same or even larger scales could be possible in outdoor park environments.

(Photos: Gutwill 2008, pg. 29-33)

Figure 3.8: APE Exhibit-Spinning Patterns

An early blower prototype split the air into two streams.

Air jets aimed in different directions allow users to 'balance' objects of different shapes and consistencies on columns of blowing air. Participants are challenged to compare different orientations of an oblong football, and wiffle ball vs. a solid plastic sphere

(Photo: Gutwill 2008, pg. 41-45)

(Photo http://clarerishbeth.files.wordpress.com/2007/06/fountain2.jpg)

Similar applications happen spontaneously at fountains such as this one at Seattle's former World's Fairgrounds. Children launch various objects from cups, to milk cartons and beach balls from the fountain jets (personal observation).

Figure 3.9: APE Exhibit-Floating Objects

spaces is part and parcel to William Whyte's theory of Triangulation (Whyte 1980). What this indicates is that educational opportunity operates under similar conditions to, and can be augmented by, healthy social conditions. Likewise, effective educative designs in public places may help instill the social conditions we value. Installations meant for learning, thought, and exploration are already at the center of Whyte's Triangulation, pulling strangers and acquaintances together in discussion of new ideas and interesting observations. Opportunities for public manifestation of culture can be seeded with *"loose parts"* for learning: props and provisions for exploring phenomena and ideas. Why not create designs for Active Prolonged Engagement at every fountain, rain garden, and public plaza?

Take Home Messages–Museum Literature

- **Build the museum experience before arrival with expectations of what is to come.** (Caine and Caine 1994, Falk and Dierking 2000)
- **Strive to create boundless experiences that connect with emotion and beg to be revisited and remembered.** (Bell et al. 2009, Falk and Dierking 2000, Roschelle 1997)
- **Cluster information and exhibits into 'chunks' to help people organize and retain information.** (Falk and Dierking 2000)
- **Build exhibits with layers of differing complexity and multiple entries and exits.** (Bell et al, 2009, Falk and Dierking 2000, Hein 1991)
- **Embrace play and open ended investigation.** (Falk and Dierking 2000, Gutwill 2008, Oppenheimer from Cole 2009)
- **Create situations where people can observe others or perform themselves.** (Gutwill 2008)
- **Learning itself might not even occur at the museum, but that doesn't mean the experience won't lead to learning in the future.** (Bell et al. 2009, Diamond 1999, Falk and Dierking 2000, Roschelle 1997)
- **Museum type learning experiences primarily reinforce relationships and connections.** (Diamond 1999, Falk and Dierking 2000, Hein 1991)

Separate flow channels help mitigate visitor interference.

A long watering trough houses a thin sheet of water flowing over a black acrylic bottom. Fine bubbles coat the water's surface, produced by a small 'air leak' in the water pump intake hose. This unit is divided into three lanes for multiple users.

Objects placed in the sheet of water create intricate and variable patterns visible in the bubbles. The black bottom creates a high contrast with the white sheen of foam, elucidating beautiful undulating forms.

This exhibit provides excellent enhancement ideas for fountain and water feature designs in eductive landscapes

(Photos: Gutwill 2008, pg. 85-89)

Figure 3.10: APE Exhibit-Flow Formations

LANDSCAPE ARCHITECTURE–LITERATURE AND PRECEDENT

"…school landscapes need to be reconceived and designed as interactive places for learning. Learning is most meaningful when it engages our senses fully, when it is grounded in daily life, and when play is part of the process. The design of school landscapes holds boundless opportunities to foster these experiences, and simultaneously enhance landscape's values for the ecology of natural and community systems."

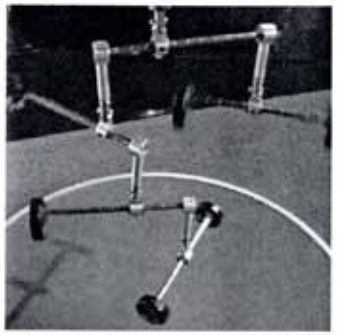
Johnson (2002, abstract)

This section explores the ways landscape architects already address education, the mind, and learning in their professional practice, theory, and research. What I've discovered, after looking first at schoolyard design and then deeper at the roots of the profession, are patterns clearly linking design with ideas of teaching, and learning. It is interesting to note that some of the most fundamental research and theory in landscape design stems from the environmental psychologist team of Rachel and Stephen Kaplan, whose work is also referenced heavily in museum literature (Falk and Dierking 2000). In many instances, landscape designs aim to draw us in with familiar patterns, laced cleverly with hints to help us appreciate a new aesthetic or reveal a facet of the region's natural history. Much in the same way Falk and Dierking (2000) describe learning in museums in terms of connections and emotion, landscape architecture plays off of people's connection to place and nature. This review of landscape architecture literature and practice reveals the bones of a new language for education, rooted in ecological paradigm, play, and community participation.

Final version of Make a Mobile

Lever arms and weights can be combined in limitless configurations, providing odd and interesting orbital patterns.

The construction aspect of this exhibit may be difficult to replicate in an intensely public setting, however the concept of movement and seemingly unpredictable gyration has interesting applications for sculpture.



Certain aspects of experimentation could be acheived if this idea was applied in a way to swings or seesaws, allowing users to sit in different places to affect changes in angular momentum.

(Photos: Gutwill 2008, pg. 115-121)

Figure 3.11: APE Exhibit-Make a Mobile

The field of landscape architecture is rich in examples of educational space design, most easily identified in terms of arboreta, zoos, schools and college campuses. For the purpose of finding overarching themes of how people interact with space as learners, I chose to focus on research and examples applicable to the broadest range of settings. To that end I largely left out analysis of specialized zoo exhibits and arboreta (grouping them with exhibits and museums) unless they carried lessons that directly applied to landscapes and open spaces in general. I have included a section on school grounds, as they are essentially public spaces providing opportunities for both teacher directed and self led discovery, not unlike the environmental learning center's studied in this document. Where I can, I've looked for specific examples of landscape design as a didactic tool, attempting to imbue visitors with new outlooks on the world or appreciation for aspects of their environment, and where landscape architects have engaged in research concerning the mind and learning in order to invigorate and improve their designs.

As pointed out in the introduction to this thesis, empirical studies on the direct connection between landscape and learning have been difficult to find. That does not mean, however that landscape architects have been designing educational spaces without philosophy or a body of research to guide their work. Much to the contrary, landscape architects draw from a deep body of literature on the benefits of nature, much of which deals with child development, behavior, and creativity. Landscape architects also make reference to rigorous psychological studies on place attachment and identity formation (Hester1980, Hart 1979 and 1980, Kaplan 1998, Louv2007, Chawla 1986) to help empower their designs and connect with communities. The concept of play as an essential part of the learning process creates the cornerstone for many discussions on playgrounds

and schoolyards (Brett 1993, Moore and Wong 1997, Johnson 2000, Stine 1997). This is similar to Falk and Dierking's discussion in the museum literature of *"free choice learning"* (2000) and provide an interesting area of overlap. I did not find, however, as many landscape designs, be it playgrounds or other educational landscapes, evaluated with the same rigor and direct focus on learning that I found in the musuem design literature.

In 2000, Julie Johnson summarized very cleanly the landscape architecture literature on school grounds and places for children's learning in her work *Design for Learning: Values, Qualities and Processes of Enriching School Landscapes.* Her literature review largely drew from the work of four other authors–Moore and Wong (1997), Sharon Stine (1997) and Wendy Titman (1993)–for their work on natural school yards, playgrounds, and student perception studies. Johnson's study focused largely on school grounds, and though she does recommend sharing these spaces with the community, her examples are largely aimed at spaces for elementary school aged children and not necessarily families. Johnson produced a list of design qualities important for school landscapes, divided into two categories: Experiential Qualities–describing what a visitor might feel, do, or encounter; and Landscape Qualities–describing physical features of the design.

"EXPERIENTIAL QUALITIES

1. *Rich and varied sensations*
2. *Abundant Choices*
3. *Opportunities to make changes*
4. *Personalized sense of place*

LANDSCAPE QUALITIES

1. *Natural and Cultural Systems*
2. *Connections*
3. *Legible and complex images*
4. *Varied scales*
5. *Flexibility*
6. *Aesthetic Quality" (pg. 18-20)*

What emerges through Johnson's development of these qualities, is an approach to learning and education using the lens of landscape architecture; one that emphasizes connection to place, ecology, and our ability to create and observe change. From a landscape perspective, people learn best when they have a diverse array of choices to explore, and ample opportunity to manipulate and play. These themes are also illustrated in the museum literature in terms of layering and complexity of exhibits, with an emphasis on free play. Both landscape and museum design speak of connections, but where landscape is concerned with links to place, ecology, and nature, museum design is more open and abstract in terms of the subject matter, emotions and ideas to link. Landscape jumps away from museum design in the value it places upon community participation. Both professions discuss the power of connecting with institutions, ideas, and culture outside the boundaries of a given site; however landscape is different in its incorporation of ideas and creativity from those who live close and experience the site most often. This participatory approach mirrors Constructivist education theorist John Dewey's thoughts on experiential education and learning by doing (Dewey 1963). By including community members in the design

process, landscape architects create learning opportunities beyond those experienced by simply visiting the finished project.

Johnson's treatment in *Design for Learning* presents a solid summary of the literature regarding youth, children, and school grounds, but several points deserve further exploration. More insights on learning and environment become evident in general landscape practice when one examines its longstanding goal of connecting people with ecology; a philosophy part and parcel to the profession from its inception. The following section explores precedents for educative design in landscape architecture through three lenses: Learning Ideals in Landscape Practice, The Power of Nature, and School Grounds and Curriculum Connections.

Learning Ideals in Landscape Practice

Intentional use of landscape to influence our acceptance or perceptions of nature, in a sense teaching, has roots as old as the landscape profession itself. Practitioners of the art have long been aware of nature's powerful aesthetic. They have also been aware of their own power to alter our perception of nature. This philosophy largely began with the seminal figures of Frederick Law Olmsted and Jens Jensen, both of whom understood the power of aesthetics to sway society as well as the importance and beauty of nature. Boston's Back Bay Fens, an historically significant, though less celebrated design by Olmsted, arranged ecologically hearty wetland plants in patterns linked to the aesthetics of the time, in an attempt to woo the denizens of Boston into appreciating the wild but necessary landscape of the tidelands (Spirn 1996, Zaitzvesky 1982). Jens Jensen, like Olmsted, designed parks to release the city's workers from their daily troubles, but deliberately used the native plants of the region, intending to reconnect his fellow Midwesterners to the heart and soul of the prairie (Eaton 1964, Grese et al. 1995). The turn of the century artistic genius of Olmsted and Jensen, that which shaped and enhanced the public's relationship to nature, was merely a foreshadowing for conversations that emerged later in the 1980's and 1990's, placing this philosophy at heart of the landscape architecture profession. Culminating in the 1998 design exhibition *Eco-Revelatory Design: Nature Constructed/Nature Revealed*, this movement called for landscape architects to recognize their responsibilities as gatekeepers to the natural environment and to shape and influence our understanding of the ecologies that surround us.

Eco-Revelatory Design

The *Eco-Revelatory Design Exhibit*, summarized in the 1998 special issue of *Landscape Journal* (Brown et al.), clearly articulates an open challenge for landscape architects to work as environmental educators and to help heal the relationship between society and natural systems. Explaining this new philosophy as distinctly different and complementary to ecological design, a more technical approach for designing with natural processes, eco-revelatory design reveals the significant ecological aspects of a site and helps visitors build meaning and connection between the landscape and their own lives. In this sense, eco-revelatory designs are all born with an agenda: they are educative landscapes, pushing their visitors to think, gain perspective, and internalize new information (Brown et al, 1998).

Two entries in particular warrant mention here, though all fifteen are worth exploring. The first, for its creative approach to revealing scientific complexity, culture, and nature, is Julie Bargmann and Stacey Levy's *Testing the Waters*, a design for treating acid mine drainage in

Vintondale, Pennsylvania. The second, one of the most robust studies I could find regarding the influence of landscape design on learning, is *Urban Ecological Retrofit* by Joan Iverson Nassauer. Her research followed a change in values for aesthetic and ecological appreciation in response to variations in design for curbside storm water treatment channels. The hosts of the exhibit, Barbara Brown, Terry Harkness and Doug Johnston, take great care in describing what deserves to be called eco-revelatory design, and stressed stringent and ambitious goals for the competition. Those chosen for the exhibit represent rigorous application of eco-revelatory design, and utilize some or all of the following strategies (Brown et al 1998, pg. xiv):

- *Abstraction and simulation of natural processes*
- *New uses of landscapes producing deeper caring for life and ecological processes*
- *Signifying features that speak for natural/cultural processes that might otherwise remain invisible*
- *Expose infrastructure and process*
- *Reclaim landscapes so that the past is remembered*
- *Change perspectives by structuring how we interact with the landscape*

The two designs I've chosen to discuss, one powerful in terms of design, the other in terms of empirical research, illustrate these strategies identified by Brown et al, and lend solid insight on the discussion of educative landscapes.

A rich example of eco-revelatory design, Bargmann and Levy's "*Testing the Waters*" (1998, pg. 38-41) demonstrates several of the strategies outlined by the hosts of the exhibit. The project reclaims a toxic mine tailings site in Pennsylvania, providing commentary on the relationship between the mining industry and the land, while at the same time demonstrating remediation for the legacy of pollution left by mining. Most significant in my mind is the remediation process itself, how it is revealed, and how this provides a new and interesting use for otherwise poisoned waters. Mine tailings are piles of soil and bedrock removed from a mine during the process of digging and excavation. They contain high amounts of minerals and metals that turn normal runoff into highly corrosive acid and give local waters a bright yellow coloring. *Testing the Waters* creates a series of alkaline lined retention ponds that remove acidity, essentially raising the pH of the water. The suspended minerals react to the changes in pH by changing color and the resulting series of ponds creates a Litmus Garden, a colorful demonstration of the remediation process (Figure 3.12). In addition to the changing hue of the water itself, pH sensitive plants line the banks of the ponds, illustrating with the shifting colors of their foliage the relationship between life processes and the acidity of the water (Bargmann and Levy 1998).

Refering to their list of strategies for eco-revelatory design, Brown et al. describe Bargmann and Levy's work as utilizing the strategy of *"Reclaiming landscapes so the past is remembered" (1998, pg. xiv)*, and I must agree the designers illustrate this technique poignantly. *Testing the Waters* also shows evidence of *"Signifying features"* in the color of the water and *"Exposing processes"* in the Litmus Garden. Mine tailing sites are unfortunately quite common in Pennsylvania, and the designers' choice to address such a widespread problem is an attempt to restructure how visitors interact with the local landscape, changing the perspective

Figure 3.12: Testing the Waters, Bargmann and Levy's Eco-Revelatory Design
This pond in the Litmus Garden changes color with the changing pH of treated acid mine draginage. (Photo: Levy 2010)

from one of aversion to one of stewardship. Levy and Bargmann's work becomes a powerful example of eco-revelatory design, illustrating several of Brown et al.'s strategies for success.

I find this project of particular interest because of its ambition to reach the cognitive and emotional mind. Bargmann and Levy's design reads like a museum exhibit, ambitiously illustrating complex scientific topics with the materials of the landscape. Their exploration of healing the scarred Pennsylvanian countryside is also educating the public about the mysteries of acid/base reactions. The reference to place, and use of color, water, and illustrative plantings create an emotional and aesthetic response, but their design also presents a phenomenon that begs the cognitive mind to ask 'why?'. The power of its presentation lies in the use of the litmus test, an procedure common in middle school science classrooms, on such a large scale and in such a unique way. Testing for pH is usually done on a small strip of paper; here it happens in entire ponds and with the leaves of the trees. Local residents of the Pennsylvanian countryside already associate color and acids on a landscape scale, with streaks and mottles of 'yellow boy' marking poisoned and polluted streams (Bargmann and Levy 1998). Playing with these colors, turning yellow to blue to green, Bargmann and Levy soften this association, showing us that we can control acid mine drainage, and teasing our minds enough to want to figure out just exactly how.

Joan Iverson Nassauer's *Urban Ecological Retrofit* illustrates a much less abstract, ecological concept than pH: the equally significant issue of storm water management. The power of Nassauer's work however lies in the fact that her design set the stage for a robust study of ecology and aesthetics. She was included as a member of the *Eco-Revelatory Design Exhibition* because her work supported its ideals, however this project was the result of research completed several years earlier and summarized in the 1995 Landscape Journal article *Messy Ecosystems, Orderly Frames (Nassauer, pg. 15-17)*. In this article, Nassauer describes the cultural aesthetic of North American suburban landscapes, which she depicts as necessarily neat and well cared for, as one which often contrasts with natural spaces. She develops a list of what she calls *"cues for care"* that people associate with valued and appreciated yards, parks or landscapes. Nassauer also points out that these *"cues for care"* are largely absent from ecologically effective landscapes, those dedicated to habitat or wetland areas, which often appear messy and undesirable. As a result, people tend to want to remove ecologically important landscapes from suburban neighborhoods, rather than care for them. Nassauer proposes that applying *"cues for care"* to ecologically functioning landscapes will transform them in the eyes of the public to be valuable and amenable

resources (Nassauer 1995).

Urban Ecological Retrofit, Nassauer's *Eco-Revelatory Design* entry, is such an experiment. Residents of Phalen, Minnesota were given the choice of traditional curbside storm drains, or native plant rain gardens designed with *"cues for care"* in mind. This was a community that in appearance represented the epitome of Nassauer's suburban aesthetic, yet all residences in question chose the specially designed, more ecologically functional option. The rain gardens have been cared for, and years later this community in Phalen is still seen as an exemplary model of ecological design (Nassauer, 1997, 1998).

Nassauer's research is significant here for two reasons. Nassauer demonstrates via research that people can learn to appreciate ecologically rich environments if designers tie in to what they already know and appreciate. This demonstration reveals significant parallels with the constructivist theory of learning and its application to education, museum design, and now landscape architecture. Nassauer is using culture to communicate and educate in the same manner Piaget, Vygotsky, and Dewey explain that which is necessary for learning. This overlap provides excellent justification for exploring how other aspects of educational theory could strengthen landscape architecture practice for ecological landscapes, places to learn, and design in general.

An interesting addendum, if not something of a challenge, can be found in Rebecca Taylor's MLA Thesis work at the University of Washington (1998). In *Aesthetics and Cognition: The Embodied Mind in the Ecological Landscape*, Taylor questions the emphasis Nassauer places on aesthetics in driving people to value ecology in a particular landscape. Taylor believes other aspects of design including phenomenological experience of movement and interpretive presentation play larger roles in how people grow to understand and value ecological stories in the landscape. She compares two parks in Seattle, Washington, both dedicated to revealing ecology, analyzing their designs in terms of *"cues to care"*, other major features, and the reactions and impressions of visitors. Gas Works Park, the iconic design by Rich Haag, is used to represent the neatly manicured and well cared for site (Figure 3.13), while Lorna Jordan's Water Works Garden (in collaboration with Jones & Jones), a series of artfully rendered waste water treatment ponds, represents a messier, more multi-layered approach(Figure 3.14). What Taylor found in interviews was that the ecological and historical meaning of Gas Works Park was not coming through. Though the park had a more classic design appeal, the huge gestures in transforming the landscape were not easily read, and the function of large earthen mounds for bioremediation was lost to the lay public. Water Works Garden on the other hand had a human scale appeal that invited physical interaction and created a strong sense of place. The unique setting engaged curiosity, and messages

Figure 3.13: Gas Works Park, Richard Haag
(Photo: http://scottandflora.com/Seattle.aspx)

Figure 3.14: Water Works Garden, Lorna Jordan
(Photo: City of Kent 2010)

layered in interpretive signage, art work and vegetation prompted people to ask even more questions about the mysterious stormwater ponds. In conclusion, Taylor found the embodied experience, the nuances of the design that invite us to linger and move through, to be as powerful if not more so than aesthetics in drawing out people's appreciation and desire to understand the landscape.

Embodied Experience

It is worth pausing here to discuss what Taylor describes as embodied experience or *"embodied mind"*. Though this term is not necessarily a regular part of landscape architecture vocabulary, it describes how the design of a space influences the subconscious on a visceral level, a process that becomes significant in how a place affects our willingness to learn. Movement, experience of mood, temperature, comfort, sound, and smell all can produce an understanding that is beyond cognitive, subtly setting our conscious mind up for a learning experience (Ellsworth 2005). Maya Lin's Vietnam War Memorial and Henry Bacon's Reflecting Pool at the Lincoln Memorial take advantage of this, reinforcing through materials, textures and ambiance the significance of historical events (Ellsworth 1995). In a similar manner, many of us have strong associations (positive or negative!) with a high school science room manifesting in the smell and taste of chemistry experiments, fish tanks, and reptile cages. I will use the term embodied learning to describe that which occurs through the immersion of the senses: attachments and associations we may not be immediately aware of, but ultimately influence our understanding of the world and our willingness to explore. Designers can use this idea not only to accentuate mood, but to connect with more abstract ideas such as history, passage of time, and biodiversity.

Author Elizabeth Elllsworth in *Places of Learning (2005)* speaks at length about the idea of embodied learning, and describes the concept of time as one effectively explored using this strategy. Referring specifically to the designs of Maya Lin and Lawrence Halprin, she explains how their work uses the physical environment to imbue the feeling or passage of time. Halprin, in his Memorial to Franklin Delano Roosevelt in Washington, District of Columbia, created a literal timeline, where visitors move from room to room following a linear progression of FDR's life and achievements (Figure 3.15). The experience involves open space after open space, connected by narrow passageways, creating a rhythm

that ticks away time as one moves through the memorial.

Maya Lin, in her Civil Rights Memorial at the Southern Poverty Law Center in Montgomery, Alabama, demonstrates the passage of time in a more cyclical manner (Figure 3.16). The design here is an elliptical stone table, covered by a thin sheet of water. Beneath the water are carved the names and dates of significant heroes of the civil rights movement and the subsequent legislation precipitated by their heroics and martyrdom. Visitors are drawn to the round table and inevitably place their hands in the water, contemplating the cycle of abuse and discrimination in American history. The embodied experience here creates a physical and emotional platform for the cognitive understanding of the names, dates, and historical significance embedded in this memorial.

The feeling of reverence or solemnity associated with moving through or simply inhabiting these places designed by Lin and Halprin may be the most indelible aspect of the experience. Ellsworth writes that such learning spaces:

> *"invite and support unintentional, involuntary experiences of the learning self. They do so by attempting to move us through 'sensations, prelinguistic and presubjectiv.' that precede concepts, images, or recognitions as things made, and promise to bring something new and unexpected into the loop."*
>
> *(2005, pg. 26)*

Legibility and Mystery

The important concept of legibility comes up time and again in general landscape theory, and particularly often in education related and eco-revelatory designs. It would be wrong here to leave out the

(Photo: http://0.tqn.com/d/dc/1/0/Q/W/fala.jpg)

(Photo: http://0.tqn.com/d/dc/1/0/S/W/men.jpg)

Figure 3.15: Franklin Delano Roosevelt Memorial, Lawrence Halprin
Halprin used rooms as points on a timeline at the FDR Memorial, sequentially illustrating chapters of Roosevelts life and Presidency.

(Photo: http://prelectur.stanford.edu/lecturers/lin/images/3_15.jpg)

(Photo: http://www.uga.edu/gm/artman/uploads/hands.jpg)

Figure 3.16: Civil Rights Memorial, Maya Lin
(Top) The circular timeline of the Civil Rights Movement at Georgia's Southern Poverty Law Center physically embodies cycles from our history.

(Above)A thin layer of water draws people to place thier hands next to the text, making a physical connection to past events.

influential work from which most of these references stem. Kaplan and Kaplan, environmental psychologists at the University of Michigan, have conducted extensive studies on the human relationship with place, including investigations on aesthetics, wayfinding, and restorative aspects of environment. Landscape architects have traditionally drawn heavily from their literature, however one work holds particular influence as it was written specifically for this profession. *With People in Mind: Design and Management of Everyday Nature*, by Kaplan, Kaplan and Ryan (1998), was aimed at designers looking to mediate and improve society's relationship with natural systems. The book reminds us that such spaces cannot be built only of and for nature, but must take into account the needs and perspectives of the human as well. This work addresses head on certain fundamentals of human psychology that mediate our interaction with the landscape and encourage designers to heed their example.

Particularly relevant to the creation of educative landscapes is the discussion of how we perceive and understand patterns in the spaces around us, a topic also heavily explored by museum literature. Kaplan, Kaplan and Ryan emphasize the terms *"legibility"* and *"mystery"* as ways to describe phenomena that help us understand and explore new places. These two terms provide balance for one another, where *"mystery"* is that which encourages us to push ahead, and *"legibility"* is that which keeps us from getting lost. *"Mystery"* is expressed in terms of previews or foreshadowing of what comes next: *"desire to explore a place is greatly enhanced if there is some promise that one can find out more as one keeps going" (Kaplan et al. 1998, pg. 16);* while *"legibility"* reads via landmarks and familiar or easily remembered elements in a landscape. Gateways are described as powerful points along a journey that provide a reference for navigation as well as an opportunity to draw us onward. *"A well designed*

gateway can provide both information and mystery…Just a hint of a view encourages the visitor to enter a new space." (pg. 86). Kaplan, Kaplan and Ryan's treatment of gateways gives them particular power as tools for engaging the mind, as they call people to make decisions, and through offering choice, force a degree of thought and consideratio:

> *"Gateways also foster understanding and encourage exploration. The gateway can add coherence and distinctiveness, making it easier to make sense of the natural setting. The limited access provided by the entryway is an effective way to increase mystery." (pg. 81-2)*

Another work that deals with legibility in the landscape Echols and Pennypacker's analysis of twenty award winning rain gardens and storm water treatment systems. *From Stormwater Management to Artful Rainwater Design* (Echols and Pennypacker 2008) presents a solid discussion of how intentionally designed storm water management systems can teach visitors about ecology. Their work is significant in that they identify a more specific list of strategies for meeting eco-revelatory design concepts than Brown et al (1998) and apply them to exposing process and changing the public perspective on ecology. Their work is a prime example of how designers use educational strategies in landscapes beyond that of the arboretum or schoolyard.

Their work is significant for its targeted discussion of design and education (summarized in Figure 3.17), and also for its broad overlaps with education literature, museum design and eco-revelatory design. Echols and Pennypacker recommend visible and legible paths for storm water, a design move that reveals process (as in eco-revelatory design), and follows Falk's recommendation in museum exhibit design of managing expectations by being upfront about subject matter and the presence of opportunities to learn. Their recommendation to provide opportunities to be close to, manipulate, and explore aspects of storm water speaks to embodied learning (Ellsworth 2005, Taylor 1998), human scale experience(Taylor 1998) as well as the roots of curiosity as described by Berlyne (1960). Echols and Pennypacker forcefully illustrate the value of narrative and storytelling in providing opportunities for learning. This is yet another crossover with previously discussed issues, tying in with constructivist principles, as storytelling creates a context and culture of its own. With the work of Echols and Pennypacker, it appears that landscape architects are tapping into ideas and concepts well studied in other arenas. Indeed, their discussion of legibility, touchable and playful designs, and narrativ represent important contributions to the final list of Principles of Educative Design.

Narratives and Storytelling

Though certainly touched upon by Echols and Pennypacker (2008), narrative as a powerful tool in landscape design is more fully explored by the research of Potteiger and Purinton (1998). Unlike Echols and Pennypacker their investigation focuses on how landscape may tell effective stories without the aid of written or verbal interpretation. In their book *Narrative Landscapes: Design Practices for Telling Stories* the authors explore a similar concept to Taylor (1998) and Ellsworth's (2005) phenomenological approach, the embodied experience of moving through a landscape, picking up on messages via texture, material, mood, and movement. The authors identify strategies and philosophies from the designs they see as carrying strong narratives, compiling a list of recommended practices:

- *"Naming*

EDUCATION GOAL Creat conditions to learn about rainwater and/or stormwater runoff-related issues	
OBJECTIVES to provide	***DESIGN TECHNIQUES***
IDEAS TO LEARN	
Hydrologic Cycle	Make stormwater trail visible and legible; Create a narrative of stormwater and/or the hydrologic cycle; Employ expressive hydrologic symbols
Historical water condition	Make stormwater trail visible and legible; Integrate stormwater-related site artifacts into the design; Create a narrative of the historical water condition; Employ expressive symbols of historical water condition
Water treatment types	Make stormwater treatment system visible and legible; Make stormwater treatment system playful, intriguing, or puzzling; Include variety of stormwater treatment systems in design
Treatment system impact	Create systems that visibly collect and store trash and/or pollution
Riparian plant types	Provide a variety of visible plant types and communities
Riparian wildlife	Provide a variety of interesting wildlife habitats: Use plants that provide widlife food; Provide different water depths; Create shelter for wildlife such as bird and bat houses
WAYS TO LEARN	
Signage	Provide simple signage or exhibits that use: Brief text; Clear graphics; Location, color, or motion that attracts people
Programming	Design treatment system to invite educational games or activities
CONTEXT FOR LEARNING	
Visibility	Create treatment systems that are visible and legible; Create visual interest by varying the apperance of different parts of the stormwater treatment system
Gathering	Create a variety of spaces for gropus to explore, gather, or sit near the stormwater treatment system
Interactivity	Create treatment systems that are touchable; Create designs that encourage people to explore and play near or in the treatment systems

Figure 3.17 Artful Rainwater Design strategies for educating the public

From Echols and Pennypacker (2008) pg 272

- *Sequencing*
- *Revealing and Concealing*
- *Gathering*
- *Opening"*

Several of these practices tie into and support many of the concepts highlighted in the eco-revelatory design philosophies as well as some of the material previously covered in the education and exhibit design sections. *"Naming"* gives visitors an idea of what to expect before arriving, and also permits connections with other stories via historical names, figures or references to other places. *"Sequencing"* plays upon the idea that when people see adjacent elements in the landscape, they assume there exists a relationship between them. This is especially effective for representing and manipulating time and also can create space for contemplation when the sequence takes the shape of a circle, spiral or labyrinth. The section on *"Revealing and Concealing"* makes an interesting distinction between playing with mystery (revealing just enough to intrigue) verses transparency (revealing it all), the latter being a strategy they liken to the expression of ecological process in design.

A more recent piece of empirical research conducted at the Cedar River Watershed Education Center in North Bend, Washington, also addresses narrative as teacher, but emphasizes the combined power of physical design and direct interpretation (Rottle 2005a). The design of the landscape and buildings here holds many narratives, largely describing the movement of water and the concept of watershed, utilizing enlarged downspouts, a stream filled courtyard, and Rain Drums played by falling water. Five years after the opening of the center, designer Nancy Rottle returned to interview 45 visitors on their perceptions of these metaphors and what messages they were able to glean from their experience at the facility. The results were quite encouraging. Study participants identified all of the major design messages with the exception of the watershed metaphors in the storm water channel and green roofs. With 99% indicating that they recognized some aspect of the educative intent of the design.

Rottle's conclusions give strong credence to the power of design as teacher. She does however include the caveat that direct interpretation combined with physical form most likely provides the best exploration of subtleties in a complex idea or landscape. This justifies even more so the need to create educative designs that span the gradients between teacher led and self directed education (Rottle 2005a).

Summary–Learning Ideals in Landscape Architecture

The concept of teaching through design has been a part of landscape practice from the beginning. Much of this largely revolves around how nature is portrayed and how designers construct our relationship with the natural environment. Certain techniques appear to have been successful in building and influencing our relationships with nature:

- Use of Culturally Appropriate Aesthetics
- Revealing Ecological Process
- Embodied Experience/Richness of stimuli
- Providing Legibility and Mystery
- Construction of Story and Narrative

Take Home Lessons–Learning Ideals in Landscape Practice

- **Narrative and storytelling offer a powerful platform for learning.** (Echols and Pennypacker 2008, Potteiger and Purrinton 1998, Rottle 2005a)

- **Natural processes, movement, and change are intriguing and build our relationship with place and nature.** (Brown et al. 1998, Echols and Pennypacker 2008, Johnson 2000)

- **Connecting with a cultural aesthetic can help visitors accept and appreciate other messages in a given landscape.** (Echols and Pennypacker, Nassauer 1995 and 1997, Spirn 1998, Taylor 1998)

- **Embodied experience: movement, interaction and physical exploration of an environment stimulates emotional and mental connections.** (Echols and Pennypacker 2008, Potteiger and Purrinton 1998, Ellsworth 2005, Taylor 1998)

- **People engage readily with landscapes that balance mystery and legibility.** (Kaplan et al. 1998)

- **Interpreting landscapes may be most powerful when both teacher guided and self guided experiences are available.** (Rottle 2005a)

The Power of Nature

It is not by coincidence that much of the discussion around learning and landscape architecture concerns the benefits of natural spaces and connection with natural ecology. After all they represent the primary materials landscape architects use to ply their trade. What becomes interesting, however, are the reasons why nature is such a powerful element in supporting learning opportunities, and how this informs the larger discussion of educative design. This link between nature and learning make both the opportunity and imperative for Landscape Architects to intentionally educate our society that much more obvious and essential.

An established and growing body of literature firmly posits exposure to nature and natural settings as a positive influence on human health, child behavior, and creativity. Largely summarized in Richard Louv's 2008 volume *Last Child in the Woods: saving our children from nature deficit disorder,* these conclusions represent the combined efforts of researchers in the fields of education, medicine, public health, and child and environmental psychology. Landscape architects and museum designers have long drawn from the ideas of Kaplan and Kaplan regarding the restorative properties of nature (Kaplan et al 1993, Kaplan et al 1998, Falk and Dierking 2000). More recently urban planners, landscape architects, and environmental educators have used this literature to justify the greening of urban neighborhoods, schoolyards, and public spaces (Johnson 2000, Louv 2008, Kaplan et al 1998, Marcus and Barnes 1999). Arguments for the value of nature justify its use as a broad brush for improving just about any aspect of our built environment from hospitals to schools and shopping malls. A closer look at some of these arguments can lend some insight into just what it is that makes a fertile environment for learning, education, and development of the mind.

Creative Play and *"Loose Parts"*

Part of the argument behind nature's benefit for education relies on accepting play as a central factor in how we learn. Play, particularly

play involving the imagination, is linked to making connections and inspiring creativity. This concept is stressed heavily by Brett et al (1993) in the *Complete Playground Book*, and is reinforced by Moore and Wong (1997), Stine (1997), and by Louv (2008). The impact of natural settings on encouraging this type of creative play was first articulated by Simon Nicholson as *"The Theory of Loose Parts"*, arguing that their multitude of textures and materials makes them particularly effective in supporting creative activity:

> *"In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it."*
>
> *(Nicholson from Louv 2008 pg 87)*

Moore and Wong articulate this connection even more strongly in *Natural Learning: the life history of an environmental schoolyard*:

> *"Natural spaces and materials stimulate children's limitless imaginations and serve as the medium of inventiveness and creativity observable in almost any group of children playing in a natural setting."*
>
> *(from Louv 2008, pg. 87)*

These points stem largely from the observation that natural areas, given their diverse array of elements and easily manipulated settings, offer great affordance for creative play. Research, however, has not reliably shown that natural areas necessarily cause children to be more creative (Louv 2008, pg. 89). Studies in Denmark, Sweden, Australia, and Canada demonstrated that children in greener areas of school grounds tend to engage in imaginary and creative games more often, but there is no evidence that the children playing in these areas weren't predisposed to creative play in the first place. A better conclusion is that when children choose to engage in creative play, they choose to find natural places to do so. Louv completes this discussion by making this point:

> *"Nonetheless, the possibility that creative children prefer natural areas for their play raises its own crucial question: What happens when creative children can no longer choose a green space in which to be creative?"*
>
> *(Louv 2008, pg. 89)*

Louv also makes the case for natural areas supporting a wide variety of intelligences, as described by Howard Gardner, with a broad range of stimuli affecting many senses and providing opportunities for engaging the physical, logical, and creative. He also touches upon Gardner's addition of an eighth intelligence, *"natural intelligence"* that is less grounded in research, but still describes a real phenomenon in terms of certain children's fascination with nature. Again, Louv warns that the loss of experience in natural areas will cause those intelligences and skills afforded by them to inevitably wane. Educative landscapes, especially those for children, need to provide the *"loose parts"* and complexity necessary to support creative and cognitive development. The manipulation and interaction necessary for such enriching play is easily afforded by natural spaces, making them powerful tools in designing for education

Calming and Focusing

Aside from direct effects of nature providing cognitive or creative engagement, there are ambient and long term benefits that also influence the ability to learn. Numerous studies support noticeable impacts of

exposure to green spaces on children's ability to think clearly, concentrate, and manage stress. This includes both long term studies looking at issues of access to green space, and immediate, positive results of playing in natural areas on reducing ADHD behavior (Louv 2008, Taylor et al 2001, Kuo and Faber Taylor 2004). These benefits are particularly pertinent when considering access to green space in and around environments where people are expected to focus for significant periods of time. This most immediately applies to schools, but follows for any high stress environments such as hospitals, office buildings, and convention centers. Kaplan and Kaplan describe the calming ability of nature as a *"restorative"* environment, where the mind can actually bypass the chatter of cognitive thought and rest in a transcendent and peaceful state (Kaplan et al 1998).

Transcendence, Identity and Creativity

Louv discusses similar transcendent experiences in nature as a possible foundation for lifelong creative thought. Beginning with Edith Cobb's work examining childhood relationships with nature in 300 famous and creative personalities, Louv suggests that experiences with nature give us glimpses of wonder that we revisit with questions and contemplation for many years. He also cites Chawla, who performed a more rigorous study that demonstrated a strong connection between powerful experiences in childhood to inspiration and creative thought as an adult. In her study nature was not the only source of such experiences, but Chawla found it to be, even in spaces as simple as a flowerbed, a dominant force in creating powerful connections that fostered creativity later in life. Louv eloquently describes nature's value as a lifelong source of wonder:

> *"Nature–the sublime the harsh and the beautiful–offers something that the street or gated community or computer game cannot. Nature presents the young with something so much greater than they are; it offers an environment where they can easily contemplate infinity and eternity."*
>
> *(Louv 2008, pg. 98)*

Summary–The Power of Nature

Nature provides both direct and indirect support for learning. The flexibility and variety offered by natural settings support creative play and imagination. Interaction with nature inherently calms us and helps us focus and concentrate. Nature remains for many a never ending source of wonder and inspiration.

Take Home Messages–The Power of Nature

- **Natural settings provide 'Loose Parts' that support creative play and engage multiple senses and intelligences.** (Brett et al. 1993, Louv 2008, Moore and Wong 1997, Nicholson 1971)

- **Natural settings have a positive effect on concentration.** (Kuo and Faber Taylor 2004, Louv 2008, Taylor et al. 2001, Kaplan et al. 1998)

- **Nature affords us opportunities to contemplate that which is not of us, but larger than the human experience. Nature provides wonder.** (Chawla 1986, Louv 2008)

School Grounds and Curriculum Connections

School grounds are probably the most immediate and obvious application for principles of educative landscapes, as they contain and surround institutions already dedicated to learning. In this respect there is a wide body of literature on playgrounds, outdoor learning spaces, natural school yards, and designing for learning in general (Brett et al 1993, Stine 1997, Moore and Wong 1997, Johnson 2000). I have attempted to hold this discussion of school grounds and curriculums to more abstract concepts that can be applied to a wide range of settings as opposed to specific design solutions. However, I have included interesting examples in the side bar in order help illustrate the discussion. Though the focus is on school settings, most of the literature openly encourages interaction with the community, and expresses the need for school grounds to address formal and informal education (Johnson 2000, Hart 1997, Taylor 1993, Brett et al 1993, Moore and Wong 1997, Stine 1997). This supports my supposition that educative landscapes are best as spaces with multiple purposes and variable user groups. Also covered in this section are school gardens, curriculum-driven installations and opportunities for student involvement. These and other issues are covered in three sections: Semiotics and Perceived Values, Playgrounds, and Outdoor Classrooms.

Semiotics and Perceived Values

Designs of schools and learning spaces send messages. They encourage students to learn by letting them know we care about them. They also encourage students to learn by demonstrating and showcasing the ideas and philosophies inherent in our curriculum. They allow us to practice what we teach.

Wendy Titman, in her seminal work *Special Places, Special People: the hidden curriculum of school grounds* (1994), began to reveal the messages students internalize from the design and maintenance of their schools. Her semiotic approach operated under the assumption that we internalize information and make judgments based upon subtle factors in our surroundings. Titman interviewed 216 children aged 8-12 from 12 different schools, and the findings more than supported this idea, indicating that students equated certain aspects of their school grounds with how much the community cared about the students themselves. Interestingly, asphalt on a playground was considered by students to be cheap, and the presence of large amounts of this material indicated that the school didn't care enough to spend money on students. Grassy spaces on the other hand were valued. However, if signs were put up preventing students from using these fields, students felt as if the school valued the lawn more than them. The study results indicated that students of this age value and are willing to care for natural environments on school grounds. They are seen as meeting many needs including providing shade, hiding, making dens, and game playing.

Titman also compiled a list of things students found preference for in their school landscape (pg. 58):

- *"A place for doing: spaces for challenging physical activity*
- *A place for thinking: providing intellectual stimulation, discovery and a chance to explore on their own or with friends*
- *A place for feeling: carrying a sense of pride and ownership, presenting color and beauty; a place they can care for, or where they can be cared for*

- *A place for being: a private place to be alone or with a small group of friends that supports identity and individuality*

- *Designed equipment: structures/equipment/materials that can be changed in actuality or with imagination*"

Students actually preferred natural environments where they could build dens, and create imaginary worlds over static built structures; and 'found' places were more significant than those built specifically for children. Preferences for any designed equipment specified materials or structures that can be easily changed, either in actuality or with the imagination. One of the fundamental desires of the children in her study group was to be challenged intellectually. This suggests that foundational aspects of what people, in this case children, look for in their recreational environments includes places for learning: educative landscapes.

In two essays entitled *Architecture as Pedagogy* (1993, 1997), Professor David Orr of Oberlin College, Ohio challenges college campuses to address their architecture and landscaping in a similar semiotic fashion. Looking at the subject matter and philosophies taught in environmental science courses across the country, Orr criticizes the potentially contrary setting in which students are instructed. He points out the antiquated, unsustainable design of most buildings on college campuses, explaining that each sends an implicit message:

"…energy is cheap and abundant and can be squandered with no thought for the morrow."

(1993, pg. 597)

He then proceeds to ask the questions:

"Is it possible to design buildings and entire campuses in ways that promote ecological competence and mindfulness?...Is it possible to teach our students that our problems are solvable and that we are connected to the larger community of life?"

(1993, pg. 597)

Orr responds to his own questions by initiating a student centered approach to the design and construction of a new building on Oberlin's campus. The resulting Adam Joseph Lewis Center for Environmental Studies, completed in 2000, was truly designed as a building that teaches. It is not only a demonstration of sustainable technologies, but lives as an ongoing research project. The systems in the building (water, energy, geothermal heating, and the living machine) are monitored and post data in real time to the internet, allowing students across the nation to conduct real research on the performance of this sustainable classroom.

Playgrounds

In the *Complete Playground Book*, Brett et al. (1993) firmly emphasize the importance of play for the intellectual, physical, and social development of children. The most effective playgrounds for supporting the developmental needs of children, according to Brett et al., contain accessible and easily manipulated material, where children are allowed to build, disassemble, and imagine. They make many references to the Adventure Playground concept where loosely supervised groups of children build the play structures themselves out of wood, stone, earth, and other available materials. Like Nicholson's theory of loose parts, the availability and range of different materials creates more opportunities for creative play. Brett et al. do point out that the Adventure Playground concept is a difficult one to fully achieve, in that it requires supervision and possesses inherent liability issues. The authors describe alternative playgrounds that contain aspects of the Adventure Playground,

emphasizing access to sand, water, and nature. Again, the heart of their argument is in the diversity and accessibility of materials.

Brett et al. also discuss the developmental needs of children, and how playgrounds must provide different amenities based on age and interests of the users. Their useful guide to the developmental needs of children important for playground design is summarized here in four stages:

- **Toddlers**–Testing developing motor skills, experimentation with simple play materials that can be used in many different ways. Imaginary/pretend experiences are important.

- **Preschoolers**–Need active engagement with their physical environment. Structures must balance the need for challenge with need for safety. Development of logical thought: conservation and classification, discovering relationships in environment, problem solving.

- **Elementary School**–Peers begin to become more important, requiring space for group games and places for social interaction. Group games/physical activity, ball games, hopping, jumping, climbing. Activities/structures that build balance, coordination, and strength.

- **Middle School**–Space for movement, areas for exploration, accessible materials, activity areas for hobbies and interest groups, large spaces for vigorous body movement, environmental flexibility and space for socialization: Adventure playgrounds!

Notable from this list are the shifts in significance from interaction with environment to interaction with peers. At toddler, preschool and middle school stages, interactions with the environment–the ability to manipulate, compare, and build–are the prime services of the playground. In elementary school, however, social activities in large groups and smaller clusters become important, and spaces appropriate for gathering on an intimate and grander scale become the focus of design. Moving into middle school, the need for socialization continues, however a need for sophisticated and complex systems for building and creating become paramount. This is the age range the authors suggest as prime for the Adventure Playground, allowing youth to build their own playscapes, club houses, and learning experiences.

Sharon Stine, another author who focuses on play and places for learning, points out that the act of teaching (especially at younger ages) largely involves manipulating the environment and letting students run free (1997). She describes children as the *"mess makers"* and teachers as the *"maintainers"* in an environment designed to encourage exploration, manipulation, and discovery. Stine outlines a series of design elements important for initiating creative play, and describes them as a series of dichotomies, allowing opportunities for comparison and a range of experiences. For these design elements to be effective, both extremes of the dichotomy must be present as the differentiation between the two helps support and illustrate them both.

Stine's Basic Design Element *"Dichotomies"*:

- ***"Accessible/Inaccessible"***–describing the need for clear boundaries for safety and demarcation of activities

- ***"Active/Passive"***–areas for vigorous movement and areas for contemplation

- ***"Challenge and Risk/Repetition and Security"***–new things can be tried and retried, alone or with the security of a partner

- ***"Hard/Soft"***–easily cleaned, well defined spaces and messier spaces for more open activity

- ***"Natural/People Built"***–demonstrating influence of both cultural and natural origin

- ***"Open/Closed"***–referring to activity, open ended emphasizing creativity (artistic activities) versus goal oriented emphasizing skill building (group games, puzzles)

- ***"Permanence/Change"***–landmarks and features that define identity of a space, some of which are created or determined by the users

- ***"Private/Public"***–spaces for groups and spaces to be alone

- ***"Simple/Complex"***–basic elements kept simple, with small, manipulable additions to add interest and flexibility: toys in a sand box or buckets and sponges near a water feature

Outdoor Classrooms

Schoolyards and open spaces can and do directly support school curriculum (Johnson 2000, Moore and Wong 1997). Outdoor classrooms, as I am calling such places, may have much in common with playgrounds, as they may double as such, or need to provide avenues for creative play as part of a given curriculum. They also need to provide certain aspects of a classroom: a place for presenting, organized seating, and a certain degree of shelter from distraction and inclement weather. Often, outdoor classrooms feature elements that illustrate key concepts or ideas in a given curriculum. Such spaces offer fantastic opportunities for educative design; however they also present a consistent challenge. Specific design elements may go unused or unappreciated when the teachers who inspired or utilized such installations leave the school (Stine 1993, Johnson 2000). Part of my inspiration for investigating more theoretical aspects of learning and design comes from this issue, and the desire to pinpoint the basic foundations of how space or a design can motivate us to learn. How could outdoor classrooms, inspired by curricula or teachers long gone, continue to support and inspire curiosity and exploration?

Julie Johnson (2000) outlines several characteristics of programs that successfully utilize school grounds to support their curriculum:

- *"Principal as Advocate- for current and continued educational use and development of school grounds, including fund raising and forming partnerships within the community...*

- *Curriculum pieces are tailored and implemented for each grade level...*

- *Teachers are trained and use the curriculum and work to expand it...*

- *Teachers incorporate site planning and design process into curriculum...*

- *Adequate Supervision is provided during structured use of school ground teaching elements. Dearborn Park (K-5 Seattle) splits classes, half to computer lab, half to their school's forested natural area for environmental education..." (pg. 62-3)*

Johnson's findings emphasize the necessity for both teachers and administrators to take an active role in supporting and utilizing school grounds as a teaching resource. This seems the factor most likely to contribute to a project's eventual success.

There are, however several other factors present in the literature that help prolong and enhance the engagement of an educational community with a educative landscape. Participatory Design allows for increased ownership by students, creating an inherent investment and

greater interest in maintaining and using an outdoor classroom. This is evidenced not only in student participation in the initial design and site planning process, but in the ongoing care and stewardship of an area, as strongly demonstrated in School Gardening programs (Hart 1997, Taylor 1993, Johnson 2000). Teachers and administrators are not the only group that can keep a curriculum alive in an outdoor classroom. Partnering with community groups, such as environmental education non-profits, shifts the responsibility of teaching and interpreting to agencies which may provide greater longevity or a broader audience for an outdoor classroom. The following sections describe in more detail how school gardens, community partnerships, and participatory design can enhance the power of outdoor classrooms and sustain connections with students and communities over time.

School Gardens

Just as the benefits of nature are held high by the landscape design community, the advantages of school gardens and gardening weigh in heavily in the field of education. Studies link school gardening activities with improved science achievement scores, as well as greater parental support and participation (Klemmer et al. 2005, Henderson and Mapp 2002, Alexander et al 1995). Gardening activities have been shown to successfully integrate with a wide variety of subject areas (Canaris 1995), offering opportunities for diverse tie-ins with different teachers, subjects and teaching styles. Johnson (2000) also extols the virtues of gardens on school grounds, for both formal education and community involvement and community building activities, citing California's commitment to place a garden at every elementary school as testament to their significance in education (pg. 23). Though teacher involvement may still provide the richest educational experience, gardens, specifically food gardens seem to offer some inherent educational benefits, many of which illustrate themes already explored in this literature review:

- Direct connection with culture and food ties into motivation to learn more about that which we already know, and to learn about things that are seen as valued and important: food.

- Easily manipulated by small hands or large, in teams or individually; gardens by definition are tended by humans and invite participation.

Even without direct participation or teacher direction, these aspects of gardens contribute to potent learning experiences. Gardens and farming hold such a powerful spot in modern society as the source of our food, that landscapes mirroring this pastime will inevitably draw us in. The standard practice of planting like varieties in rows makes for easy comparison, and the change in vegetable crops during the course of a growing season is large and easy to see. Gardens occur in big fields, small plots, in green houses, and in flower pots. They can change scale but the basic idea is the same and accessible. School gardening has many links with educational non-profits and groups outside of the school itself; allowing opportunities for community involvement in addition to, or even replacing, teacher support (Johnson 2000). Though perhaps not practical in all situations, the garden, regardless of design characteristics, comes up time and time again as a powerful place for learning and teaching (Moore and Wong 1997, Johnson 2000, Stine 1997, Taylor 1993). Its effectiveness should not be disregarded when designing any learning space.

Community Partnerships–Beyond School Grounds

Just as school gardens tie into a larger body of curricula beyond the school itself, looking to district wide themes or popular enrichment programs may be ways to increase the longevity of curricula based designs in outdoor classrooms. In Seattle, WA two projects demonstrate this strategy. David Minnery's MLA thesis project at the University of Washington created an educational rain garden design for Adams Elementary School that tied in with district science standards and National Science Foundation kits and activities (2008). Minnery created a matrix with design gestures for each grade level, connecting with appropriate themes and activities from the district's inquiry based science curriculum. With Minnery's help, the plans for the rain garden were created, gathering input from current students and teachers of the school. The integration of standardized curriculum enabled the design to benefit future teachers, and created a model for projects school district wide. Unfortunately, the constructed project left out several key features of Minnery's educative design. The original schematics can be found in his 2008 thesis at the University of Washington.

Associate Professor Nancy Rottle, also of the University of Washington, held a 2005 landscape architecture student studio using environmental education and the district 6th-8th grade science curriculum as guides for developing designs for the Magnuson Outdoor Learning Lab (MOLL) (Rottle 2005b). Located in Seattle's 350 acre Magnuson Park, MOLL was the result of 2002 efforts by community environmental groups to utilize this vast city open space for educating students and teachers about Lake Washington's shoreline ecology. The 2005 studio designed a portion of the park to specifically meet the needs of the 6th and 8th grade Seattle schools science curriculum. The 6th grade curriculum, based on *The Truth About Science* (Kelsey 2001), emphasized student led investigation, while the 8th grade was more subject driven, focusing on evolution and ecology. The resulting designs created opportunities for activities such as comparing, observing, and reflecting; emphasizing visual and measurable changes prompted by season and water condition. Interesting proposals included a grid of snags, designating transect lines for monitoring the area, as well as 'leaky weirs' or long linear damns that extended out into the ponds and eventually underwater. This work is significant for two reasons. First, like Minnery's project, the district wide curriculum is used at the heart of the design. Second, in this case the venue was created to serve a multitude of schools, supported by the local non-profit environmental education community. Trips to the Magnuson Outdoor Learning Lab can be run by teachers from public schools, from various environmental organizations, or simply by families themselves; stretching the common curriculum across three different learning groups, and reinforcing this educative landscape as useful for multiple communities and multiple purposes.

Participatory Design

Though my desire in this thesis is to investigate how the physical design of a space influences learning, it is important to mention the potential power of student and community participation in the design process. Taylor describes such opportunity as potentially more powerful than the final design itself, as it creates immediate student investment in a space. Johnson and Skipton (2002) and Minnery (2008) in their work with Seattle grade schools blended every step of the participatory process with the school's curriculum; an approach recommended again by Johnson (2000) with her example at Dearborn Park Elementary. Hart (1997) in

particular as well as Stine (1997) speak to the value of including young people in the design of public spaces as essential for learning stewardship and the value of civic process. Over and above the learning inherent in participation, all the authors here also stress the value of including youth, teachers, and community for simply making spaces more effective. Though finished parks and schoolyards can be permanent inspirations for learning, the opportunities carried by community involvement create different lessons in motivation, creativity, and stewardship for those who participate.

Summary–School Grounds and Curriculum Connections

Students are sensitive to their surroundings, and perceive the care and attention in their places of learning as care and attention for themselves. This reflects in their motivation to participate in the school community and value for lessons being taught. A well cared for school lets students know they are cared for as well.

The design of spaces around schools can support education directly via demonstrative, exhibit like elements, or simply by affording opportunities for creative play. Playgrounds and gardens support many aspects of learning, from creative problem solving to community building, manipulating, and testing. Outdoor classrooms supporting specific curriculum do best when also supported by teachers, administrators, and community. Involving these three groups, as well as the students, in their design can create powerful opportunities for learning and equally powerful designs.

Take Home Messages–School Grounds and Curriculum Connections

- **Cues in the landscape influence the general motivation and investment of students in their education.** (Orr 1993, Titman 1994)

- **Portions of designs should be left unfinished to provide for creativity and ownership of users. 'Loose Parts' can apply to specific areas of a design (a garden), the entire thing (Adventure Playground), or even a designer led charrettes process.** (Brett et al. 1993, Johnson 2000, Johnson and Skipton 2002, Minnery 2008, Stine 1997)

- **Educative landscapes benefit from support by communities and schools, especially when supporting specific curricular or programmatic needs.** (Hart 1997, Johnson 2000, Johnson and Skipton 2002, Minnery 2008, Taylor 1993, Titman 1994)

- **Students require a rich tapestry of materials and experiences that provide ranges between risk and safety, solitude and groups, structured and chaotic.** (Brett et al. 1995, Johnson 2000, Stine 1997)

CONCLUSIONS–PRINCIPLES FOR EDUCATIVE DESIGN

Connections between place, learning and design emerge strongly in literature from education, museum design, and landscape architecture. Overlapping themes and ideas from these three disciplines form ridges of strength, supporting and identifying a list of principles for creating educative landscapes. To this end, I've taken the thirty 'take home messages' from this literature review, and refined them into ten categories, or principles. Importantly, there is much overlap, as several 'take homes' apply to more than one principle, possibly indicating that these 'take homes' are more fundamental to learning and define a greater breadth of opportunities for design. Also significant are the overlaps between the three disciplines, where 'take homes' from each support the same principle. The more robust the support, the more likely that these principles may be fundamental to the idea of educative landscapes and educative design. These patterns become easier to see on figure….. a matrix showing the principles, brief descriptions, and their supporting 'take homes'.

It would be impossible to remove my own bias as a teacher in choosing and naming the ten principles proposed here. The formation of this list has been iterative, beginning with my own reflections on teaching and designing, and growing through conversations with thesis commitee members Nancy Rottle and Julie Johnson. The literature review further refined and supported these ideas, and the final section of this thesis, the case studies, is meant to refine them further still.

Definitions for these principles are intentionally broad and abstract; however, I attempt to capture the heart of the idea with each description. Likewise, I may not list all of the 'take homes' in my discussion that necessarily support a given principle. I have chosen to use those which seem to best support the definition in true spirit and intention.

The principles also relate to the Learning Cycle for Educative Design presented in Chapter Two (Figure 2.2). Their definitions offer finer explanations for the five activities that define learning in educative landscapes. Representations of the learning cycle diagram accompany each principle listed below, showing links with one or more of the learning activities. In this way, the Ten Principles of Educative Design

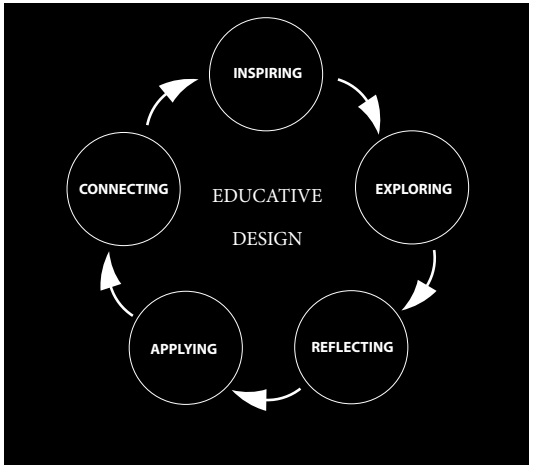


Figure 2.2: Learning Cycle for Educative Design

Inspiring: Experiencing excitement, interest, and motivation to learn about phenomena in the natural and physical world.

Exploring: Manipulating, testing, experimenting, predicting, questioning, observing, measuring with the intent of making sense of the natural world

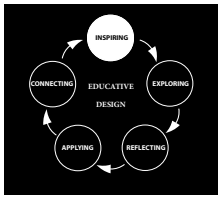
Reflecting: Deriving general principles, patterns, relationships from observation; 'making sense of'

Applying: Retesting ideas in new situations, trying things out

Connecting: Making meaning, linking ideas with identity, culture, prior knowledge

not only rest upon research from three disciplines–education, museum design, landscape architecture–but are meant to embody the definition of learning itself.

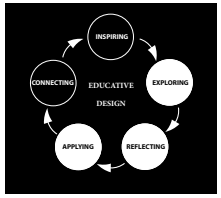
Ten Principles of Educative Design

1. 

Strives to Instill Wonder: This principle stems from the idea that wonder is at the heart of all new knowledge. To achieve a state of wonder is to peer beyond the accepted and familiar into the unfathomable and unknown (Opdal 2001, Louv 2008,). If curiosity drives us to tinker, wonder forces us to think, contemplate, and imagine. This inspires the emotional connection Falk describes in his work on museum design, and is what draws us back to a place or experience time and time again (Kaplan et al. 1993, Chawla 1986, Louv 2008).

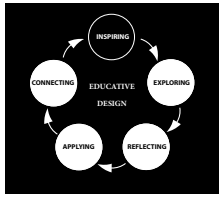
In terms of this principle, wonder can bring both excitement and peace. It stems just as easily from transcendent reflection on our small place in the universe, as it does from the awe of power, beauty and the unknown. Louv offers a clear example of wonder in his descriptions of nature:

"Nature presents the young with something so much greater than they are; it offers an environment where they can easily contemplate infinity and eternity." (2008, pg. 98)

2. 

Provides Manipulable/Interactive Elements: Drawing heavily from the Exploratorium's *Active Prolonged Engagement* philosophy (Gutwill 2008) and Nicholson's theory of *"Loose Parts"* (1971), this principle engages people's need to tinker, problem solve, and play. People learn via testing and retesting (Hein 1991, Bransford et al. 2000), with the ultimate goal of making predictions and applying them to new situations.

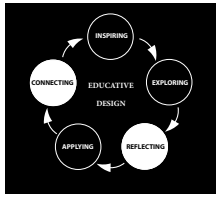
Excellent examples of manipulable and interactive elements include specialized water features such as the 'Flow Formations' APE exhibit (this chapter Figure X), adventure playgrounds, gardens and natural settings.

3. 

Allows for Observable Change/ Comparison: It is one thing to manipulate and change the environment, but the consequences must also be clear and easy to see. Can they be measured and compared? Seasonal changes in temperature, day length, weather pattern, and humidity may not be easily interpreted by every observer. What can design do to reveal these processes? Champions of eco-revelatory design work to expose changes and patterns in the natural world and, at their best, expose cause and effect relationships–the foundations of ecology. It is important to distinguish between manipulation and observation.

Manipulation allows learners to control their investigation and form their own questions. However, without a way to observe, measure or compare, patterns are harder to detect. Direct user manipulation adds a separate, important layer, but is not always a feasible option. An eco-revelatory landscape or museum design is successful in its own right, simply by clearly revealing change and demonstrating patterns (Falk 2000). Stronger designs will allow for more precise observation, using units of measure, or side by side comparisons. It is also important to provide comfortable places from which to watch and observe. People are more likely to notice subtle changes of the landscape when they have a sunny place to linger and relax!

Designs which highlight observable change and easy comparison could utilize sundials, rain and water gauges, or windmills. A personal favorite is Bargmann and Levy's Litmus Garden showcased earlier in this chapter.

4. 

Balances Clarity and Mystery, Novelty and the Familiar: Mystery and novelty are seldom left out of conversations on learning. They are fundamental to curiosity and help ignite the basic drive to explore (Kaplan et al 1998, Berlyne 1960). A more delicate but necessary conversation in design may be *how much* mystery and novelty to include. Studies in education, museums, and landscape preference show that too much complexity and novelty is met with disinterest and dislike (Berlyne 1960, Falk 2001, Kaplan et al 1998). Designs need to provide a degree of familiarity with a degree of the unknown: easily perceived paths with mysterious destinations, and new ideas parsed in incremental steps. There is also advantage in letting people know what learning is about to happen–there needs to be no mystery as to the presence of the mysteries themselves…

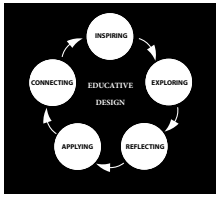
In design language this includes clear educational intent, clear landmarks for orientation, repetitive themes or patterns, and previews of certain experiences found in the landscape. Designers should also consider how information or ideas will be organized on site. Garrett Devier(2007) in his MLA thesis recommends the use of cohesive narratives that stretch the length of an interpretive trail, and shuns breaking up information into individual stand alone stations. Likewise, Falk and Dierking (2000) recommend organizing museum exhibits into broad clusters of ideas with a central, well interpreted main feature, and accompanying smaller exibits with simple to no signage at all. This relatively broad principle contains several ideas, summarized in the list below:

- **Clarity**: Open and clear educational intent, Easy and inviting to navigate–uses landmarks, signs, and prospect to help orient; presents information in clear and direct manner; clusters ideas and presents themes where possible

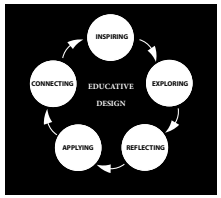
- **Mystery**: Information/wayfinding unfolds incrementally using previews to draw visitors along. Inspires curiosity and exploration.

- **Novelty**: Presents new ideas and unique experiences

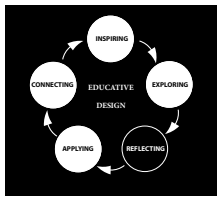
- **Familiar**: Maintains feeling of safety and comfort, uses legible shapes/images/representations appropriate to culture/age/experience of visitor. Balanced with novelty, creates amusement and intrigue by presenting recognizable objects or experiences with odd or new messages or meanings.

5. 

Supports Self Directed Learning: This principle demonstrates the need for educative landscapes to remain effective across a broad range of learning communities. In the absence of a teacher or interpreter, can lessons be perceived and discovered on one's own? The ability of a space to support self directed learning will of course rely on the presence of the other principles; however, there are a few specific points that must be addressed. One is the idea of multiple levels of entry. Taken directly from museum literature (Falk and Dierking 2000), this can be applied both to the physical design of an area, as well as its mental engagement. Are there several examples or different ways for people to physically access the material or lesson at hand? Are there mental and emotional entry points that will appeal to a wide range of audiences, both novice and expert, older and younger? Self directed learning environments tie in best with some sort of cultural familiarity, allowing for links and connections to be made without prompting from a teacher. This principle also links with ideas of free choice learning articulated by Falk and Dierking (2000)–allowing for internal motivation to guide and shape a visitors experience.

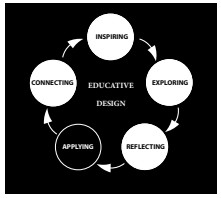
6. 

Supports Teacher Facilitated Learning: The presence of a teacher or interpretive guide can often expand the learning experience in ways a self directed activity will not. Certain terms, ideas or experiences may be too new, too mysterious, or too abstract for novice learners to tap into. Teaching, one on one or in group settings, can allow some students to access material and concepts faster and with more depth than they could on their own (Vygostky 1978). Designs that support teacher directed learning possess larger spaces for gathering and presenting, smaller venues for groups or individuals to share, and again information with multiple levels of entry, to allow teachers to scale their lesson to the group. The significance of combining teacher facilitated and self directed learning opportunities is articulated clearly in Rottle's 2005 study of the Cedar River Watershed Education Center. She concluded that richly designed spaces, layered in metaphor and sensory experience, created the most powerful learning opportunities when accompanied at some point by direct interpretation.

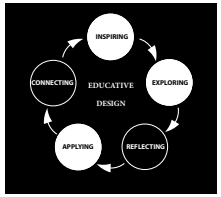
7. 

Creates Multi-Layered Experiences: This principle feeds the senses, providing rich, stimulating environments that access many intelligences through cognitive and embodied experience. Environments contain

small cues and clues that influence the mind and body on a subconscious level. Delicately arranged, such factors can guide the mind and body to experience and learn as a single integrated unit (Ellsworth 2005). Maya Lin's table at the Civil Rights monument in Montgomery begs visitors to place their hands on its edge in a thin layer of running water representing the flow of time, while in the center a circular timeline speaks to the cycle of discrimination and struggle for justice in American history.

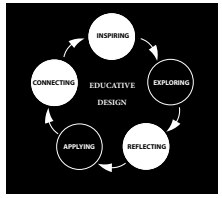
8. 

Invites Collaboration: We learn better when we share. Our minds internalize information as we process and vocalize ideas into speech. Learners are often comfortable collaborating with peers, taking turns teaching and learning. Educative landscapes need to provide spaces where people can see and experience things together, spaces to pause on a trail, to observe on an overlook, that encourage us not only to see, but to share as well. Is there more than one telescope at the lookout? Are there windows for people tall and small? How many people can manipulate the water feature at once? People like to perform and people like to imitate (Gutwill 2008), visitors see what others are doing?

9. 

Invites Play: People learn better in a relaxed atmosphere, free from judgment and consequence. Does the landscape invite interaction and exploration, or is it fragile and protected? Fear of breaking something, of messing things up or simply being wrong can hinder experimentation, an important part of play. Stine (1997) points out the importance of boundaries, of the need to delineate between soft and hard environments, to create definition of appropriate activities for appropriate places. Her discussion is inherently practical but by and large it's the softer and messier environments that are embraced by other authors for their sense of freedom and support for creative play–factors that encourage problem solving and learning in powerful ways (Nicholson 1971, Brett 1993, Louv 2008).

People also learn better when they are comfortable in an environment that allows them to relax and be themselves. Is the space scaled for a variety of ages and abilities, with access and themes for small children, elderly, and ages in between? Do visitors feel that the space is *for them*?

10. 

Provides Social and Cultural Relevance: The incorporation of new knowledge into how we think and how view the world happens in a social and cultural context. People retain knowledge as it becomes significant for themselves and the people around them. This means that educators, and in this case designers, must be sensitive to the cultural values and habits of their audience. The idea of a rain garden may have different connotations depending on the culture, affluence, and urban density of a given community.

Lessons afforded by such a design and the aesthetic of the design itself will likely be different for each case. Social and cultural relevance applies on different scales, and will change depending upon peer group, family and societal contexts. Learning how to drive a car or identify invasive species may have different values for teenagers depending on the context of family versus peer group. Designs with themes that connect on personal, regional and global levels, help make more effective places to learn.

Cultural relevance can also be created onsite. Participatory design and stewardship activities promote ownership of an area, encouraging users to spend more time, notice more details, and possibly find more lessons (Taylor 1993). Narratives also create a cultural bond, as stories and storytelling are natural pieces of most cultures. People connect with the idea of characters and settings, or even simple representations of a storyline, in the landscape (Echols and Pennypacker 2008, Potteiger and Purinton 1997, Devier 2008). This could take the form of a real story, such as the children's *book The Tree that Came Home* (Brainerd 2008), depicted in the architecture and landscape at IslandWood, or more metaphorical statements such as the nested representations of the watershed at the Cedar River Watershed Education Center (see case studies in Chapters Four and Six). References to well known regional or cultural icons, such as the canoe or the salmon's journey in the Pacific NW, reinforce the sense of place for the locals, and help educate visitors from afar.

Balance, as with the fourth principle, becomes an important consideration here, as Disneyland could easily be seen as the ultimate narrative driven design, as perhaps it may be for its given clientele and business plan. However, not all designs require this same degree of blatant clarity, and most may benefit from greater degrees of novelty and mystery.

Familiar items, used in new and different ways in the landscape also support this principle. Nassauer's camouflaged rain gardens (1995) not only provide a point of cultural relevance, but work to change the accepted cultural point of view as well. This principle encompasses a broad range of ideas, summarized in the list below:

- Relates to society/culture as a whole
- Relates to family/peer group values
- Respects cultural norms
- Ties into cultural traditions
- References common cultural icons, stories or idioms
- Creates narrative or story to explain messages on site
- Builds culture onsite via activity–participatory design and construction, stewardship and maintenance

These ten Principles of Educative Design are most significant in their combination of philosophies from education, museum design

and landscape architecture theory and research. Figure 3.18 lists the principles allong with thier supporting 'take home messages' from the literature reveiwed in this chapter.

Principles of Educative Design	
1	**STRIVES TO INSTILL WONDER** *8, 9, 11, 16, 17, 19, 26*
2	**PROVIDES MANIPULABLE/INTERACTIVE ELEMENTS** *3, 7, 14, 24, 28*
3	**ALLOWS FOR OBSERVABLE CHANGE/ COMPARISON** *3, 7, 17, 19, 22*
4	**BALANCES CLARITY AND MYSTERY, NOVELTY AND THE FAMILIAR** *1, 2, 6, 10, 12, 22, 27*
5	**SUPPORTS SELF DIRECTED LEARNING** *1, 2, 13, 16, 30*
6	**SUPPORTS TEACHER FACILITATED LEARNING** *4, 5, 13, 18, 23, 25, 27, 29*
7	**CREATES MULTI-LAYERED EXPERIENCES** *8, 13, 21, 24, 25, 27, 30*
8	**INVITES COLLABORATION** *4,5, 13, 14, 15, 30*
9	**INVITES PLAY** *2, 6, 7, 14, 15, 24, 28, 30*
10	**PROVIDES SOCIAL/CULTURAL RELEVANCE** *1, 2, 3, 4, 5, 10, 13, 16, 17, 18, 20, 27, 29*

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Education Literature

1. People approach every situation with pre-conceived notions.
2. All new knowledge is built upon frameworks of older knowledge. That which is too unfamiliar is often ignored.
3. Shifts in understanding take time and repeated exposure.
4. We learn better when we share.
5. We learn better when it is socially significant to our friends, family or larger society.
6. Novelty and complexity are fundamental to curiosity, however too much leads to disinterest.
7. Investigation happens at three levels: observation, manipulation and experimentation.
8. We learn via mind, body and emotion.
9. Wonder lies at the heart of all new knowledge while curiousity plays upon that which we already know.

Museum Literature

10. Build the museum expereince before arrival with expectations of what is to come.
11. Strive to create boundless experiences that connect with emotion and beg to be revisited and remembered.
12. Clustering information and exhibits into 'chunks' helps people organize and retain information.
13. Build exhibits with layers of differing complexity and multiple entries and exits.
14. Embrace play and open ended investigation.
15. Create situations where people can observe others or perform themselves.
16. Learning itself might not even occur at the museum, but that doesn't mean the experience won't lead to learning in the future.
17. Museum type learning experiences primarily reinforce relationships and connections.

Landscape Architecture

Lessons from landscape practice

18. Narrative and Storytelling create a powerful stage for learning.
19. Natural processes, movement, and change are intriguing and build our relationship with place and nature.
20. Connecting with a cultural aesthetic can help visitors accept and appreciate other messages in a given landscape.
21. Embodied experience: movement, interaction and physical exploration of an environment stimulates emotional and mental connections.
22. People engage most readily with landscapes that balance mystery and legibility.
23. Interpreting landscapes may be most powerful when both teacher guided and self guided experiences are available.

Nature is a Powerful Teacher

24. Natural settings provide 'Loose Parts' that support creative play and engage multiple senses and intelligences
25. Natural settings have a positive effect on concentration
26. Nature affords us opportunities to contemplate that which is not of us, but larger than the human experience. Nature provides wonder.

School grounds and Curriculum Connections

27. Cues in the landscape influence the general motivation and investment of students in their education
28. Portions of designs should be left unfinished to provide for creativity and ownership of users. 'Loose Parts' can apply to specific areas of a design (a garden), the entire thing (Adventure Playground) or even a designer led charrette process.
29. Educative Landscapes benefit from support by communities and schools, especially when supporting specific curricular or programmatic needs.
30. Students require a rich tapestry of materials and experiences that provide ranges between risk and safety, solitude and groups, structured and chaotic.

Figure 3.18: Principles of Educative Design supported by Take Home Messages from the Literature Review

CHAPTER FOUR | METHODS

The Pacific Northwest is uniquely situated to engender design that blends ecological function and appreciation of nature. The proximity to natural wonder, the dependence upon natural resource economy, and the overlap of development with endangered wildlife habitat have created here a breeding ground for creative design that embraces ecology in both aesthetics and function. When saddled with the task of choosing 20 of the best examples of artful and effective rain gardens from across the county, Echols and Pennypacker in their 2008 study could only find two that were not in Seattle, Washington, or Portland, Oregon. The same climate has produced several award winning designs for Environmental Learning Centers (ELCs) in the Puget Sound area, serving as destinations for young and old, demonstrations in sustainability, and thresholds between the urban and the wild spaces of Washington.

Environmental education organizations are not new to Washington, nor are Environmental Learning Centers. The Olympic Park Institute, one of the older ELCs, opened its doors in 1987, and environmental education has been mandated in one form or another for Washington school children since 1991 (RCW 28A.230.020). The last ten years have seen the construction of highly specialized campuses, designed and sited to embody and facilitate the mission of environmental education. The dedication of these places, in form and in operation, to education and the reinforcement of environmental ethics makes them prime opportunities for studying relationships between the designed environment and learning. As mentioned in Chapter One, I've chosen three ELCs as case studies to further the discussion of educative landscapes. Their investigation via the lens of the 10 principles developed in the literature review is an opportunity for the critique of ELC design as well as a chance to further refine and develop the principles themselves.

These three institutions–Cedar River Watershed Education Center (CRWEC), Mercer Slough Environmental Education Center (MSEEC) and IslandWood–not only represent innovative educational designs, but also house program staff and instructors that observe visitor interactions with these designs on a daily basis. All three receive upwards of 9,000 visitors annually, both young and old, and provide a wide range of experiences from free choice solo explorations to teacher directed group investigations. Their curricula and educational themes all stress water, watersheds, and environmental stewardship. More details for these three institutions are listed in Table 4.1, but it is important to note is that IslandWood is the only residential facility in the group. It is also the only fully independent non-profit of the three, with the other two being government and non-profit partnerships (IslandWood 2010a,b and c, City of Seattle 2010, Pacific Science Center 2010, City of Bellevue 2006, Jones & Jones 2010a,b , Mithun 2010). These differences allow IslandWood to be a bit more exclusive in their visitation, controlling when groups may visit their campus. Mercer Slough and Cedar River Watershed Education Centers on the other hand are completely open to the public. The overlap between the three centers, along with their variations in programming, allows for interesting comparison and contrast of the observations made by the educational staff. These observations also reflect the success

	Cedar River Watershed Education Center
Mission/Guiding Principles:	"The Center provides opportunities for thousands of visitors to learn about the complex issues surrounding the region's drinking water, forests and wildlife." (City of Seattle 2010)
Parent Organization:	Seattle Public Utilities
Current Facility Opened:	2001
Construction Cost:	$4.7 million
Age of Program:	20+ years
Location:	Cedar Falls, WA
Annual Visitors:	30,000 visitors, young and old
Programs:	Day long school programs K-12, community use, drop-in
Number of Staff:	3 full time, 2 seasonal, volunteers
Educational Staff Interviewed:	Celese Spencer
Designers Interviewed:	Jones and Jones- Landscape Architect: Nancy Rottle
	Mercer Slough Environmental Education Center
Mission/Guiding Principles:	"This partnership brings year-round education and interpretation of freshwater ecosystems, wetland ecology, environmental stewardship and the effect of urban development to adults, youth and families." , "We use science-based education programs to inspire lifelong awareness, understanding, appreciation, and a sense of stewardship for the natural world." (City of Bellevue 2010, Pacific Science Center 2010)
Parent Organizations:	Bellevue Department of Parks and Recreation, Pacific Science Center
Current Facility Opened:	2008
Construction Cost:	$10.8 million
Age of Program:	Pacific Science Center ran programs in old facility for 9 years
Location:	Bellevue, WA
Annual Visitors:	At old facility 8,000/yr; currently 25,000, looking to exceed 40,000
Programs:	k-8th school programing- day long programs, High School seasonal programing, community events, drop-in
Number of Staff:	15
Educational Staff Interviewed:	Apryl Brinkley, Christina Dyson-Farrell
Designers Interviewed:	Jones & Jones- Architect: Mark Johnson, Site Planning: Nate Cormier
	IslandWood
Mission/Guiding Principles:	"To provide exceptional learning experiences and to inspire lifelong environmental and community stewardship. At IslandWood, learning comes alive for children and adults through: delivering experiential 'hands-on' education; using the environment as a classroom; engaging diverse learning styles; integrating science, technology and the arts; showcasing sustainable practices." (IslandWood 2010a)
Parent Organization:	none
Current Facility Opened:	2002
Construction Cost:	$32 million
Age of Program:	9 years
Location:	Bainbridge Island, WA
Annual Visitors:	4,000 elementary students, 5,000 adults
Programs:	4 Day educational programs for 4-6th grade; Conferences and weekend programs for community and adults
Number of Staff:	16 Educational Staff and 16 Graduate Student Interns
Educational Staff Interviewed:	Denise Dumouchel, Clancy Wolf
Designers Interviewed:	Mithun- Architect: Dave Goldberg
	Berger Partnership- Site Planning: Linnea Ferrell
	Sahale LLC -Trails Caroll Vogel (deceased)

Table 4.1: Summary of Environmental Learning Centers

(IslandWood 2010a, c, City of Seattle 2010, Pacific Science Center 2010, City of Bellevue 2006, Jones & Jones 2010 a, b, Mithun 2010)

of the intentions of the designers in creating a place that supports an educational mission. The case studies here examine not only what is working, or not, with regards to the educational design, but also look at how well the architects and landscape architects responsible for these projects were able to translate their vision into reality.

METHODS

The information presented here comes largely from in depth interviews and site visits, with supporting details from websites and documents issued by the design firms and learning centers themselves. I am primarily interested in the motives, thoughts, and strategies of the designers, and the success with which their approach manifested the educational values and programs of these institutions. Though IslandWood has conducted an in-depth evaluation of its educational programming, it focused on the efficacy of the curriculum and teaching methods, largely leaving out reactions of visitors to the educational design of the facility. The Cedar River Watershed Education Center is the only one of the three to have undergone such an evaluation regarding site qualities and educational impact. Nancy Rottle's post occupancy evaluation (2005a, see pg. 41 this volume) will be discussed again as part of the case study, as the results are quite powerful and encouraging. Each site was visited twice as a part of this investigation: by myself and guided by one of the staff contacts.

Prior to this study, I have spent considerable time at CRWEC and IslandWood through my work as an educator. In 2002, I worked for three months at Islandwood, leading groups of 4th graders on overnight adventures as part of the facility's inaugural season. I've also visited CRWEC as a student on field trips with the University of Washington, and as a teacher bringing groups of 4th-5th graders and High School students. My observations and thoughts from these experiences are included in each case study.

Interviews were conducted informally and lasted anywhere from 45-90minutes. Though I used a set list of questions, in the interest of allowing natural and unsolicited responses, I let the conversation dictate the order in which subject areas were covered. Not all questions were asked, as some became redundant or not applicable over the course of given interviews. I present each interview as clusters of responses to themes that pervaded all interviews throughout the case studies. Different sets of questions were asked of designers and staff, directed to investigate the motivations, methods, and expectations of the designers, and the professional opinions, evaluation, and suggestions of the staff.

Designers were approached with questions following three categories. The first line of questioning was used to identify the goals and intentions of the project. This included discussion of background, key players and context as well as the designers' descriptions of key features, spaces and structures. Then the designer's process, collaborations, consultants, research and/or charrettes: where and how they looked for ways to meet the goals of their design. Finally, the last line of questioning covered the designer's philosophies on design in general, experience with other educational landscapes, and how they strive to capture the spirit of wonder and magic in their own work.

Response Clusters for Designer Interviews

Design:

- Who were the clients/key players?
- Intended Audience

- Basic Design Goals
- Site Selection
- How did you create a place for learning?

Process:

- Who gave input?
- What research was done?

Personal Philosophies on Design:

- Where is the wonder in design?
- Recommendations, additions to 10 Principles?

Questioning for Staff interviews was organized in a similar manner, with additional questions on visitor and teacher experience. The motivation was to elucidate aspects of the design that worked well at different points along the continuums of educative landscapes detailed in Chapter Two, differentiating between group sizes and levels of teacher involvement. Staff members were asked about the nature and extent of their involvement in the design process itself, but this line of questioning was dropped if their participation was negligible.

Response Clusters for Staff Interviews

Design:

- How does this design support your mission?
- What features best address learning?
- What do you see as weaknesses/challenges for this design?

Visitor/Teacher Experience:

- What do people ask about/engage with?
- How transparent are the design intentions, do people 'get it'?
- What places help you teach?

Personal Philosophies on Design:

- Where is the wonder in design?
- Recommendations, additions to 10 Principles?

Summary of Staff and Designer Contacts

For IslandWood I was able to contact lead architect Dave Goldberg of Mithun and lead landscape architect Linnea Ferrell of the Berger Partnership. Mithun was prime on the project, with the Berger Partnership responsible largely for site planning and rough trail layout. Important to note, Caroll Vogel of Sahale LTD was responsible for the layout and construction of the trail system, as well as the installation of the Suspension Bridge and Forest Canopy Tower. Sadly, he suffered fatally from cancer, succumbing soon after I began this thesis. His work and methods were described with much admiration by the other interviewees. The two staff members interviewed, Denise Dumouchel and Clancy Wolf, have worked for IslandWood in both administrative and teaching capacities since before the facility was completed in 2002.

I was able to interview the lead architect Mark Johnson of Jones & Jones, and the lead landscape architect, Nate Cormier, also of Jones & Jones for the Mercer Slough Environmental Education Center. This facility houses two educational programs, and I was able to interview representatives from each: Christina Dyson-Farrell, park ranger for Bellevue Parks and Recreation, and Apryl Brinkley, site manager for the Pacific Science Center Mercer Slough programming. Ms. Brinkly has worked with the Mercer Slough programs for nine years and was present and active for the construction of the current facility in 2007. Ms. Dyson Farrell began work when the current facility opened, as a founding member of the programs run by the City of Bellevue.

For the Cedar River Watershed Education Center, I interviewed Nancy Rottle, formerly with Jones & Jones, as lead landscape architect for the design and Celese Spencer, public education specialist and lead naturalist for current programming onsite. Both individuals have an interesting history with the site. Professor Rottle began work as a project manager in 1994, finishing a master plan for the watershed basin that would house the future education center, and Celese began working as an interpreter onsite that same year, seven years before the current facility opened in 2001.

It should be noted that for both of the latter projects, the MSEEC and CRWEC, a third party participated as project manager representing the interests of their respective branches of city government. On MSEEC the project manager from the City of Bellevue was Ken Kroeger, and in the case of CRWEC, Marie Ruby worked as the project manager for Seattle Public Utilities. In both situations, the designers mentioned that interviewing these individuals may add interesting perspectives; however, in the interest of time, I did not approach them for this thesis. Where possible, their opinions and influence are included in the descriptions offered by the architects and landscape architects.

Case Study Format

The following three chapters will present each case study separately as a series of interviews, preceded by a brief synopsis of the mission and details of the learning center. Each series of interviews will be followed by a summary and discussion of lessons learned in the form of answers to three main questions:

1. How well did the design goals of the project align with the observed performance by teachers and staff?

2. How well does the design support the 10 Principles of Educative Design?

3. What observations (from myself or interview subjects) offer significant new lessons for the design of educative landscapes?

CHAPTER FIVE | ISLANDWOOD

Honors and Awards (Berger Partnership 2010)

Gold LEED Rating

(first gold rating in the State of Washington)

Top Ten Green Projects Award

AIA—National

Located on Bainbridge Island, a 35 minute ferry ride from downtown Seattle, IslandWood sits upon 255 acres of second growth coniferous forest, encompassing the entirety of Mac's Creek watershed. The property contains a remarkable diversity of landscape types including a bog, marsh, pond, Mac's Creek itself, the forest, and access to the tidelands at Blakely Harbor. The proximity to a large city and the wide range of ecosystems make this site a prime candidate for environmental education programming aimed at urban populations. These characteristics did not go unnoticed by IslandWood's founders, Debbi and Paul Brainerd, when the land went up for sale in 1997. Seeing the property's potential and knowing that less than half of the students in Seattle schools had opportunities for overnight outdoor educational experiences, they began piecing together plans that would eventually create this precedent setting 'school in the woods': an environmental learning center, conference center, and demonstration of sustainable building techniques (IslandWood 2010).

ORGANIZATION AND STRUCTURE

Mission: *"To provide exceptional learning experiences and to inspire lifelong environmental and community stewardship." (IslandWood 2010a)*

Guiding Principles: *"At IslandWood, learning comes alive for children and adults through:*

- *delivering experiential "hands-on" education*
- *using the environment as a classroom*
- *engaging diverse learning styles*
- *integrating science, technology and the arts*
- *showcasing sustainable practices" (IslandWood 2010a)*

Largely the brainchild of Debbi Brainerd, the co-founder set out in 1998 to conduct two years of research, touring 25 existing environmental learning centers across the country, consulting focus groups with students, teachers, scientists and artists, and conducting community meetings on Bainbridge Island. The structure that arose was a four day overnight program, geared to 4th-6th grade students, running from September to

June in concert with the public school calendar. Teaching techniques and curriculum development followed examples set by the 1998 Pew Charitable Trust report *Closing the Achievement Gap* which encouraged the use of activity based learning outside the classroom environment to boost educational performance. The curriculum is largely taught by cohorts of 16 students who come to IslandWood to begin graduate degree work towards a certificate environmental education. Their ten months at IslandWood also earns credits towards a Master's in Education through the University of Washington. The remaining educational staff includes several full time naturalists, program coordinators, and instructors for graduate level coursework. The main School Overnight Program (SOP) is complemented by summer programs for children and families, teacher trainings, and weekend programming for adults. IslandWood opened its doors in 2002, and after nine years of operation annually hosts 4,000 students through the SOP and 5,000 community members through weekends, summer programming, and conferences (IslandWood 2010b,c).

IslandWood's School Overnight Curriculum comes in two themes: Watersheds or Ecosystems. Both utilize the Mac's Stream watershed to illustrate connections between organisms and resources, with an emphasis on human relationships and stewardship (IslandWood 2010a, Dumouchel 2010). Sustainability and the built environment are stressed in IslandWood's curriculum and facility more so than at CRWEC and MSEEC, focusing on energy and waste with details that are left out of learning objectives at the other sites.

FACILITIY OVERVIEW AND VISITOR EXPERIENCE

At 70,000 ft^2 IslandWood has the largest built campus of the three case studies. Both CRWEC and MSEEC are one seventh the size at 10,000ft^2. IslandWood is also the most costly at $32 million for construction and acquisition, while CRWEC and MSEEC were $4.7 million and $10.8 million respectively (Mithun 2010, Jones & Jones 2010a,b). IslandWood's need to provide facilities for overnight programming, including lodges and a dining hall, required significantly different cost and design strategies than the other two case studies. The overnight programming aspect of IslandWood also alters the way the space and the landscape are used. The need for safety and control over groups necessitates a much more teacher focused educational approach. Likewise, because IslandWood vouches for the safety of their students, they do not allow drop in visitors and essentially maintain a closed campus. Families and outside community groups can obtain access to the grounds at special events and on volunteer days, however IslandWood is essentially private property.

IslandWood's teaching facility, including its trail system, multiple field structures, and Learning Studios, covers the entirety of its 255 acre site (Figure 5.1). Its built facilities are largely comprised of seven buildings clustered on the west side of the property near the entrance on Port Blakely Road. The central complex of three buildings includes the Welcome Center, Dining Hall, and Learning Studios, while the four residential lodges are dispersed a small distance away. The central complex also includes the Garden, Friendship Circle, Greenhouse, and a Living Machine that processes onsite waste water. There is a small cluster of graduate student housing in the northwest corner, but they were not included in this study as they were not designed with the same

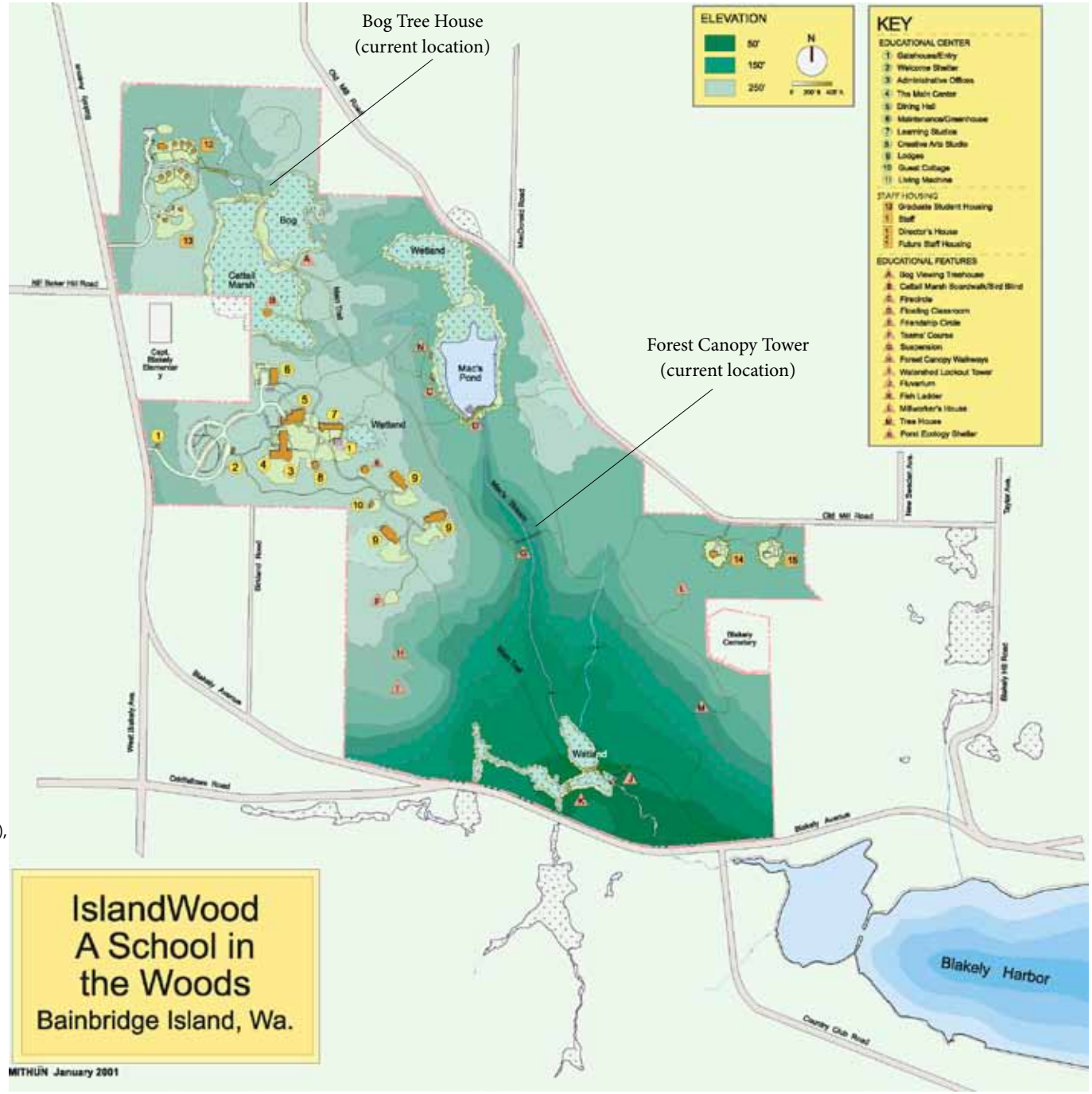

Figure 5.1: Original IslandWood Site Plan
(Image: Mithun 2010)

IslandWood's property encompasses all of Mac's Creek Watershed. This Site Plan represents proposed development, not all trails or Field Structures have been developed as indicated. Important differences are shown where necessary.

All building footrpints and property lines are accurate.

Worth noting are the locations of the main campus (listed on the figure as 'Education Center'), parking lot and entrance. These facilities have been clustered close to the property edge, away from sensetive ecosystems.

educational intent as the other buildings. Spread farther out across IslandWood's acreage, lay six field structures, placed in the landscape as destinations for field study groups:

- Floating Classroom
- Bog Tree House
- Bird Blind
- Forest Canopy Tower
- Suspension Bridge
- Tree House Classroom

The system of trails connecting these structures winds through the landscape, offering views and access to the property's array of different

Figure 5.2: IslandWood's Forest Canopy Tower rises mysteriously out of the woods

Figure 5.3: The access road to IslandWood leads visitors through tangled second growth forest

ecosystems. Several loops, large and small, give the naturalists choices of how far to wander into the woods, and create opportunities for multiple groups to explore the field without running into one another. A converted logging road called the spine trail literally runs the length of the watershed, offering access to the wetland, bog, Mac's Pond, and hugging the edge of the steep ravine containing Mac's Creek. The main thoroughfare for the property, this trail affords use by maintenance vehicles and offers access to the tidelands at Blakely Harbor to the south. This large trail and its smaller loops not only provide connections with the natural and built amenities of IslandWood, but add to the sense of mystery on the property as well. The spur trails leading to field structures seldom offer direct line of sight access. Visitors may see the Forest Canopy Tower looming across the ravine, but the way there is not immediately apparent (Figure 5.2). Likewise, signage on the trails is kept to a minimum, limited to simple place names at trial junctions. Many of these signs are actually covered by a hinged flap, allowing students to quiz themselves on their map

Figure 5.4: Massive Architecture of IslandWood references the forest landscape

reading abilities before revealing their actual whereabouts.

The theme of mystery applies not only to the trails at the heart of the property, but the entrance and approach to the facility as well. Students and visitors turn onto the IslandWood access road and immediately become enmeshed in large, second growth forest, with the road taking several twists and turns before the parking lot becomes visible (Figure 5.3). A small shelter welcomes students and visitors to the site, offering a threshold to cross into the wilds of IslandWood. The pathway immediately forks, offering visitors a short but winding walk to the Welcome Center, while the other path leads to the residential lodges where the students will stay. The entrance shelter also houses a group of carts, used by students to haul their baggage along the quarter mile trek that leads to their lodges, far from any other buildings on the campus.

The lodges and the other buildings of the central campus were built with an aesthetic that embraces their forest surroundings. Large wooden pillars–solid tree trunks–skirt the sides of the buildings, supporting wide roof awnings and rooting the structures to the ground (Figure 5.4). Details both within and without speak to the forest origins of the materials. The wood trim around doors and windows in many places retains a portion of its bark, and large wooden door handles have obviously been hand hewn from uniquely shaped branches of the Pacific Madrone tree.

A different story lies inherent in the Welcome Center's long open meeting room. A huge square beam runs the length of the building, suspended not as a structural member, but as a gesture to the industrial logging of Bainbridge Island's past. Called *"the tree that came home"*, (Figure 5.5) this timber was milled at Blakely Harbor, to the south of IslandWood's property, at a time when the mill there harbored the largest saw in the world. The beam was found in a mine shaft in Montana and identified as a product of the Blakely mill, given its age and extreme size. Too large to fit on a railroad car, the beam was flown back to IslandWood and immortalized in the architecture of the Welcome Center (Dumouchel

Figure 5.5: Welcome Center Lobby and *"the tree that came home"*

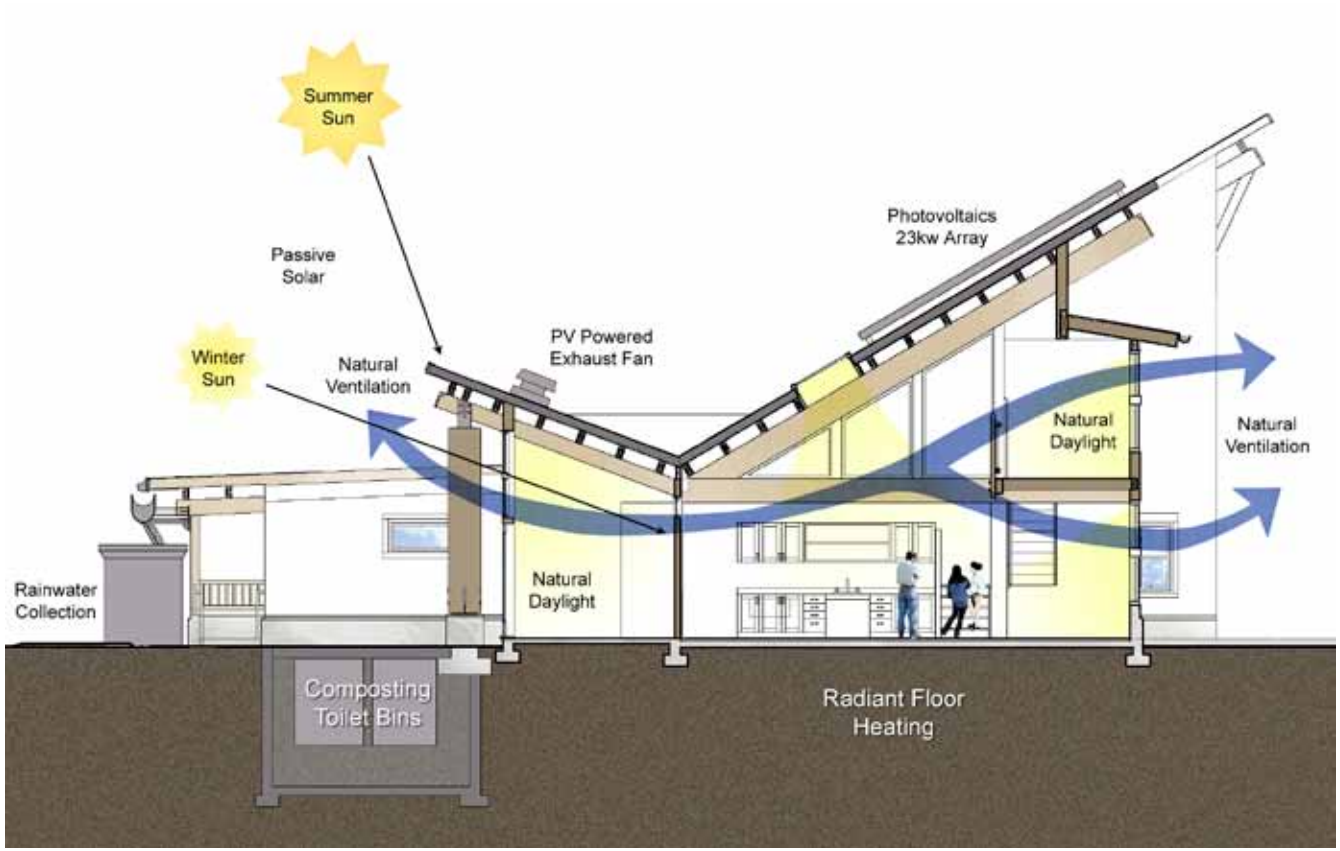

Figure 5.6: Sustainable technologies showcased in IslandWood's Learning Studios (Image: Mithun 2010)

2010). Its story is published as a childrens' book *The Tree that Came Home* (Brainerd 2008), available in hard copy at the gift shop.

The buildings of the central campus and lodges were constructed to share stories of sustainability, with the intention as much for environmental performance as for the demonstration of sustainable techniques and materials (Figure 5.6). Details of sustainable construction strategies are summarized in a Cascadia Region Green Building Council study (2010) and Mithun's *IslandWood Factsheet* (2002). Several of these aspects stand out in their intention to be used for teaching:

"***Energy:***

- *Passive Solar Heating- southern orientation and distinctive rooflines to capture winter sun*
- *Manual controls for window venting to regulate air flow*
- *Radiant floor heating*
- *Learning Studio building was built with the largest photovoltaic array in Western Washington, located*

on the north side of a cleared solar meadow

- *Passive Solar Heating of water in rooftop collectors*

Waste:

- *Living Machine has accessible green house for a teaching space*
- *Composting Toilets*

Learning Lab rooms demonstrate multiple recycled materials:

- *Yogurt container stalls and sinks in bathroom*
- *Sunflower seed counter tops*
- *Recycled rubber floor"*

INTERVIEWS

Dave Goldberg–Lead Architect, Mithun

Design

Goldberg emphasized from the outset that the vision for IslandWood came from Debbi Brainerd. Her years of research on ELCs and focus groups created a very strong and clear vision for the design team to work with. The basic design goals came straight from her request to *"create a magical place…to capture a sense of awe and wonder."* Complementary to this request were the goals to strive for an emotional connection and to make the IslandWood experience uniquely memorable. Goldberg reinforced this last point as particularly important for reaching the 4th-6th grade population that were identified as the intended audience, and who he saw as the clients of the project. In his opening pitch to the Brainerds, before Mithun secured the contract for designing IslandWood, Goldberg described his intentions:

"You're not our clients, our clients are the kids and the environment. We're one big team to serve them!"

This child centered perspective won Mithun the contract, and continued to pervade the design process to the point where if a young voice couldn't be present at meetings, cardboard cut-outs were placed at the table to remind the designers of who this facility would eventually serve. Likewise, though he was hired as an architect to create physical buildings on the site, Goldberg maintained a strong perspective on what the mission of IslandWood was meant to be. Commenting on the layout of buildings on the site map, Goldberg demonstrated his point:

"Two hundred and fifty five acres: that's the classroom..."

Then gesturing to the clustered buildings:

"This is the support."

The buildings were clustered to provide a small footprint, and to leave the landscape as uncluttered as possible. Goldberg described working with the Berger Partnership on the site selection process as intensive, combining map overlays of forest age, slope, and water conditions. In the end, the buildings were placed on the flattest sections of ground, away from wetlands and only displacing the most recently logged areas of the forest. In addition to ecological concerns, the siting of the buildings reflects deliberate attention to the experience of the students using them. The lodges were separated from the learning areas; giving students a

sense of having a place of their own. Students are also asked to navigate the long ¼ mile trail from the parking lot to their lodges, in order to reinforce a sense of being deep in the woods and to provide a situation where they can work together hauling their belongings in carts provided by IslandWood. Goldberg explained that all the buildings were kept far away from the *"most beautiful areas,"* forcing visitors to work for the chance to participate in the peak experiences offered on IslandWood's grounds. This was meant to reinforce the sense of adventure and to make areas such as Mac's Pond, the Marsh, and the Field Structures seem that much more special.

Figure 5.7: The Art Studio awning offers an outdoor teaching space at IslandWood

When asked what features of the design best address learning and education, Goldberg immediately focused on the dynamics of the field study groups for the School Overnight Program, explaining: *"There are learning spaces everywhere…"* A template was made that represented a ten person class, and this was used in plan view to measure the necessary size of spaces for field study groups. *"We used it like a stamp,"* fitting spaces for groups under porch overhangs (Figure 5.7) in as many places as possible, in the walkways between buildings and between the supporting columns of the buildings; the bases of which were made deliberately large to accommodate seating for student groups. Goldberg also stressed the detail and layers of meaning in the architecture as creating a successful environment for learning:

> *"Teachers may not use it, but the buildings create a sense of learning from the layers that are embedded and surround students."*

He was particularly proud and excited about the vision for the interiors of the lodges and teaching facilities:

> *"I wanted walking through a building to be like walking through a forest, with something under every rock…"*

The buildings, as he described them, are definitely meant to be text books, embedded with layers of learning. For example, the fireplace in each of the three student lodges is made with a different type of rock–igneous, metamorphic, and sedimentary–illustrating the major groupings of rocks in geology (Figure 5.8). This was the brainchild of one of the project managers with a background in geology, and Terry McLaughlin, an educational staff member during the design and construction phase. All three rock types were combined in the giant fireplace at the Welcome

Figure 5.8: Lodge Fireplace showing layers of different metamorphic rock (Image: Mithun 2010)

Center. Dave emphasized that visitors were meant to see just enough to make it interesting, just enough to prompt a question, but nothing more. By design, there is very little signage. *"This place is meant to be shared…"* Goldberg said, supporting co-founder Debbi Brainerd's request to make sure that the stories here must be learned from interaction and sharing between people. *"I like it that way,"* Dave expands, *"it creates an institutional history that must be passed on…."*

Students were meant to manipulate and interact with the buildings as well. The environmental controls are all manual. There is no automatic system venting the building when it gets too hot, and students must use poles to open and close strategically placed windows. The hope was that students would gain some interest, if not a little understanding, about the passive heating and cooling in the building, its orientation to the south and conspicuous solar meadow beyond its walls. Budget constraints removed another interactive idea from the design: monitors that would measure energy consumption for each dorm.

The design team was also sensitive to the needs of students, most of whom were away from home for the first time or had never before left the city. The bunkrooms were made for home-like comfort with two beds per room, a nightlight, and private bathrooms. Students interviewed during the design process emphatically renounced group showering facilities as the one thing that scared them most about going to camp! Another aspect of the facility that recognizes student's possible lack of familiarity with the outdoors is the gear room built off of the Dining Hall, where students pick up rain gear and boots to be used for the duration of their stay.

The most important strategy for facility design at IslandWood smacks of the stewardship the institution works to inspire. In Goldberg's words:

> *"Bottom line they [the buildings] need to be beautiful- so people will want to care for them."*

Process

Though Goldberg repeatedly points out the reliance upon Debbi

Brainerd's vision and research during the design process, several other sources were used for inspiration and consultation. Along with Brainerd, the first head naturalist for IslandWood, Denika Kaufman, held Mithun's ear and was able to influence the design. Goldberg also consulted with directors of other successful ELCs: Jack Shea of the Teton Science School and Saul Weisberg of the North Cascades Institute. Though he did conduct some focus groups with teachers, Golberg was much more inspired by the thoughts of children.

"Teachers want storage, convenience and practicality, and a good teaching wall…..we wanted to focus on MAGIC."

Anticipating this need, Debbi Brainerd enlisted the help of the University of Washington Department of Landscape Architecture to do just that. Led by faculty members Julie Johnson and Iain Robertson, student volunteers from the University held design charrettes with close to 250 local 4th-6th grade students. Goldberg participated in these as well, introducing the project to the young participants at the beginning of each session and making observations throughout. In our interview, he emphasized the importance of these findings for inspiration, though many of the actual suggestions were too outlandish for construction. He specifically recalled their desire to be surrounded by nature, particularly water, and their fascination with unique viewpoints, ways to get above, below, and inside a place.

Personal Philosophies on Design

Goldberg had no experience designing ELCs before IslandWood. In terms of capturing wonder and instilling curiosity, Goldberg reflected, *"IslandWood gave us lessons that still ring true…"* Many of these lessons appear to have made it into Mithun's current design philosophy, summarized by the term biophilia, human's biological drive to experience natural settings (Kellert et al. 2008). Goldberg invoked the firm's philosophy several times when attempting to describe the heart of what inspires wonder and awe. He specifically made reference to the principles of *"Serendipity"* and *"Resilience"*, two of the seven *"Attributes of Nature"* (Figure 5.9) compiled by Judith Heerwagen and Mithun CEO Bert Gregory in *Biophilia and Sensory Aesthetics* in the book *Biophilic Design* (Kellert et al. 2008). Goldberg doesn't separate that which is effective at IslandWood from that which makes for good design in general. To him they are one and the same. Overarching themes of flexibility, lighting, and beauty become evident in his descriptions of all places that create wonder, awe, and magic. He points out that children do require special attention to feel ownership over a space and mentions the importance of making things kid scale. In the end, however, he notes that designs for children follow the same rules as any good design:

"Kids respond to the same kind of beauty in spaces that adults do."

Sensory Richness

Motion

Serendipity

Variations on a Theme

Reslience

Sense of Freeness

Prospect and Refuge

Figure 5.9: Biophilia and Sensory Aesthetics–the Seven Attributes of Nature
from *Biophilia and Sensory Aesthetics* (Heerwagen and Gregory 2008)

Linnea Ferrell–Lead Landscape Architect, Berger Partnership

Design

Linnea Ferrell headed the Berger Partnership's site planning work for IslandWood. Immediately she mentioned the team oriented nature of the project. Though Debbi Brainerd led the charge, she left much open to be determined, and, as Ferrell put it, the designers had a rare opportunity to help design the site and the program at the same time. Brainerd and the team focused on the experience of the young visitors. Their goals were less about what was to be learned, and more about what was to be seen, felt, and explored:

> *"Everything was vetted by experience…Magical was our word at the time."*

Ferrell combined this philosophy with striving to be as light on the land as possible when choosing sites for buildings, field structures, and the overall trail system. She emphasized preserving the richness of experiences on IslandWood's 255 acres. She appreciated the presence of so many distinct ecosystems, and worked to showcase each of them while preserving as much of the space in between as possible. A similar philosophy she called *"keeping the sacred sites sacred,"* spaced the buildings and other large interventions as far as possible from the most beautiful places onsite, protecting the power and integrity derived from remote locations (Figure 5.10). Berger Partnership employed a comprehensive method of overlays–soils, water, forest age, slope–to determine the final siting of the main campus. In the interview, however, Ferrell was more interested in describing the experiences for the young students, framed

Figure 5.10: IslandWood's central buildings are clustered far away from sensetive ecosystems. (Photo: Mithun 2010)

deliberately bythe design.

High on the list of importance was the entrance sequence to the facility, especially for the students. The two phrases she used to describe this were *"decompression experience"* and *"getting off the bus and onto their feet as soon as possible."* Brainerd and the design team wanted to emphasize the journey from Seattle, across Puget Sound, and to their lodge at IslandWood as an important transitional experience for the students. This was their decompression from the city to the woods. To accomplish this, the Brainerds purchased an additional swath of property, widening the reach of the forest around the meandering access road and preventing any views of civilization beyond. Ferrell remarked that the ferry ride already made IslandWood feel far away from the city, and by design they wanted it to feel even further. Instead of pulling the buses directly up to their lodges, students walk the quarter mile from the entrance, extending the decompression experience, and gradually heightening exposure to the natural world. Ferrell mentioned the need

Figure 5.11: IslandWood's Welcome Shelter directs young visitors to their lodges.

here to carefully balance the comforting presence of architecture with the new and unfamiliar forest. The Welcome Shelter makes an important invitation with familiarity, while main campus buildings remain, though accessible for emergencies, well hidden in a nearby clearing (Figures 5.11 and 5.12).

Ferrell worked with contractor Carol Vogel designing and laying out the trails at IslandWood. This process was inherently linked to place and what the land had to offer. She described going out in her rain gear and bushwhacking for hours, acre by acre, searching out definitive and interesting landscape features for the trails to frame. She was particularly appreciative of Vogel's method, which she called *"connecting the dots"*. He would walk a wide swath of forest between two destinations, marking spots where he found some artifact of interest, be it a boulder, an interesting stump, or a view. He would repeat this several times, revising until he had achieved the desired sequence of meandering experiences. The trail crew would then come through and *"connect the dots"*, linking with soil and gravel the pieces of personality Vogel had teased from the woods[1]. In this way the designers utilized the trails to capitalize on the natural wonders found at IslandWood. They also kept their footprint light, utilizing desire lines and former trails wherever possible. The main spine trail is actually the remnant of a former logging road, stretching the length of the site.

Aside from this general philosophy, Ferrell did not recall many of the details regarding small scale decisions along the trails. When asked specifically if the access trails to Field Structures were deliberately designed to heighten mystery, Ferrell was honestly admitted she was unsure. She did point out that a basic tenet of good design is to place your points of interest some distance off the main trail, making sure there is a buffer protecting them from traffic. She also mentioned that ADA

1 For anyone who has never bushwhacked through the thick understory of a Pacific Northwest second growth forest, it can be hard enough to see ten feet, let alone move through the dense vegetation. The fact that Vogel and Ferrell did this over much of the 255 acres at IslandWood demonstrates respectable dedication to their craft!

Figure 5.12: Students pull thier belongings in carts as they navigate the 1/4 mile to their lodges.

Figure 5.13: Landscape decisions at IslandWood knit the buildings into the forest

accessibility played a large part in dictating the details of the paths. This discussion of the visibility of the field structures to the trail did bring up another important design move for Ferrell: that the trails and destinations were carefully spaced to heighten a sense of isolation from other groups. It was important that the experience for students in the woods be one of total immersion.

In the end, Ferrell explained, the overall guiding principle she worked under was to *"let nature be the strength."* The landscape design at IslandWood, according to Ferrell, was meant to be *"understated, not striving, and quiet."* She took particular pride describing situations where friends and visitors would have difficulty identifying her work at IslandWood. Instead, the buildings and facilities rise seamlessly from the surrounding forest, a testament to the skill and hard work of the site planning team (Figure 5.13).

Process

Ferrell was quite impressed with the background and support provided by Debbi Brainerd, specifically her research on environmental learning centers. She also mentioned Saul Weisberg of the North Cascades Institute as a helpful consultant. More exciting for Ferrell, however, was a trip the design team took to the Olympic Park Institute (OPI) near Port Angeles, Washington. One of the older environmental learning centers in the state, the OPI staff treated their guests as they would a student group, playing games, sharing lessons and exploring the mysteries of the rainforest. Ferrell found this experience quite useful in orienting herself towards the needs of teachers and the kinds of experiences awaiting students at successful ELCs.

Ferrell also recalled the design charrettes with the University of Washington, pointing out that the window next to each bed in the lodges came from a specific request to gaze out into the woods from their bunks. Aside from this example, she couldn't recall how strongly the student's ideas dictated features of the design. She did emphasize the power of this activity, exposing her to the imagination, energy, and sincerity of the 4th and 5th grade students who would one day visit IslandWood.

Aside from the above points, the process used by Ferrell and the landscape team was largely place based, responding to unique aspects of the landscape and tying in visitor experience with the richness of IslandWood's environment.

Personal Philosophies on Design

When asked specifically about places she found inspiring, Ferrell stuck to the site at IslandWood, describing interesting spots on the 255

acres that demonstrated the overlap of human and natural forces. She was fascinated by what she called the *"Ivy Forest"*, a large stand of alder trees completely overrun and masked by the invasive English ivy. She also described an area scared by former clear cut, illustrated by a distinct shift in age and complexity of the forest along the straight line of a former property boundary. Farrell was drawn to these environments because of their eerie power and interesting *"unnaturalness"* that provoked thought on the relationship between human and wild.

Clancy Wolf–Head of Educational Technology and Sustainability Education, IslandWood

Design

Clancy Wolf began working with IslandWood in 1999, just before the groundbreaking for the construction of the facility. His work is largely with graduate student field instructors, teaching and advising on sustainable technologies curriculum. He also works directly with visiting adult groups sharing the sustainable technologies demonstrated by IslandWood's facility. Naturally, when asked how the design supports IslandWood's mission, he focused on sustainability, citing the recycled materials, certified forest products, and LEED Gold rating. He also described the extreme intention built into every aspect of the facility, large and small. To illustrate, he recalled a heated discussion over the type of silverware and plates to be used in the Dining Hall, with the final verdict being:

> *"We use real silverware and hefty plates so kids would know that we never throw them away, that they're always washed and re-used."*

Intentions around food, waste, and recycling are illustrated well,

Figure 5.14: IslandWood's Garden was identified as a powerful educational feature

according to Wolf. When asked "what features best address learning", he responded by describing the Garden (Figure 5.14). Placed directly behind the Dining Hall, students actively harvest food from the Garden, and then find it on their plates in the evening for dinner. The connection is hard to miss. Likewise, Wolf mentioned Wade as a memorable part of every student's experience. At the end of each meal, students collect leftover food at the table and allow Wade (Figure 5.15), an anthropomorphized balance scale, to weigh the under utilized food before it goes to the compost heap and eventually the Garden. Each meal turns into a contest to see if Wade will find less waste than the last. For Wolf this is where the educational designs at IslandWood fit best with their mission and curriculum, with many of the other design intentions going unnoticed or underutilized.

When asked about challenges and weaknesses of the design, Wolf's first response was the need for interpretive elements. Especially with the sustainable materials and design of the buildings, Wolf remarked that

Figure 5.15: Wade the weigher of food waste

adults know enough to ask questions, but there are few resources to help them find answers:

> *"for adults, [there is]enough familiarity to achieve cognitive dissonance…but there needs to be some sort of materials for follow through…"*

Young students, he found, don't have enough frame of reference to recognize many interesting details, such as the butterfly roofs and passive solar panels for heating water, while adults always want to know more. He specifically referred to the *"oral tradition"* at IslandWood, that the messages here are meant to be passed on and shared from person to person, not necessarily read from signs. He also lamented the number of learning opportunities missed by both children and adults when they are unable to complete the connection between something they find curious or interesting, and how it actually works. According to Wolf, the buildings all have great possibilities for teaching physics, particularly heat and energy transfer, but few graduate student instructors have latched onto this opportunity. Without their interpretation, the lessons are lost on most visitors. Similarly, the Living Machine and composting toilets are somewhat beyond the knowledge base of most staff, particularly the graduate students, and their functions are rarely explained thoroughly and accurately (Figure 5.16). Interpretive signs would keep these pieces

Figure 5.16: IslandWood's Living Machine

of infrastructure better understood by all.

This issue extends into a larger challenge Wolf identified in the curriculum at IslandWood. Most field instructors emphasize for their students the time spent outdoors, away from the buildings. Wolf believes this prevents IslandWood from fully meeting its goal for teaching sustainability. The sustainable aspects of the buildings are left to be noticed by the adults, and Wolf would like to see more work put into making these details core aspects of the curriculum. The *"connection is not made between environment and building…"* This connection with sustainability, Wolf points out, may be more relevant for the urban students at IslandWood than the time they spend in the forest.

Figure 5.17: Natural details in IslandWood's architecture

Wolf noticed that the expectations of what they will see or do at IslandWood are different for adult and child visitors, and appear to have a large impact on their final experience. Many adults ask about materials and energy infrastructure because they knew it was there before they arrived. Most students also have a picture of what lies at IslandWood and it largely revolves around the Field Structures. The excitement these expectations generate often leads to disappointment, largely because students simply cannot interact with all of the structures in a four day period. Wolf also mentioned that certain elements, such as the Bog Tree House, are praised by adult visitors for detail and workmanship, while students may be disappointed because they don't resemble the traditional shape or form that they imagine a tree house to be.

Visitor/Teacher Experience

Wolf did describe how many of the details on the buildings, as well as the layout of the site help connect the visitors with nature. In particular the natural finishes and the bark left on the wood trim inspire a particular aesthetic that mirrors the surrounding landscape (Figure 5.17). He appreciated the trail system that builds a sense of mystery and the closeness of the trees to the buildings and windows, enhancing one's immersion into the forest. However, Wolf also pointed out that the closeness of the forest has on occasion been a source of fear for some students. They were not used to how quiet and dark the woods can be at night, prompting the installation of curtains in all the bedrooms.

When asked about the transparency of the design at IslandWood, Wolf didn't stray from his prior observations, commenting: *"People do*

not recognize the facility as a textbook" and *"The kids are just overwhelmed because of the new environment."* He described how much people love the geology themed fireplaces, however they are seldom recognized without interpretation, and seldom used as tools by field instructors. Wolf himself has tried to make his favorite aspects of the buildings, the butterfly rooflines and southern solar meadows, more explicit by tracing shadows on walls and placing large display thermometers in rooms, but with little response from visitors.

Wolf gives credit to IslandWood for introducing a few new elements that enhance the learning experience of students. Portable tent canopies allow for flexible shelter that can be moved depending on season or the desires of the field instructor. This allows groups to stay out longer in the forest. Also, the implementation of Wild-Zones, spaces for unstructured play in the woods, has helped considerably in increasing comfort levels with dirt, mud, insects, and other discomforts students often associate with natural areas.

Personal Philosophies on Design

Wolf shared several thoughts related to the design of teaching spaces, though none confronted the concept of wonder directly.

> *"Unpredictability is desirable as a teacher…work with the deer that walks through the meadow."*

Wolf emphasized that good teaching spaces will contain surprises that keep both students and teachers on their toes.

Designing to create cognitive dissonance, a breach in understanding, is only useful if the learner knows enough already to place the experience in perspective. This concept is key to capturing curiosity and fostering learning, but it requires familiarity with what your visitor already knows.

Wolf also speculated about the usefulness of a strategy employed at Disney World he called the 'hidden Mickey'. Somewhere on every costume, every tourist trinket, every piece of furniture and object in Disney World lies a little Mickey Mouse symbol. Finding the 'hidden Mickey' becomes a game for visitors, an ever-present mystery adding depth and intrigue to their experience. Regardless of its truth, Wolf explained, this could be a fun concept to play with: the consistency and predictability of knowing there is the same secret *everywhere* in a place, just not knowing where it is. His description emphasized the benefits of clarity and transparency of intention, especially if done subtly, in successfully piquing the interest and curiosity of visitors.

Wolf also suggested adding one more to the list of Principles for Educative Design:

> *"a quiet place to sit, to be alone, a place for reflection."*

Denise Dumouchel–Head of Graduate Education, IslandWood

Design

Denise Dumouchel was hired in 2000 as Education Director after most of the design had been finalized. She currently works instructing the graduate students and coordinating their educational program, but has worn many hats at IslandWood including direct instruction and coordination for the School Overnight Programs. She has experience and insight into all aspects of the 4th-6th grade student learning experiences at IslandWood.

Figure 5.18: The watershed divide on IslandWood's Marsh Loop Trail

When asked how the design of IslandWood supports its educational mission, Dumouchel referred directly to the Watershed curriculum central to their School Overnight Program. The spine trail walks the edge of a ravine, allowing students to experience an entire watershed and peek over the edge to look at Mac's Creek below. The Forest Canopy Tower takes this a step further, allowing students to see the entirety of the Mac's Creek watershed from an utterly unique vantage point above the trees. Down below, Dumouchel related her appreciation of the Marsh Loop Trail, which travels atop a human constructed ridge, dividing two watersheds and exposing the manipulation of land and water (Figure 5.18). This ridge was built long before IslandWood, after Mac's Pond was dammed, to keep water from backing up and flowing onto the neighboring property. Dumouchel likes to use this portion of the trail; but she was unsure if it was actually part of the original design. I was able to locate this spot on the original IslandWood master plan, however this trail does not appear to have been finalized and currently resembles more of a desire line than a beckoning path.

When asked about aspects of the design that directly support learning, the Garden and its 'kid height' raised beds were first on her list. The fact that everything could be eaten and touched, Dumouchel explained, allowed for great opportunities to explore with immediate connection to food and culture. Her strongest response for this question was the Bog Tree House (Figures 5.19 and 5.20), calling it a very special place for reflection. Instructors often bring students there for creative writing, painting or just quiet sitting. Dumouchel describes the experience:

Figure 5.19: IslandWood's Bog Tree House

"Something about being up there that inspires a kind of pause and creativity…It's cold up there, but it's never wet, and if you're still for awhile you can feel the tree moving. Yeah, it's a very special experience for many kids."

Another favorite educational design is the Bird Blind, for its ability to focus the attention of the students on nothing but the marsh, intentionally framing the view of this powerful ecosystem (Figure 5.21).

Dumouchel appreciates IslandWood's ability to transport students to a seemingly wild place, only fourty five minutes away from downtown:

Figure 5.20: Looking up inside the Bog Tree House

Figure 5.21: IslandWood's Bird Blind

"To be so close to a major metropolitan area and yet give them a sense that they've really stepped

into the wilderness is pretty amazing."

Some of this, according to Dumouchel comes from the nature of the woods themselves and the dense underbrush. Some comes from the adjacency of the buildings to the trees themselves and how they are enveloped by the forest.

"Tucking ourselves away in the woods, lowering our impact, adds to the magic of the place."

Finally, the diversity of ecosystems on the 255 acre property makes it possible to travel farther than it seems possible in one day.

"…so many different environments on 255 acres. It makes it feel like you've walked to different worlds…"

Dumouchel recognized the appeal of the field structures to children, particularly their wish get up high off the ground and to be surrounded

by water. She credits inspiration for both the Floating Classroom and the Forest Canopy Tower to the children participating in the University of Washington led charettes. However, much like Clancy, Denise acknowledges that the field structures come with their own challenges.

"*We work really hard not to be venue driven,*" said Dumouchel, refering to the noticeable pattern of students wanting to go to the next Field Structure even before they've left the one they are at. Many times they've heard of all of the structures and are disappointed because they will not have the chance to see the ones they are interested in. Often, the Field Structure itself is so new or intense, like the 120 foot Forest Canopy Tower (Figure 5.22), that students are too distracted to focus on learning activities. Such experiences are obviously providing a certain kind of learning, but often turn into one shot excitement-driven experiences, especially if students are already distracted by looking forward to the next venue.

Figure 5.22: IslandWood's Forest Canopy Tower

Dumouchel also concedes that it's hard to teach sustainability to this age range, and most of the features of the buildings do not register as things to investigate or ask about. Likewise, there's no geology curriculum at IslandWood, and most Seattle students don't get exposed to the subject with very much depth until later in middle school, explaining why the geologic fireplaces are probably, in Denise's mind, one of the least used learning opportunities on campus. She does point out, however, that students routinely notice and discuss the constellations of stars represented on the lampshades and the animal names denoting their bunkroom doors.

Improvements to the IslandWood facility over the years have included more bathrooms in the field and the installation of Wild Zones. Dumouchel was particularly supportive of the latter addition, appreciating the allowance for looser forms of play and opportunity for students to make their own special places in the woods.

Visitor/Teacher Experience

In our conversation, Dumouchel spoke very little about people's perception of design intent or her favorite places to teach. She did explain that the students at IslandWood are just old enough to begin seeing detail so that by the time they leave they may notice and appreciate some of the embedded stories in the buildings. The story of the tree

found in the Montana mine shaft and returned to its Bainbridge Island origins is extremely popular with students. Dumouchel explained that many know the story by heart even before they arrive at IslandWood, but, unprompted, often take a full four days to realize the beam in the rafters of the Welcome Center is actually the one and only *Tree That Came Home*!

When asked what people respond to or ask about most often, Dumouchel first mentioned Wade, the mealtime weigher of food waste.

> *"When students come back to visit at the end of the year they want to show their parents three things: their lodge or their bunkroom, their field instructor, and Wade."*

In prior correspondence with IslandWood graduate students, I have heard them express students' pointed interest in the composting toilets. I asked Dumouchel if she found this to be true as well. She responded that it wasn't a fair test of educational design, adding, "*Well sure, every kid wants to see poo!*" Dumouchel also mentioned that students are often drawn to the Living Machine, but only because you can find frogs in the plants!

Personal Philosophies on Design

Dumouchel took great pause to contemplate questions about wonder and design, but did not answer directly, responding more readily to questions on how design may reveal nature, and what things she would add to IslandWood. She highly valued designs that provide shelter in the woods, allowing teachers and students to stay out longer in the landscape. In her eyes this is the best way design can reveal and further connect a visitor with nature. Her comments also revealed a fascination with things secret and special:

Figure 5.23: IslandWood's Floating Classroom and Mac's Pond
The far portion of the dock detatches, becoming the Floating Classroom that moves along cables to the center of the pond. Students power its movement with hand driven cranks.

> *"I love that there's one side of the pond you can see, but no one goes there." (Figure 5.23)*

Her new addition to IslandWood would be a secret trail through the bog; one only for people accompanied by an instructor...and only after they've earned it!

SUMMARY AND LESSONS LEARNED

Given the rich stories and perspectives offered by these interviews, how well were the designers able to meet the needs of an educative landscape? Did their design moves intended to educate visitors and personify the learning center's mission find success?

How well did the design goals of the project align with the observed performance by teachers and staff?

Given the opinions of Clancy Wolf and Denise Dumouchel, the designers were quite successful meeting several aspects of their educative goals for IslandWood's design. The Brainerds, Mithun, the Berger Partnership, and Sahale LTD appear to have created the magical school in the woods they intended. The journey to IslandWood, the sequencing of the entry, and the layout of the trails truly transport visitors to another world, seemingly much farther away than the 45 minute trip from Seattle would imply. This is particularly evident in the way the buildings are hidden from the entrance route and the circuitous and clandestine nature of the trail system. The closeness of the buildings to the trees, the positioning of the windows, and the seamless integration of the landscaping into the forest also heighten this experience, bringing visitors closer to the mysteries of the nature that surrounds them.

Magic and wonder are evident in the field structures, many offering new and interesting vantage points. These and the trail system partner with the ecological diversity on the site, heightening the visitor's experience of these unique natural features. The Forest Canopy Tower and the Suspension Bridge (Figure 5.24) provide exhilarating experiences by simply being so far off of the ground, and offer remarkable views both into and above the forest canopy. The design embraces the rare and serene qualities of the bog, becoming even more pronounced when experienced from the subtly swaying Bog Tree House overlook. The magical character of the natural systems here are mirrored in the details and quality of the workmanship and materials in the field structures, buildings, and landscaping.

Though the ephemeral qualities of magic and wonder are captured well, certain aspects of IslandWood as a teaching facility did not meet the expectations of the designers. This largely revolves around the sustainable messages of the facility. This aspect of IslandWood's mission appears to be a curricular challenge, as sustainability does not seem to resonate well with the 4th-5th grade age range targeted by the program. This, combined with Wolf's description that most of the naturalists choose not to use the built environment as a teaching tool, makes it difficult to accurately evaluate the efficacy of the buildings educative design. At the same time

Figure 5.24: IslandWood's Suspension Bridge

the question must be raised: if the sustainable aspects of the facility were exposed or engaged in a different way, could these curricular challenges be resolved? Wolf pointed out that adult clientele engage readily with the sustainable techniques and materials at IslandWood, but are limited in their access to information. The sustainable messages at IslandWood are not only confined to the architecture. The painstaking site selection process, minimizing impacts to the natural systems, is not directly readable or heavily utilized in teaching. Likewise, the large meadows to the south of each building, cleared to allow the necessary sunlight for heating these structures, are not often recognized as intentional gestures. This aspect of the design (at least during my time teaching at IslandWood) was initially explained to every learning group, but did not play a significant role in lessons, experiments or activities.

Designers placed much time and effort into the messages offered by the fireplaces in the three Lodges and the Welcome Hall. However, without direct interpretation these intentions are hidden from most visitors. Dave Goldberg openly admitted that many of the messages were meant to be subtly hidden, and not necessarily discovered by everyone. According to Dumouchel, the theme of the fireplaces is rarely discovered at all; however, the numerous and accessible layers found elsewhere in the Lodges make up for the silence of this deeply buried treasure.

How well does the design support the 10 principles of educative design?

1. Strives to Instill Wonder: This principle is at the heart of IslandWood's design, and is clearly articulated in Mithun's basic design goal described by Dave Goldberg: "[to] *inspire wonder and awe.*" As described above this is captured by the design's ability to transport the visitor far, far away from the city and create an immersive experience in nature. The field structures not only provide breathtaking vantage points–the Forest Canopy Tower and Suspension Bridge–but offer calming transcendent spaces as well- the Bog Tree House and Bird Blind. The richness of ecological systems is made accessible by the delicate trail system, allowing visitors to experience many worlds in one day.

2. Provides Manipulable/Interactive Elements: This idea was only weakly addressed by the designers, as opening and closing windows to control temperature was the only aspect mentioned during their interviews. The comments of the educators did not reflect strong engagement in this activity.

Though not stressed in my discussions with Goldberg and Ferrell, other aspects of the design do afford experimentation. The Learning Studios provide excellent platforms for teacher led investigations, using microscopes to examine soil and pond water samples. They also house a computer lab and some demonstrative elements that invite interaction. Wolf at one point had a system of hydraulic tubes that created a water cycle, and Dumouchel mentioned a graduate student that was working on building a bicycle powered washing machine. The designers appear to have left room to augment the facility's interactive elements, but aside from flexibility, direct manipulation does not appear to have been central to the goal of IslandWood's design.

The Garden represents the piece most clearly dedicated to interaction and manipulation. Garden beds were designed size wise to be accessible for small children, and students participate in growing and harvesting food. This feature was cited immediately by both staff members when asked about how the design supports education, yet Ferrell pointed out

that it was deliberately hidden behind the 'back door' of the kitchen. Its proximity to the cooking and eating area works well in making the connections between garden and food, however its visibility appears to have been a trade off between learning potential and the naturalistic landscaping that dominates the campus.

More recently, staff at IslandWood have addressed this educative design principle directly, adding Wild Zones–designated spots for free play and interaction with loose parts in the natural landscape.

3. Allows for Observable Change/Comparisons: The many different recycled materials used in the Learning Studios offer opportunities for comparison, however they do not necessarily demonstrate measurable changes over time. Better opportunities for this could be found in the energy, water, and climate control systems in the buildings. Openly displaying and monitoring of these factors could add greater relevance and interest to the sustainability curriculum IslandWood struggles with. Wolf did mention putting a large temperature display in one of the rooms, and at another time tracking the path of the sun across one of solar meadows, with mixed success. A more holistic design move that combines these demonstrations may prove more effective in holding visitor attention. Also, having this sort of display repeated in several buildings would make it more noticeable and add another aspect for comparison.

The curriculum at IslandWood utilizes many tools for measuring and comparing natural systems in the field, studying factors such as humidity, temperature, wind speed, and mapping distribution of wildlife. The design of the field structures supports these activities immeasurably, allowing for creative and interesting applications. Dumouchel described using the Forest Canopy Tower to measure light, temperature, and humidity on a vertical gradient up through the trees, and the Floating Classroom allows for water sampling from all parts of Mac's Pond. Even without scientific tools or measuring devices, these structures provide unique and different perspectives, offering observation and comparison of the forest and pond from several vantages.

4. Balances Clarity and Mystery, Novel and the Familiar: This principle encapsulates a large portion of the design discussion at IslandWood. Mystery is well expressed via the winding trails and layers of detail in the buildings. The educational intent of the buildings also appears to be clear, however the specifics of the messages themselves, particularly in terms of sustainability, are difficult to read. Many of the educators here desire a greater degree of interpretive signage, a factor that was deliberately handled lightly by the designers. I have found this split to be rather consistent, both in these interviews and at the other institutions. Educators tend to push for greater clarity and explicit messages (often times in the form of signage) and designers push for quieter communication implicit in form and function. One solution offered comes from David Orr's Lewis Center for Environmental Studies (this volume, pg. 46), where interpretation and environmental monitoring can be accessed online. Given the ease of mobile internet connections, an online environmental monitoring station for the buildings and other points on the property could prove a powerful teaching tool both indoors and out in the field.

Another consideration regarding the challenge of teaching sustainable design, follows Falk and Dierking's suggestion (2000) to cluster information into like groupings. Applied to IslandWood, each

lodge or building would emphasize a different aspect of sustainable design, enabling visitors to pick up on a heavier theme, and removing the possibility of crowding the message by emphasizing them all. Buildings could still posses the same inherent sustainable attributes, but one could emphasize water systems, another the relationship with the sun, another local and sustainable materials, and so on. Giving each lodge a clear and unique sustainability theme would help visitors pick out aspects they otherwise might not be looking for because the overall theme is clear. This idea operates in the same way Falk and Dierking's example showed that multiple interpretive signs are less necessary if there was one clear overarching topic (2000). This suggestion would have been most useful during the design stages of the project, but still represents an interesting application of museum design to this case study.

Balancing the novel and the familiar was central to IslandWood's efforts to make their visitors from the inner city, or any environment, comfortable for their stay in this wilder more natural setting. The lodges catered to the requests of grade school students: bunking two to a room, private bathrooms, a shelf for sentiments from home, and a window to view the woods. The latter addition of heavy curtains was also sensitive to visitors' comfort levels with darkness and the forest.

This principle also came into play in discussions on the field structures, and Dumouchel's comments on their struggle to avoid being *"venue driven"*. These field structures are so novel, so numerous, and so well publicized that several problems ensued:

- Students engage more with the field structure than the natural environment it is meant to enhance.

- Students are so attached to preconceived notions of the field structure that they are disappointed upon arrival.

- Students are too excited by the number of field stations, only concerned with seeing 'what's next' or disappointed by lack of access to them all.

It is difficult to suggest changes to the design of the field structures, as they all offer unique, beautiful and inspiring experiences. Somehow allowing students to experience these structures more than once, to let some of the novelty wear off, is one possible solution to the problem.

5. Supports Self Directed Learning: This principle is weakly addressed by the original design. Interpretive signage may help in this area, however, as Goldberg pointed out, the lessons at IslandWood were meant to be shared and interpreted almost as part of an oral tradition. The recent addition of Wild Zones has added a much stronger self directed aspect, allowing students to develop personal connections with the natural environment.

6. Supports Teacher Facilitated Learning: IslandWood's facility was designed to meet this purpose and does so successfully. Spaces are provided indoors and out for multiple group sizes, be it under roof awnings, in a field structure, Learning Studio, or the large amphitheatre of the Friendship Circle. The field structures provide amazing platforms for interpretation and reflection and the trail system allows an instructor to quickly access important destinations, or take a detour for a long walk in the woods. The messages buried in the buildings require interpretation and were meant to be shared to enhance the experience for all.

7. Creates Multi-Layered Experiences: This principle is well represented in the designer's intentions, given the proximity of trees to the structures, the attention to light and solar orientation, as well as the massive nature and materiality of the buildings. These spaces were meant to be experienced by many senses in ways that carry the environmental education mission of the site.

The field structures create unique and intriguing experiences felt by the body as well as perceived by the mind. Some of these are subtle, such as the gentle sway of the Bog Tree House or the rocking of the Floating Classroom. Others are exhilarating, such as the bounce and wiggle of the Suspension Bridge and the extreme exposure felt at the top of the Forest Canopy Tower.

8. Invites Collaboration: Group problem solving is addressed on the IslandWood Ropes and Teambuilding Course, however this aspect is more of a support piece than a defining part of the IslandWood experience. Team problem solving at IslandWood is for group dynamics, not necessarily for connecting with nature or demonstrating sustainability related issues. The carts pulled by students from the parking lot to their lodges require two or more students, providing an opportunity to decompress and reflect together. The best example offered during the interviews was the team oriented paddle wheels of the Floating Classroom, requiring collaboration to experience Mac's pond in a new and different way (Figure 5.25). As part of a teaching facility, all of the field structures have space for a ten person learning group, offering opportunities for sharing during some of the peak experiences at IslandWood. The Bird Blind is particularly powerful in this regard by creating a space where each student has their own uniquely framed view of the marsh, but remain free to switch and share their experiences.

9. Invites Play: The original design of IslandWood struggled with this concept. Very little space (or time in the curriculum) was allotted for free play. It is unclear how heavily the need for a multi-use turf field remained in the vision of the design team. Goldberg described the area between the main campus buildings as intended for a demonstration native plant garden. Ferrell recounts spending a considerable amount

Figure 5.25: Student driven hand cranks on IslandWood's Floating Classroom

of time designing an engineered soil for a turf field because the existing conditions were horribly muddy. When I arrived in 2002, the field had just been hydro-seeded and I was told its ultimate purpose was unresolved. Currently the main field is used for large group games, and the addition of Wild Zones has created opportunities for children to interact with the forest in free and creative play.

10. Provides Social and Cultural Relevance: This principle is inherent in the designers' intention to help students from urban areas feel more comfortable in their IslandWood lodges. The design also includes powerful, culturally relevant experiences in the Garden, Wade and the narrative story of the *Tree that Came Home*. These features relate universally to human culture via the commonalities of food and story telling.

Another powerful piece that ties into cultural familiarity is the onsite treatment and recycling of grey water. The Living Machine, composting toilets, and waterless urinals deal with issues that are as real in the city as they are at IslandWood, bridging a cognitive gap, that might otherwise be difficult to make, regarding what students learn here and what they see at home.

What observations (from myself or interview subjects) offer significant new lessons for the design of educative landscapes?

The strongest pieces in the design of IslandWood are the use of trails and field structures to augment the diversity of natural systems on the property, and the sense of isolation and immersion that pervades ones journey through the forest. The Brainerds selected a site with amazing ecological features, made even more tangible via the unique perspectives offered by a Suspension Bridge, Forest Canopy Tower, Floating Classroom, Bird Blind, and Bog Tree House. While I was an employee at IslandWood, none of the Field Structures were yet in place. I was still impressed by how the trail system seemed endless on such a small plot of land and the particular beauty and diversity present on the property. Returning six years later, the opportunity to view these systems from new perspectives brought a whole new feeling of awe and wonder. The Bog Tree House, the marsh Bird Blind and the Forest Canopy Tower I find particularly impressive as they offer windows into places otherwise unreachable by foot (Figure 5.26). I was also taken by the sense of mystery created by the placement of these structures a fair distance from the main trail. On most of the access trials a small preview of the structure is visible through the woods; just enough to create a feeling of anticipation (and in some cases a small piece of impatience) while pushing on to uncover the mystery ahead (Figure 5.27).

Figure 5.26: IslandWood's Bog from the Bog Tree House

Embodied experience plays a large role here, particularly the unique sensations created by walking the Suspension Bridge and sitting in the gently swaying tree house. The many layers inherent in the design of the lodges may not be obvious to everyone, but, the few that do emerge let visitors know that they are surrounded by small mysteries in the buildings and the woods outside. The details, materials, and attention to beauty communicate the special nature of this place, even if all of the messages do not resonate openly with the cognitive mind.

Figure 5.27: Preveiws of Field Structures create a sense of mystery along IslandWood's trails

The literal stories in the landscape and architecture, specifically *The Tree That Came Home* and Wade, the weigher of waste, demonstrate extremely well the power of personification and the creation of characters to engage young minds. IslandWood also demonstrates the inherent, cultural power of gardens to engage as well. The Garden was named by both Wolf and Dumouchel as the most direct connection of design and learning at thefacility.

The sustainable features at IslandWood need to be called out in a more creative and deliberate fashion. This could take the form of interpretive signage or an interactive website. A large missed opportunity here is the measureable performance based aspect of the technology. Exposing this could increase opportunities and motivation to manipulate and interact directly with the design itself, also increasing access to self directed learning. The treatment of water on and around the buildings also provides an opportunity for interaction. Currently the gutters and downspouts run into large, visible cisterns (Figure 5.28), but there is little beyond this that would register on Echols and Penneypacker's list of artful rainwater designs. These rain catchment systems could be brought closer to eye level and made measurable, touchable and manipulable, thereby adding another layer of demonstrated and visible sustainability. The urinals, Living Machine, and composting toilets make statements about waste and water, and detained or harvested stormwater can tie into this story as well.

Other challenges in the design of IslandWood frame two fundamental questions for the design of ELCs and the structuring of outdoor and environmental education programs. The first revolves around the fact that the greater the access given to a natural area, the more quickly it can become destroyed. I witnessed this dominate conversations at

Figure 5.28: Rain catchement at IslandWood
The 'windows' are for placement of found objects, and do not offer views into the cistern

IslandWood during its inaugural season, with naturalists arguing over whether or not children should be allowed to take rocks home from the beach, and the ethics of taking learning groups bushwhacking through the woods. Both of these experiences could help create or reinforce bonds with nature, yet at greater scales become significantly destructive activities. This is the same discussion that drove decisions to place IslandWood's buildings far from the site's delicate and natural wonders. It is also a point which would prevent greater public access to the site, an opportunity which would increase cultural relevancy and could possibly help alleviate the venue driven nature of the Field Stations.

The ability for IslandWood visitors to return again and again could solidify the social relevance of lessons learned on the first school overnight program. Establishing IslandWood as a regular venue for students helps establish this place and its associated values as part of a student's own identity. Opportunities to bring family members also give the experience social relevance beyond the peer group. Finally, opportunities to return and experience field stations more than once, or to eventually experience them all, may remove the tension created by their extreme novelty and appeal. Students may eventually have a chance to relax, stop worrying about 'which field site comes next', and appreciate the unique perspective on nature and environment that these amazing structures offer.

The second fundamental question is one of the possible competition between designed space and natural space in helping students find connections with the natural world. This also came up as a concern for naturalists at IslandWood during my time as an employee. Many naturalists strove to take their students as far away from the buildings as possible, looking for an intensive experience with nature, and lamented the fact that the students would only talk about how much they loved their rooms. This problem is also linked to the "*venue driven*" problem associated with the Field Structures, where the experience of being on the device has become more important than what the device enables you to see. It must be mentioned that many of the design moves in question were made in an effort to best serve the poor and minority populations central to IslandWood's founding goals. Overnight ELC experiences traditionally do not appeal to inner city groups, largely for cultural reasons related to lack familiarity with natural spaces, lack of inclusion in the mainstream environmental agenda, and concerns over safety in overnight settings

(Matsumoto and Poppo 2002, personal communication with staff at IslandWood, Seattle Audubon Society, 4-H of King County, Earth Corps and other Seattle based environmental education organizations). The design shows sensitivity to this through its Field Stations that build excitement in even the least nature oriented students, and its Lodges that exude security and comfort. IslandWood was controversial in the world of ELCs because of its huge budget and heavily designed spaces, but it was also a pioneer in its move to change the face of environmental education.

Honors and Awards (Jones & Jones 2010b)

Green Globe Award, 2009 Leader in Sustainable Building

King County

Bronze Merit for "Future Value to the Profession," 2009

American Consulting Engineers Council

John H. Stanford Education Achievement Award, 2007

Cascade Land Conservancy

What Makes it Green? 2007—Unbuilt Category*American Institute of Architects, Seattle Chapter*

Merit Award for Physical Plans 1990

Washington Chapter, American Planning Association and Planning Association of Washington

The Mercer Slough Nature Park fills 320 acres of wetland on the eastern shores of Lake Washington. Just south of Bellevue, twenty five square miles of the city's storm water catchment and salmon bearing Kelsey creek drain into this basin. Bounded to the south by I-90 and the floating bridge, this Bellevue park is within easy driving distance from Seattle. Seeing its potential as a site for environmental education, the Seattle's Pacific Science Center began bringing students here on field trips in the year 2000. Utilizing a small cluster of buildings a short hike from the slough, the Pacific Science Center's programs grew to host 8,000 students a year by 2008. The new Mercer Slough Environmental Education Center, opened in fall of 2008, represents a joint venture between the Pacific Science Center and the Bellevue Department of Parks and Recreation, with hopes to eventually host close to 40,000 visitors a year (Gebben 2010). The Mercer Slough Nature Park also features a boat ramp, canoe and kayak access, seven miles of hiking trails, and an historic blueberry farm (City of Bellevue 2010). Its proximity to the urban environment, easy access and powerful ecological and human history make Mercer Slough a fantastic site for interpretation and environmental education. The Mercer Slough Environmental Education Center was designed to capture and frame these features for students, families and visitors of all ages.

ORGANIZATION AND STRUCTURE

Mission: *"The MSEEC is a collaboration between the City of Bellevue and the Pacific Science Center. This partnership brings year-round education and interpretation of freshwater ecosystems, wetland ecology,*

environmental stewardship and the effect of urban development to adults, youth and families."

City of Bellevue (2010)

"We use science-based education programs to inspire lifelong awareness, understanding, appreciation, and a sense of stewardship for the natural world."

Pacific Science Center (2010)

MSEEC hosts two different educational institutions with overlapping missions and similar constituencies. The difference lies in their geographic base and approach to educational programming. The City of Bellevue Parks Department runs a drop in visitor center and hosts free and informal evening and day events such as hikes, guided canoe trips, and presentations. A Park Ranger is seated in prominent view in an open office to greet visitors and answer questions. On the other hand, the Pacific Science Center offices are less public, located in the Sullivan House, a historical building preserved as part of the new campus. Their programs are largely fee-based and aimed at hosting classes and schools in groups of up to 90 students. The Science Center offers programs for teens, adults, and families at the Slough, but its most active programs serve K-8th grade schools and link directly with district science curricula in Seattle and Bellevue.

FACILITY OVERVIEW AND VISITOR EXPERIENCE

The MSEEC buildings and grounds occupy a thin slope between a two-lane arterial road and the edge of the slough wetland. The campus spreads out linearly north/south, squeezed between road access and access to wetland. Great care was taken to preserve as many trees as possible and to leave the patterns of water flow across the site intact. Three of the buildings are lifted up off the ground, perched atop metal stilts, to leave groundwater flow relatively undisturbed (Figure 6.1). The other buildings, possessing traditional foundations, have green roofs meant to offset their impact on the movement of water. The buildings and railings along the interspersed decking come dangerously close to the trunks of trees, sometimes touching them, and elsewhere dodging with perfectly sized notches. Edges where water would normally stop, pool or fall are treated playfully: runnels carry water from roof downspouts and along every handrail, filling the site with motion and sound during and after every rain and where there would normally be curbs, stone filled gabions permeate and percolate runoff into engineered soils below. The Mercer

Figure 6.1: MSEEC rises up out of the woods

Figure 6.2: Gabions lining the Log Jam Plaza at MSEEC

Slough Environmental Education Center feels in some parts like a tree house, and in others like a cattail marsh.

The center can be accessed via automobile in a drop off loop from the paved sidewalk/bicycle trail, or via gravel paths and a perimeter trail that connect with the parking lot and the larger system of trials around Mercer Slough. A large Welcome Plaza greets visitors from the drop off loop. Also called the Log Jam Plaza, gabions, inset at grade level, splinter at odd angles the seemingly impervious surface with slits of loosely packed rock (Figure 6.2). In actuality, the entire plaza is pervious pavement, and the gabions make legible what observers may only otherwise notice on a rainy day: water flows above, below, and through this landscape. The gabion is used as a signature throughout, accentuating places where water meets land. Rain chains at the ends of downspouts and runnels fall onto splash blocks, simple gabion chunks like big rock sponges, slowing the water's path to the earth.

Access from the perimeter path draws the viewer's attention to other key features of the design. The trail descends from the parking lot underneath the long narrow Slough Overlook (Figure 6.3), close to

Figure 6.3: The Slough Overlook, seen from the main parking lot

fifty feet above, which obviously commands a view of Mercer Slough and Bellevue beyond. The overlook juts from the large Community Room, floating on stilts, where the visitor on the trail below can gaze clear underneath the building to the light coming from the other side. Passing under the overlook and turning a corner, the underside of another building floats over the forest, this one with another long pier and something different, a lookout tower: the Tree House (Figure 6.4). The path turns uphill now towards the main complex above, but the focus is not on the climb, instead it's impossible not to wonder what views may

Figure 6.4: MSEEC Tree House

Figure 6.5: MSEEC Community Room (left) and Visitor's Center (right)

be obtained upon reaching the towers and floating buildings overhead.

Upon reaching the top of the trail, the space opens up as a long narrow deck, with the Tree House Overlook on one end, and the Log Jam Plaza, Visitor's Center and Community Room on the other. From this vantage it is hard not to notice the outdoor sink and the copious overhangs on the classroom buildings. As one moves past, towards the plaza, the odd shape of the decking becomes evident, zigzagging around large trees, offering views of itself and the different buildings, as well as the landscape below and in between. The water bearing runnel beside the hand rail draws even more attention to the nooks and crannies created by the sharp turns of the deck.

Walking amongst these floating buildings, one can see the emphasis on view, through the buildings via the spaces in between, and through the large windows which open up the classrooms, Visitor's Center and Community Room to the outdoors. The facility is built to showcase views of the wetland as well as views of itself and its intricate design.

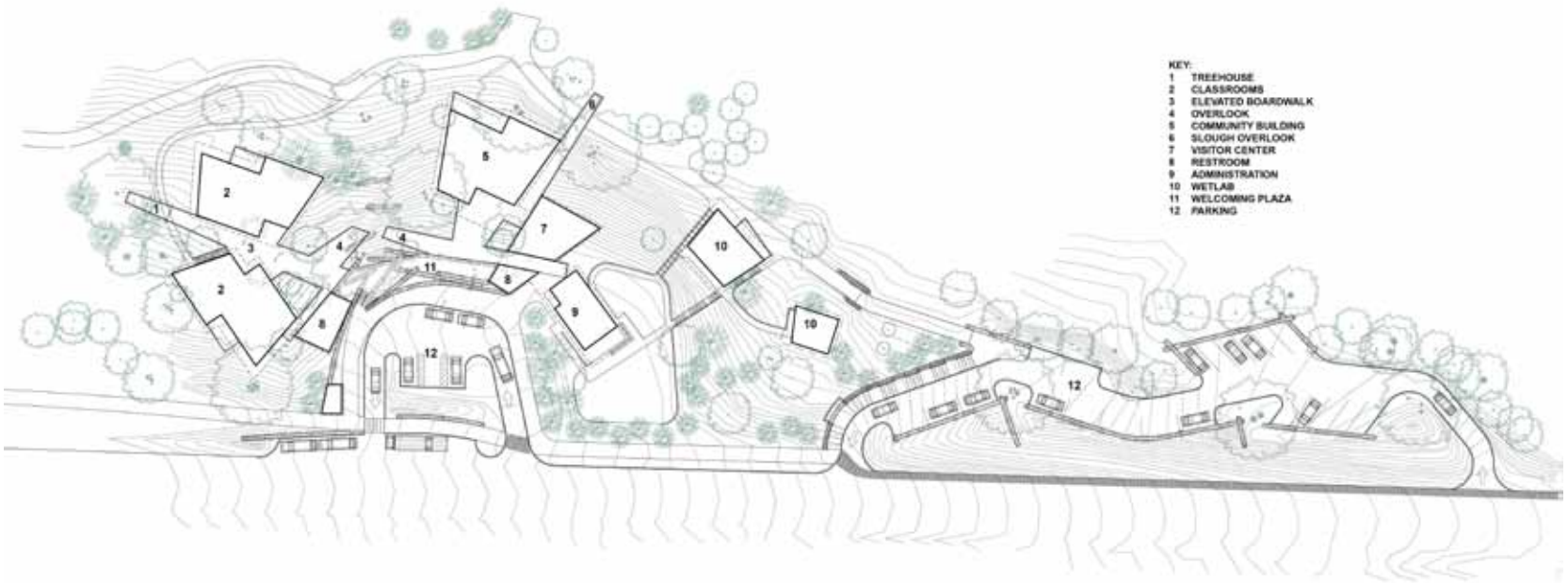

Figure 6.6: MSEEC Site Plan (Image: Jones & Jones 2010c)

Though open and easy to explore, the campus was actually designed for separate use by the two different programs. The southern portion, including the four classrooms, Tree House and one of the two restrooms were meant to be used for school programs offered by the Pacific Science Center. The northern portion, including the Community Room, Visitor's Center, second restroom and long Slough Overlook were slated for use by community programs and Bellevue City Parks and Recreation. The Log Jam Welcome Plaza sits between the two, as a large gathering space appropriate for close to 300 people.

Major facilities in the center's design include (adapted from Jones & Jones 2010b and Figure 6.6):

- Four classrooms (two have been built)
- One large Community Room
- Two Wet Labs (one has been built)
- Visitor's Center
- Two public bathrooms
- Large Welcome Plaza (Log Jam Plaza)
- Various decks, overlooks, piers and lookouts
- Perimeter trail and access to the wetland
- Parking lot and rain gardens

INTERVIEWS

Mark Johnson–Lead Architect, Jones & Jones

Design

The expression of Mercer Slough Environmental Education Center as a tool for teaching was paramount to the design vision from the beginning. Lead Architect Mark Johnson recalled that though the needs of the two clients, Pacific Science Center and City of Bellevue, were different, the overall shared goal–that of experiential and environmental education–truly formed the heart of the project. Mark described questions and challenges the design team asked themselves at the beginning of the project:

> *"…we needed to make this place that has the ability to not only provide educators with a place to teach, but be a part of the educator's tool box. How can we make a learning center that makes it easier to teach? [Where] you not only take the student to the microscope and to the book , but where that experience makes that microscope and that book a part of them?"*

Meeting this mission, and the separate needs of the clients, drove efforts to make the design function at many different scales. The design was meant to welcome large community groups, single classrooms, small learning groups, and individuals to Mercer Slough. Johnson pointed out that in the end, it is the design's ability to do this that makes the center work well as an educational space. Spread across the facility are places for classes and small groups under awnings, inside and in between buildings, on overlooks and piers. The Log Jam Plaza and Community Room provide larger areas for presentations and special events. Johnson recognized the importance of social groups in the learning experience, and tried to factor this in to as many spaces as possible:

> *"Working at the classroom unit scale was a big part of that immersion experiential goal that we set for ourselves. How do we move the whole unit so that students can learn together?"*

Johnson referred many times to the Pacific Science Center's educational strategies of immersion and experience as touchstones for details. However it was the City of Bellevue Parks Department that drove the site selection and most of the major design moves. Johnson describes the education center as the *"apex of fifty years of conservation work in the slough,"* referencing Bellevue's efforts through building code and storm water abatement policy to remain a city perched at the edge of the wild. Of the nine different sites identified as possibilities, the final choice was, in Johnson's opinion the most difficult to work with: long and narrow with significant slopes and a preponderance of legacy trees no one would want to remove. However, according to Johnson, it was the final design's reactions to these challenges that became its greatest strengths. Summarizing our conversation about the design goals for the project, the basic program included:

- Create a bridge between the city and 320 acres of powerful wild space
- Facilitate movement of students and allow access to experience the slough
- Build a learning place and a teaching tool

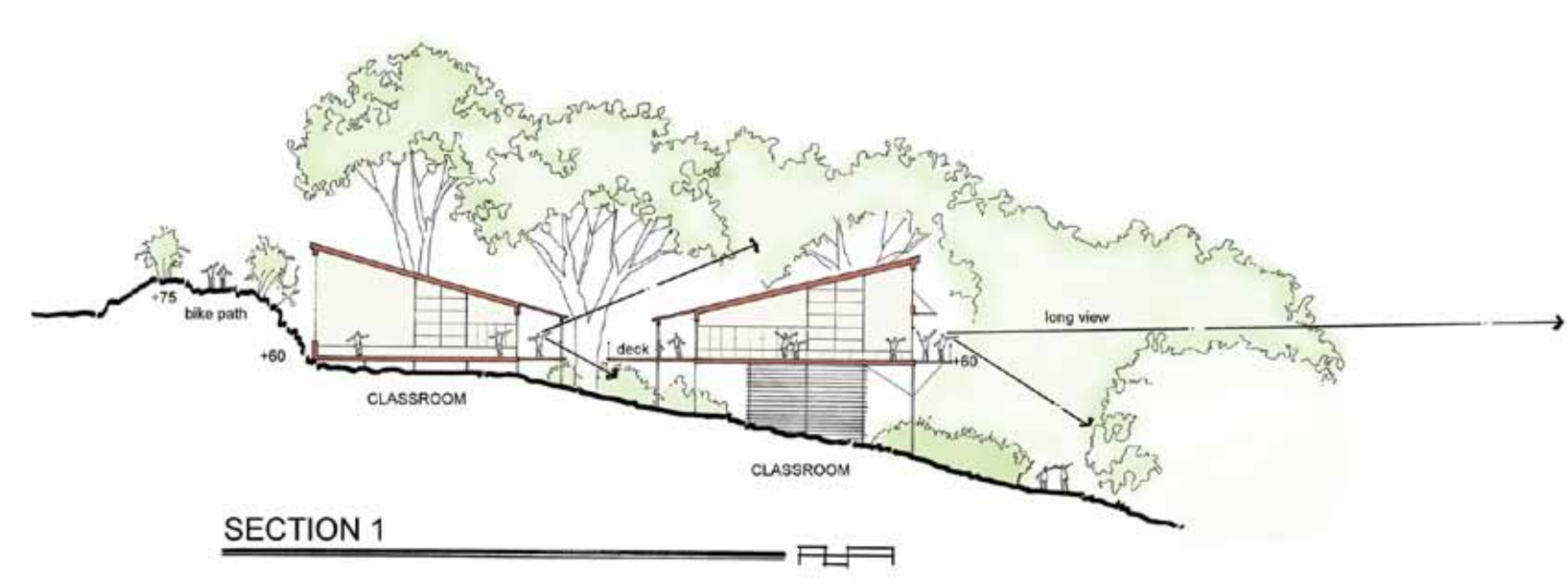

Figure 6.7: Awnings and boardwalks at MSEEC The bulidings here are separated, allowing views from the many boardwalks and covered spaces (Image: Jones & Jones 2010c)

- Work with what was there: no heavy grading, maintain surface and sub grade water flows, remove as few trees as possible

The last goal in particular, working with what was there, determined of the footprints of the buildings and their locations on the ground. The number and size of the buildings grew from the available space in between stands of large trees. As mentioned before, several structures float high above the forest floor to relieve impacts on groundwater flows. These combined elements give the campus what Johnson calls a *"perforated and penetrated effect"*, in a sense creating *"fractured buildings"*. This idea becomes key, according to Johnson, in drawing people closer to the outdoors by way of the built environment:

"…how these buildings open up and allow the landscape to move through them…..you have this ability to be part inside and part outside…..the buildings themselves are perforated and penetrated by these boardwalks that are at once both landscape and part of the architecture." (Figure 6.7)

Johnson also commented on how the smaller size of the rooms encourages the use of the outdoor spaces under awnings for breakout groups during meetings or classes. Even the fact that the bathrooms are a walk from the main buildings becomes a useful impetus, in Johnson's words, to initiate an experience with the out of doors.

Johnson stressed flexibility as a strong design philosophy for supporting education. He wanted to prepare spaces for *"teaching in the round"*, referring to the educators' desires to move furniture, clear spaces, pull their group indoors and out depending on the needs and momentum

of the students. Here again he emphasized the creation of defined areas for groups of many different sizes, explaining that it's in these diverse yet flexible areas that learning and discovery often happens:

> *"It's the unprogrammed space that allows for magic to happen, because you can't plan for those moments…it's not formulaic."*

Johnson acknowledged that the unique features, the arrangement of the buildings, the gabions, and the water rills along the railing help make people realize this place is different; that it is a demonstration. However, he kept coming back to views and transparency as the most powerful features of the design. The size of the windows, their proximity to the trees, and the views they offer of the other buildings as well as the forest all capture the powerful overlap of humans in nature.

The overlooks provide another place to contemplate our relationship with nature, but add a different perspective. The Tree House, meant as a refuge, high but sheltered in the tree canopy, allows rare glimpses of birds flying and perching at eye level and reveals the complexity of the vegetation below. In contrast, the Slough Overlook juts out exposed for a full view of the city and the wetland lying in between. Interestingly enough, this places visitors themselves in full view from the Community Room and Visitor's Center behind them. Key to both of these experiences, Johnson explained, is that they require a little effort on the part of the visitor to reach them. The opportunity is not hidden to explore, yet visitors must take it upon themselves to climb the ladder to the Tree House or venture out, visible to all, on the long Slough Overlook. The design provides an impetus, but what visitors take back from these experiences is their own.

Process

Johnson described working at length with educators Apryl Brinkley (also interviewed here) and Brad Street from the Pacific Science Center on ways the facility could meet the needs of their program. Most of the discussion concerned practical functions such as lowering the height of sinks to kid level, specific needs for storage and flexibility in the classroom. He specifically recalled the term *"working walls"*, describing the need for vertical spaces to provide opportunities to hang coats and art work, or to be used as a surface for projectors or writing and drawing. Particularly useful was the opportunity to observe the teachers at work in their original classrooms and facility. Johnson mentioned that many of the educators liked to point out what the old facility was lacking, and this last experience allowed the designers to see how the teachers adapted, encouraging design moves to accommodate for the unexpected as well.

As far as precedents or research in general on spaces for education, Johnson mentioned the Cedar River Watershed Education Center as a definite influence because he had been at Jones & Jones during its design and construction. The design team also visited the Carkeek Park Education Center in north Seattle. Johnson also cited his own prior work on the Icicle Creek Music Center as an important experience in capturing the spirit of a place and in melding the built environment with nature and open space. Aside from working directly with the Pacific Science Center and the visits to these two precedents, Johnson mentioned no other dedicated research in education, learning environments or interpretation.

Personal Philosophies on Design:

For Mark Johnson, the wonder in design lies in the *"little things and the big things"*. He spoke of design moves that hark back to his own childhood experiences and imagination, as well as that which fundamentally connects us to a place and to our environment:

> *"One of the little things, you see the rills here, that are out there along the rails….leaf boat races were a big part of my growing up. I wanted it to happen here." (Figure 6.8)*

Johnson mentioned this playful feature as something he'd been trying to place in a design for quite some time, even pushing for it to be included in the Cedar River Watershed Education Center design years before. On a more universal level, Johnson described the concept of transparency as a powerful force in providing wonder and contemplation–to be able to see the human place in something greater:

Figure 6.8: MSEEC Water Rill Railings

> *"Really, transparency to me is wonder, both transparency to be able to see through something and move through something, and to be able to see the human scale in something. That to me really makes for wonder. This place is not a big facility but wherever you look there is a place for humans."*

Johnson finished with comments on his personal design philosophy, which largely revolves around remaining sensitive to the site. He spoke of *"things above us and beyond us"*, and of the "*site forces,"* or *"sub grade,"* on a site:

> *"the things that inspire you, whether it's cultural, spiritual, or ephemeral–the things we can't quite put our hands on but we can wrap our minds around."*

His respect for the context of the existing landscape, combined with the need to create spaces that welcome humans in a way they understand, provide for Johnson a conceptual bridge between the natural and built environment. This bridge, according to Johnson, is most apparent at MSEEC along the two large outlooks, one drawing visitors into the forest canopy, the other out over the slough itself. Here, visitors may witness the messages of the design and nature at the same time, and begin making connections that will inspire them for a lifetime.

Nate Cormier–Lead Landscape Architect, Jones & Jones

Design

Cormier described a major difference between his experience and Johnson's in their work in Mercer Slough. The program they were given and the suggestions from the City of Bellevue and the Pacific Science Center were largely building related and did not focus on the landscape. Less directed by the client, the designers focused on what would connect people to the natural forces on the site. As landscape architect, Cormier worked primarily with the layout and drainage of the complex, siting of smaller buildings such as the Wet Labs, the Welcome Plaza (Log Jam Plaza), and the overall planting plan. Cormier summarized his program and strategies for the task:

- *"Create a story about building on this setting*
- *Utilize Cedar River Watershed Education Center as inspiration and model*
- *Build lightly*
- *Focus on legibility and framing of process"*

Cormier expanded upon this last point of legibility and framing in terms of keeping the hydrology visible on the site (Figure 6.9). Citing Joan Nassauer and the importance of working within cultural frameworks, Cormier pointed out the intention behind the use of gabion splash blocks instead of traditional basins, and the exaggerated rills along the deck railings.

Figure 6.9: Water movement made legible at MSEEC
Pervious pavement of the Log Jam Plaza, gabion splash blocks and exaggerated downspout

These are making statements about hydrology, Cormier explained, in a cultural context that helps people gain a new understanding of how water works on the landscape.

The story that emerged here, similar to what Johnson described, is that of creating a space that embodied the transition from city to wetland.

> *"We brought to it … an agenda to go beyond just environmental learning...to have the structure and environment itself tell a story about what it is like to build in that setting."*

The driving concept became *"Break it up. Lift it off. Slow it down,"* with examples given by Cormier in the raised, loosely knit buildings, and

in the details of the Log Jam Plaza. The latter piece is one Cormier spent considerable time with, working on a way to transition from the loud, fast environment of the street to the slower, calming setting of the slough. In the end his design ties in aesthetically with the gabion splash blocks, creating gabion 'logs' that unfold and trickle to the main deck below.

When asked about aspects of the design that successfully support education and learning, Cormier immediately jumped back to the term *"framing"*, describing this time not only the displays of hydrology, but the views prompted by the carefully placed piers and overlooks. Each was meant for a different purpose, he explained. The Slough Overlook shows the city rising up out of the wetland, demonstrating Bellevue's proximity to this wild space. The Tree House pulls the viewer up into the canopy and allows visitors to observe not only the trees, but the other structures and piers of MSEEC that jut out into the forest. Finally he points out the perfect size of the decks just off the classrooms, designed as a cozy space for a teacher and a learning group. Cormier also reminds us that the setting itself and the native plantings, both original and those part of the planting plan, serve as educational resources on their own.

Process

Cormier, as well as Johnson, worked with teachers from the Pacific Science Center on aspects of the design. He mentioned observing their work in the original facility, and pointed out that the amenities there were so lacking that the educators were begging simply for practical supports for their teaching: storage, classroom space, sinks, Wet Labs. Cormier has some familiarity with education and curricular protocol from family members that are steeped in the teaching profession. He personally chose to let the teaching professionals deal with links to curricular standards, expressing that the designer's role is much more powerful in linking people with place and broader context. The most exciting research for Cormier was mapping the trees onsite and exploring the possibilities of how to fit the needs of an education center within the constraints of their trunks and the sensitive wetland soils below. He also discussed perfunctory visits to the Cedar River Watershed Education Center and IslandWood, as he saw both as significant examples for capturing place and building for education.

Personal Philosophies on Design

Cormier was very explicit in his preference for how design draws people in and inspires wonder:

> *"I don't like a lot of signs and 'explanation explanation', I like experiences to be a little more subtle and grab you by the gut."*

To explain, he described a different project, also in collaboration with Mark Johnson, which achieved a certain amount of depth through what he called a *"quiet humility."* The Mt. Baker Ridge Viewpoint in South Seattle embodies what the two designers came to describe as an *"earth instrument"*–that which gives people fresh eyes on how to see nature and our relationship with the environment. The design there acts as a sunset dial, which in Cormier's words *"takes the pulse of the earth"*, revealing bits and pieces of the grand cycles that affect our daily lives.

Cormier also expressed a keen interest in designs that can be measured; for example, places that teach via the concept of adaptive management. He cited the Thornton Creek Water Quality Channel, near Northgate Mall in Seattle, as an interesting opportunity to observe different planting treatments exposed to the ebb and pulse of storm water

cycles. He also described a similar project using rain gardens run by Washington State University's extension office in Puyallup. Cormier appears to have made the concept of learning central to his own design philosophy, with his audience being the designers and engineers who build these projects, not just the visitors who enjoy them.

Christina Dyson-Farrell–Park Ranger and Manager of MSEEC

Design

Dyson-Farrell began work as manager and educator at MSEEC about six months before the grand opening of the facility in 2008. At the time of the interview, she had one year of experience guiding interpretive tours of the facility, leading nature walks, and meeting and greeting a large portion of the 25,000 visitors the center receives. For her, the most significant aspects of the design are the demonstration of a conservation ethic and the framing of powerful views. Windows and overlooks play a large role in her perceived success of the site, enabling its use by a large cross section of society who otherwise might not have access to nature for cultural, financial or mobility related reasons.

> *"We're so close to the outdoors, the windows, the whole space, even while you're inside any of our buildings, you can point through the window and people can actually see what you are talking about. That's one of the features that I really like because again we're bridging a gap…A lot of ethnicities are not comfortable in the woods ….you are able to bring folks in that may otherwise not want to experience the outdoors…When they come inside they feel safe, they are able to look out that window and have that passive connection with nature without actually being outside."*

Figure 6.10: The alarming proximity of trees to bulidings at MSEEC

In her description, the design of the center acts as a cultural and physical portal between the city and natural space. The wide windows where participants can actually reach out and touch the trees provide previews of what may come later during a nature hike, and create a safe perch from which to observe the wilds below (Figure 6.10). Such visuals are particularly important for short interpretive programs, such as those given by the park rangers at MSEEC, as they give people a chance to experience and make connections for themselves. She cites the Slough

Figure 6.11: The view from MSEEC's Slough Overlook
The wetland and historical blueberry fields in the foreground and the city of Bellevue in the background

Overlook as particularly powerful in bringing history alive for visitors because they often ask questions about the human uses of the wetland (Figure 6.10). Interpretation of the wetland for everyone, with no barriers to access, is a clear and important mission for the park rangers of MSEEC, and, according to Dyson-Farrell, one which the design supports powerfully.

She went into great detail on the aspects of the project that demonstrate Bellevue's commitment to water conservation and low impact development, citing the LEED Gold rating and the way the design slows the flow of water, just like the wetland itself. However she did not go into great detail as to how the lay individual may interpret these features on their own. She explained that Bellevue Parks and Recreation was actively developing interpretive signage to address this issue, though she cautioned that too many signs would lead to distraction.

Dyson-Farrell also discussed the physical divide between the institutions housed at the center, believing that the split into the *"youthful education wing"* of the Science Center and the *"welcome and interpretation wing"* of the Bellevue Parks effectively works for the two. She was also careful to point out that people do wander the entire campus. The division merely adds to the flexibility of the space should the Science Center choose to create more exhibit type programming in their section of the facility. This flexibility was also key in her descriptions of the facility as a place for both teaching and self led exploration.

Visitor/Teacher Experience:

"Every nook and cranny of this facility gets used, particularly the overlooks," Dyson-Farrell noted while explaining how the MSEEC can hold a hundred visitors, and then absorb one hundred more without feeling crowded. At an interpretive center, a visitor's experience may begin with ranger led programs, but much of the learning experience is intended to be self led discovery. The myriad of places with interesting views of the trees, wetlands, and the buildings themselves, in her description, allows the center to serve both of these functions, offering places to focus, observe, and explore.

People commonly ask about the green roofs, often looking for information about how to install one of their own. The dual flush toilets are also conversation pieces. The permeable pavement, however, is often overlooked because it does not have the rough surface people normally associate with this treatment. Though visitors do not necessarily pick up on all the sustainable design features, aesthetically the message comes through, with visitors often commenting on how well the buildings blend in with the environment. Many of the buildings, Dyson-Farrell pointed out, are seldom noticed from the road.

The Tree House in particular is a piece visitors love to engage with, in part it seems, because it is hidden at the south end of the facility. It becomes something of a discovery in itself:

"A lot of folks just don't know it's there, so when they do find it, even adults jump up and down. They're really excited; there's a very youthful expression when people are using the Tree House."

The water rills along the deck banisters also catch the attention of visitors and are heavily used on rainy days. Dyson-Farrell also described a less anticipated but equally exciting reaction some visitors have towards the inclusion of the Sullivan House in the design (Figure 6.12). The house was originally located in downtown Bellevue, where it was used for historical interpretation by Bellevue Parks and Recreation. Now, on this new site, it is greeted with much excitement by visitors who participated in its programming decades ago.

Dyson-Farrell was certain that the center's existence and the obvious care and investment in the facility make people think differently about Mercer Slough and other wetlands:

"A lot of people don't know a lot about wetlands, and this whole place is about wetlands. You come in and the buildings equally represent the importance of and the caretaking of water. [The center] mimics the filtering properties of a wetland. By living lightly on the land, we're showing how important wetlands are and at the same time providing the ability to educate about wetlands."

Personal Philosophies on Design

When asked 'where is the wonder in design' and how a space can push people to explore, Dyson-Farrell immediately jumped to the Tree

Figure 6.12: The Sullivan House at MSEEC

House and the water rills as aspects that inevitably draw people in. Upon further thought, she described a significant, but much less tangible feeling visitors express at facility:

"They notice mostly that the more you walk the site, the bigger the buildings get. One woman said, 'it seems like such a meek and small place, but then when you walk around, it seems so grand.'"

This last comment supports the designers' and the City of Bellevue's hopes that a visit to MSEEC would help place the built environment in the larger context of wetlands, watersheds, and nature. Dyson-Farrell's

only request to add to the design had more to do with this last contextual piece than design of the onsite facility. She expressed a strong desire to see links with the park's inner trails, and a salmon ladder at Kelsey Creek to strengthen connections with the larger watershed and beyond.

Apryl Brinkley–Pacific Science Center Site Manager for MSEEC

Design

At the time of this interview Apryl Brinkley had spent eight years working at Mercer Slough and played a significant role in the design and transition to the new facility. She explained that her role was largely in the design of interior classroom spaces, accessibility to the wetland, and logistics for school bus access. The Pacific Science Center programs at the Slough serve K-12 students; however the bulk of their learners are in elementary school and the need for facilities to be sized correctly, easily cleaned, and flexible was tantamount.

When asked about features of the facility that best address learning, Brinkley described those that generate a feeling of immersion in the park, wetland, and forest. Their former site was more visible and accessible to the public, but the connection the new facility provides with the slough creates a powerful experience for visitors. Brinkley noted several aspects of the design that facilitate this connection, including the close proximity of the buildings to the trees, views of Bellevue and the slough, green roofs, and the movement of water through the system. She spoke with fondness of the porous gabion walls and water rills, taking particular care to describe the splatter and drip of falling water on the splash blocks positioned below the downspout rain chains. The lifting of the buildings off of the ground and the closeness of trees, according to Brinkley, give visitors the feeling that this place was built with nature first, emphasizing the fragility and importance of the wetland and forest.

> *"The idea that the ground is important, the trees are important, that they're working here as a system. I think there are many kinds of subtle ways that people catch this meaning…"*

The care and detail given to the design, and the size of the center itself, in her opinion, help reinforce the importance of the Pacific Science Center's mission of environmental education. The desire of the program to see students develop a lifelong connection with the outdoors is also facilitated by the fact that Mercer Slough is a public park. Brinkley described with great pleasure the number of return visitors they welcome, often former students with parents and family in tow.

Though Brinkley was largely ecstatic about the design of the center and how it caters to the needs of the Science Center program, she did offer some critiques. Brinkley believed many of the details for sustainable design that led to the center's LEED Gold rating are missed by the public. She described in particular the amazing glass wall of the bathroom that gives no hint of its recycled bottle origins, possibly indicating, for her, a need for more direct interpretation. The few additional challenges Brinkley saw in the design relate to the specific needs of her program. Students in the K-8 age range need larger and softer outdoor play surfaces for vigorous group games; activities that become important when working with this demographic for many hours. There is a section of turf that they have been able to use for smaller groups, and Brinkley mentions using the classrooms for games on rainy days. The size of the sinks and the storage facilities have also proven too small for the needs of the program. Brinkley was quick to point out that the general flexibility of the space

has allowed them to improvise and compensate for these and many other unanticipated programmatic requirements, however she felt that better communication during the construction phase of the project would have helped them find stronger compromises. Brinkley explained that the wishes of the educational staff were translated quite well into the original design documents, but that communication did not continue far enough into the other phases of the project.

Figure 6.13: Visitors at MSEEC are drawn to the Wetland

Visitor/Teacher Experience

The center's elevated position and long lofty overlooks, according to Brinkley, draw excitement and interest from visitors:

> *"The Tree House and the Slough Overlook are the main things that people are drawn to …I mean, who doesn't like to be up off the ground? It's the idea that you can get higher than you normally can; you can see things from a different perspective."*

The younger students are immediately attracted to the water rills, always curious about where they go and always experimenting with small floating objects. Brinkley describes the height of the rills as perfect for engaging students, because they are right at their eye level. Questions are also generated by the visible green roof on the Wet Lab. Regardless of age, however, all visitors, according to Brinkley, are drawn to the wetland (Figure 6.13). The orientation and size of the windows on the buildings, as well as the position of the Slough Overlook, make this view the focus of attention.

As far as how well visitors see the educational intent of the design, Brinkley is unsure. Students may enjoy reaching out and touching a tree from an overlook, or following leaf boats along the railing, but they may not be consciously articulating that this experience was built for them to learn. She does echo Dyson-Farrell's sentiment that the fact that the center exists, and on such a grand scale, gives very readable messages as to the importance of wetlands and environmental education.

For Brinkley the strength of the design as a tool for teaching lies in its sheltered access to nature and in the flexibility of its spaces. In particular she stressed her use of the canopies, overlooks, and various nooks and crannies for quiet reflection activities. Students are instructed

to find an 'eagle perch' where they quietly observe the sounds, smells, and colors of the forest around them or simply reflect in solitude on the days activities. She noted:

> *"To have so much space and places for kids to sit outside was really exciting for us."*

The extended rooflines and large windows offer students a safe, dry place to reflect on nature, and still feel outside. Brinkley stressed this point in contrast with their old facility, where a student's memories may be more of their wet socks or the water running down the inside of their jacket than their experiences with the plants, animals and ecology of the slough. Brinkley emphasized how the comfort provided at the new facility eases the transition to the outdoors.

Brinkley explained how the design serves the practical as well as the contemplative. The broken, fractured shapes of the plazas and overlooks work well for breaking up large groups into smaller learning teams, and the mobility of the amenities in the classroom makes them an extension of the open space. The outdoor sink makes program logistics like cleanliness and the handling of muddy samples a relatively seamless process.

Brinkley conceded that the structured nature of their curriculum actually makes it difficult to use all the teaching opportunities provided, and that the interpretive approach used by the park rangers may do the centers' design more justice. The sustainable aspects of the design have been discussed at length with teen programs, specifically at green building camps held for sixth graders. Both teachers and students found the elevated buildings useful for illustrating discussions on structural soils and sub surface water flow. Aside from this specialized programming these aspects are not central to the daily instruction that occurs at the center.

Personal Philosophies on Design

When asked about creating wonder in design, Brinkley replied in terms of places and experiences that provoke calm contemplation: *"Things that slow you down"*. She spoke of the fact that at Mercer Slough people just want to sit and hang out; that there are things that make people want to stay. Compared to the Pacific Science Center in Seattle, a high energy space with few guidelines or boundaries, Mercer Slough offers a superior environment for learning and teaching. Students can run, but the boundaries are clear, or students can sit and relax in solitude or in groups. Brinkley described the Rain Drums at the Cedar River Watershed Education Center as another piece that draws people in and makes them want to stay. For her, finding wonder is creating a place that calmly begs a visitor sit and just be:

> *"What kind of underfeeling do you have at a place….that [makes] someone want to stay longer? [At Mercer Slough] the buildings do that. The fact that there are different spaces and alcoves where you can just sort of sit and chill out, or just sit and listen, is good. I definitely feel like this place evokes that."*

SUMMARY AND LESSONS LEARNED

Given the rich stories and perspectives offered by these interviews, how well were the designers able to meet the needs of an educative

landscape? Did their design moves intended to educate visitors and personify the learning center's mission find success?

How well did the design goals of the project align with the observed performance by teachers and staff?

The goals and intentions of the designers at Mercer Slough appear to have meshed quite well with the needs of the educators and the messages embodied by both programs. This is particularly evident in the use of the center as an instrument to facilitate the transition from urban experience to the wild. The large framed view of the slough with the city of Bellevue rising in the background plays a strong role in this connection. Also, the broad windows and deep awnings allow comfort and safety for visitors unable or unready for a direct trip to the wetlands below, easing the transition from urban to nature.

The message of the City of Bellevue's philosophy of building lightly on the land and the Pacific Science Center's value for environmental education is also evident. The buildings, elevated into the forest canopy denote to visitors the delicate and precious nature of the wetland soils below. The beauty, detail, and size of the facility indicate the worth of its mission–promoting the value of wetlands and environmental education–to all who arrive.

As far as the staff of the center are concerned, the only pieces that seem lacking in this design are the need for a larger open green space and more storage areas. Though it was reiterated many times that the program has adapted, and the facilities are highly valued, it was pointed out that the original schematics had these features. Their loss during the construction phase opens up an interesting discussion about how and when to involve teachers in each phase of a project.

How well does the design support the 10 principles of educative design?

1. Strives to Instill Wonder: The design at Mercer Slough appears particularly effective at meeting this principle by providing opportunities for quiet contemplation, proximity to nature, and new and interesting perspectives. The closeness of the trees and the feeling of being lifted up off the ground were mentioned by all those interviewed as powerful experiences. On the Slough Overlook, the juxtaposition, or "*dichotomy*" as Apryl Brinkley put it, of the city and the slough creates a view with many layers of meaning, prompting both pause and pondering. From the Tree House Overlook, the canopy stretches out at eye level opening a new world for observation. If wonder here does not lie in the design itself, it certainly lies in the access to natural splendor woven within and around Mercer Slough Environmental Learning Center.

2. Provides Manipulable/Interactive Elements: The most obvious link here is with the Pacific Science Center programming, specifically water sampling and support of classroom activities. The design certainly affords these uses, however I did not find evidence of actual invitations to tinker, alter, experiment or change in the design of the center. I consider the classrooms, sinks, and Wet Labs excellent tools to support teacher facilitated learning, providing a wide open platform for programmed activities, but they are not open for creative use outside of instruction hours. The facility provides for teaching, however there is little affordance for ongoing manipulation or experimentation either as

a demonstration or for direct visitor involvement. Within the wetlabs, opportunities may exist for more direct interaction with equipment, but again, this is not visible or accessible for most. If experimentation does occur as part of these programs, it is not evident that a particular portion of the design or physical structure of the facility plays a central role in this aside from unprogrammed or easily cleanable space. The wetland and forest environment themselves offer opportunities to experiment and manipulate, however the design of the center does not necessarily encourage these activities with framing, visibility or signage. Even boards displaying experimental evidence or efforts of environmental restoration crews would provide indications that people could participate in activating and altering this space. Another option, telescopes, even when fixed, are still moveable and manipulable in terms of allowing visitors to frame their own views, but were not included on any of the outlooks.

The rills running along railings that carry water from downspouts are the best example of manipulatives I could find. Mark Johnson's leaf boat races provide opportunities to investigate the speeds of different leaves, twigs, bark or whatever endless options of water vessels an experimenter may choose.

3. Allows for Observable Change/Comparisons: The Center offers strong examples of observable changes in terms of natural systems and land use history. I was fortunate enough to visit the site on both rainy and sunny days, and can attest to the power of water revealed onsite. The rain chains, rills, rain gardens, and splash blocks show water moving, pooling, splashing, and falling–the harder the rain, the more activated the space! The trees themselves, given their proximity, sway and creak noticeably, making a wind gauge out of the entire site. The view itself from the Slough Overlook covers a gradient of different landscape types, revealing histories that visitors readily notice and ask about. In order of adjacency to the center, visitors can easily discern between horizons of wetland, former blueberry farms, the coniferous trees marking the former shoreline, and the skyline of downtown Bellevue. Add to this that everything here can be observed from the ground as well as up high, making the journey around and through the Center an exercise in observation and comparison in and of itself.

Most of the powerful observations here involve qualitative comparisons, which are effective, but little is done in the way of providing measurable phenomena. There is nothing showing the amount of rainfall or the rate of flow in the water rills, nor a photo study demonstrating the progress and establishment of the green roof. Such information could be put online or incorporated into the design itself, and may help reveal some of the sustainable design features that are a challenge to make legible.

Apryl Brinkley pointed out that seasonal changes are particularly evident at Mercer Slough, citing their proximity to the forest and excellent view of colorful foliage in the wetland. She wasn't sure how clearly this came through for the visitors and stressed the need to return at many different times of the year. The fact that Mercer Slough is a public park and offers access to both comfort and nature year round makes this center a powerful option for many.

4. Balances clarity and mystery, novelty and the familiar: Legibility is one of Mercer Slough's strongest points, offering clear and powerful messages about water in the landscape and the transition from urban to natural environments. It is easy to follow the lines where water

runs, percolates, filters and pools; all the time with reference to the slow seeping waters of the slough. Visitors recognize the sensitivity and value of the environment below the center's carefully perched buildings and platforms. The powerfully framed view of Bellevue and the slough make a clear statement, contrasting urban and natural systems.

A sense of mystery is equally apparent. The perimeter trail and the overlooks play off of one another, giving visitors glimpses of what lies ahead, overhead, or just on the other side of the next building (Figure 6.14). The novelty of floating buildings makes visitors want to look underneath, and the raised overlooks draw people out, not just for the views on the horizon, but to explore the wrinkled bark and twisted branches now at eye level, above the forest floor. The Tree House lends another level of elevation, but only for those willing and able. The broad decking underneath offers a more secure venue, allowing people to explore within their own comfort zone.

Figure 6.14: Views through the clusterd buildings at MSEEC. Small glimpses of the other buildings looming in the distance encourage exploration.

Though the idea of building lightly upon the earth comes through clearly, the finer aspects of sustainable design that earned the buildings a LEED Gold rating do not read as well. Interpretive signage for this, courtesy of the City of Bellevue Parks Department, was being developed at the time of this research. The impact and effectiveness of the signage will be interesting to follow.

5. Supports Self Directed Learning: The affective, emotional messages of Mercer Slough connect with individuals as well as groups. This applies to the emphasis on water, on building lightly, and on connecting urban and wild places. Beyond this, the facility requires interpretation to gather more messages or complex ideas. Currently this takes place through teachers and presenters. There is not much on the exterior of the buildings or in the landscape to guide solo investigation. Interpretive signage and manipulable elements would help in this category. It should be mentioned that the Visitor's Center itself is rich in written materials and is consistently staffed by an interpretive ranger outside the center. Similar access to self directed learning, in the form of activity, writing or artwork is largely absent.

At a basic level the facility does offer opportunities to connect with former experiences and draws upon former knowledge via playful references to familiar structures such as downspouts, curbs and water

pipes. This helps visitors make connections other wise difficult without interpretation.

6. Supports Teacher Facilitated Learning: Mercer Slough offers strong opportunities for teaching and working with groups. Aside from the myriad of different experiences, vantages, and views that provide material to discuss and interpret, the design of the facility directly supports group management and presentation. The fractured nature of the plaza space and overlooks provides excellent spaces for focusing, presenting, and breaking up groups. Students can have solo experiences, small group and community discussions. The classrooms are flexible as well, with balconies and deep awnings that extend the classroom out into the forest canopy.

The design also creates powerful messages in a similar manner to what Wendy Titman describes as semiotics (1994). The obvious investment of resources in this site tells visitors that education about the slough is valued and important. It tells the public that they can be comfortable in this wild space, and they are welcome to come explore.

7. Creates Multi-Layered Experiences: The nature surrounding the MSEEC provides numerous sensations and vivid layers of experience. The space itself accentuates this via sounds of water splashing on metal roofs and rock; via flowing rills and thick barked trees within arms reach. The senses of sound, touch, and sight thrive here, particularly on a rainy day. The design calls people out into this sensory rich environment, quite simply, by not providing as much space inside. Mark Johnson specifically mentioned earmarking outdoor alcoves for break out spaces, and requires a walk through the outdoors to reach the bathrooms!

The embodied experience of traveling through the trees thirty feet off of the ground provides unique perspective, and suggests the sensitivity of the ground below. The design of the Tree House accentuates the feeling of climbing by offering an exaggerated step ladder, seemingly steeper than it needs to be, for ascension to the top. Emphasizing through movement and design the upward path towards a new way of seeing the forest.

8. Invites Collaboration: The design here does not necessarily offer activities or experiences that require people to interact, however the size of the spaces created on the overlooks is conducive to discussion and small group gathering. The space in the Tree House and the space at the end of the Slough Overlook are sized to encourage people to stand close, creating situations for interaction between strangers. The view provides both impetus to place oneself next to possible strangers and the invitation to discuss the experience.

9. Invites Play: The power of youthful energy, playfulness, and freedom is evident in the water rills, taken directly from Mark Johnson's childhood, and the Tree House, symbolizing an iconic childhood dream or experience. These strong gestures are balanced by the rest of the design which emphasizes delicacy and respect for nature and the land. This is particularly notable in the words chosen by Apryl Brinkley who describes the overall feeling as one of peace and calm. I would agree that the general ambiance created resembles reverence, and there is little invitation to fiddle with or change the environment. The lack of large spaces for vigorous activity literally reduces opportunities for play, and

also supports the idea that this area is meant for gentle protection rather than active recreation.

The inside of the Visitor's Center is an exception to this. It is obviously for people, with comfortable chairs and a coffee table. Surrounded by bookshelves, this area could be in a person's home, if they had a penchant for natural history. It invites you to come inside, relax, and be yourself.

10. Provides Social/Cultural Relevance: The design at Mercer Slough strongly utilizes familiar structures in a slightly different cultural context. The double flush toilets are no longer about flushing water away, but about conserving it. The gabion curbs and edges do not direct water, but absorb it. The rain chains, rills, and splash blocks don't hide water away, but display it. This artful play on what we normally associate with getting rid of water asks us to consider water in a different way.

In a similar manner, the center acts as both cultural and physical bridge to Mercer Slough by providing a shelter that actually brings visitors closer to the outdoors. The experience here also connects back to life away from the slough with the powerfully framed view of Bellevue and open access to return with friends and family time and time again.

What observations (from myself or interview subjects) offer significant new lessons for the design of educative landscapes?

From my own observation, the strength of the MSEEC lies in coherent and legible design, with messages clear, few in number and grand in scale. In the observations of the staff who work there, visitors respond powerfully to three messages in the design: the value of water, stepping lightly upon the land, and the tension between urban and wild.

Much of the power here emanates from the framing of views, diverse array of spaces, and their unique placement within the trees. By creating spaces that look inward as well as out, the design draws visitors to explore its many rooms and outlooks, while constantly following views of the slough, the forest canopy and the way to their next vantage point. By pushing the buildings up to the trees, and the overlooks out to the wetland and above into the canopy, the facility itself takes a walk into the wild. The comfort created within the buildings and under their awnings gives visitors a peaceful place to safely cross the threshold from city to nature.

Also interesting is that neither designer had experienced any training in teaching or education, yet certain design moves intuitively followed points made in education literature. The designers demonstrated sensitivity to several aspects of constructivist learning theory, including the importance of learning in groups and the need to begin with familiar ideas when attempting to present something new. Some of this may have come from watching Pacific Science Center educators utilize aspects of space to manage and instruct student groups. Some, such as Nassauer's focus on culture, are inherent to the design profession. Regardless, there appears to be a connection here between certain aspects of education philosophy and the practice of design in general. Cormier translates this into strategies for adaptive management, indicating how the next step in successful landscape design is one that teaches designers and visitors alike.

The success and coherency of the MSEEC design make me question the need to include all ten principles of educative design in every project. Possibly focusing on a smaller suite of principles with depth and simplicity may be equally, or even more powerful. The designers at Mercer Slough seem to have made a compromise, leaving out aspects of

self directed learning, inviting play, and manipulable elements, in favor of a more contemplative, respectful, and wondrous setting.

This emphasis on elegance and simplicity may be the most powerful lesson from the design at Mercer Slough, not simply for the creation of beautiful spaces in general, but also for those that support learning as well. A second lesson, mirroring one of the strengths in IslandWood's design, is the emergence of calm and reflective spaces as part of the learning experience. Admittedly, it is hard to lead people to reflect on specific topics without a direct teacher driven activity, but making space or opportunity for reflection is important (Falk 2000). The designs of both IslandWood and Mercer Slough Environmental Education Center seem to produce places conducive to peaceful contemplation and reflection that educators and visitors find powerful, indicating that this aspect may need to play a larger role in the Principles of Educative Design.

CHAPTER SEVEN | CEDAR RIVER WATERSHED EDUCATION CENTER

Honors and Awards (Jones & Jones 2010a)

Merit Award 2004—Design

ASLA—National

Honor Award 2003—Design

ASLA—Washington Chapter

What Makes it Green 2002—Built Category

AIA—Seattle

Honorable Mention Award 2001—Outstanding Public Project

Northwest Construction

Located 35 miles from downtown Seattle, the Cedar River Watershed Education Center (CRWEC) is the portal for visitors wishing to explore the primary source of the city's water supply. The Cedar River Watershed, the source itself, comprises roughly 90,000 acres of wild space protected from human activity for the sake of maintaining clean drinking water (City of Seattle 2010). In 1986, Seattle Public Utilities (SPU) chose to open up a small portion of the watershed for public education, a use that blossomed by 1992 to an organized program, hosting school groups from 5th grade through high school (Spencer 2010). The area visited by the public stretches from neighboring Rattlesnake Lake, actually outside the protected watershed, to the former electrical utility town of Cedar Falls. By 1994, the design firm Jones & Jones had been hired by the city to create a master plan for the entire area, and later to develop plans for what would be called the Cedar River Watershed Education Center, which opened by 2001. The site chosen reuses a portion of an old railroad camp, creating opportunities for links with historical interpretation (Rottle 2010). Though Rattlesnake Lake itself is not directly part of Seattle's water source, it is used heavily by educators as a microcosm for the processes occurring farther up in the Cedar River watershed. Though not on a highway or major road, the center is relatively visible in its location next to the well--used Rattlesnake Ridge trailhead and the popular beach on Rattlesnake Lake itself.

This site is unique amongst the three case studies because it is the only one for which a post occupancy evaluation was conducted. As referenced in the last chapter, project landscape architect Nancy Rottle returned for two successive seasons after the center's completion and questioned adult visitors about learning and messages found in experiencing the site (Rottle 2005). These findings will be discussed again here and incorporated into the analysis of the overall success of the design.

ORGANIZATION AND STRUCTURE

Mission: *"The Cedar River Watershed Education Center is a regional education facility created as a gathering place to connect people with the source of their water. The Center provides opportunities for thousands of visitors to learn about the complex issues surrounding the region's drinking water, forests, and wildlife." (City of Seattle 2010)*

The CREWC is a public facility staffed to welcome drop-in visitors 4-5 days a week during the spring, summer, and fall seasons. The center also hosts school programs in the spring and fall–generally day long programs with 4-5th grade students exploring the upper watershed or the environs of the education center itself. The staff has begun offering year round programming for 2nd-3rd grade students that largely focuses on indoor interpretive materials and exhibits. The center is often rented for events and will offer tours for other groups; however, the main focus of programming has been 4th-5th grade students, tying in directly with the Seattle school district Land and Water science curriculum for this age (Spencer 2010, City of Seattle 2010).

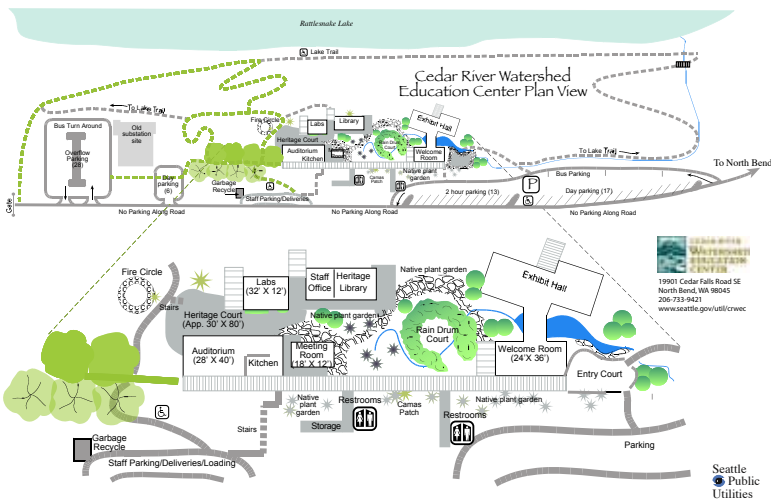

Figure 7.1: Facility map of CRWEC showing connecting trials to Rattlesnake Lake (image: City of Seattle 2010)

Figure 7.2: View of Rattlesnake Lake and Rattlesnake Ledge from CRWEC

FACILITY OVERVIEW AND VISITOR EXPERIENCE

The CRWEC sits on a small slope overlooking Rattlesnake Lake, sandwiched between a former railroad grade, now the access road, and the shoreline. Rising overhead is the 1,100 foot rock formation of Rattlesnake Ridge (Figure 7.2); though undeniably grand, it is a reminder in miniature of the massive snow covered slopes that form the Cedar River Watershed above. A loop trail winds from the center down to the shores of the Lake, connecting with a larger system of trails from which stalwart hikers can reach the summit of this little peak (Figure 7.1).

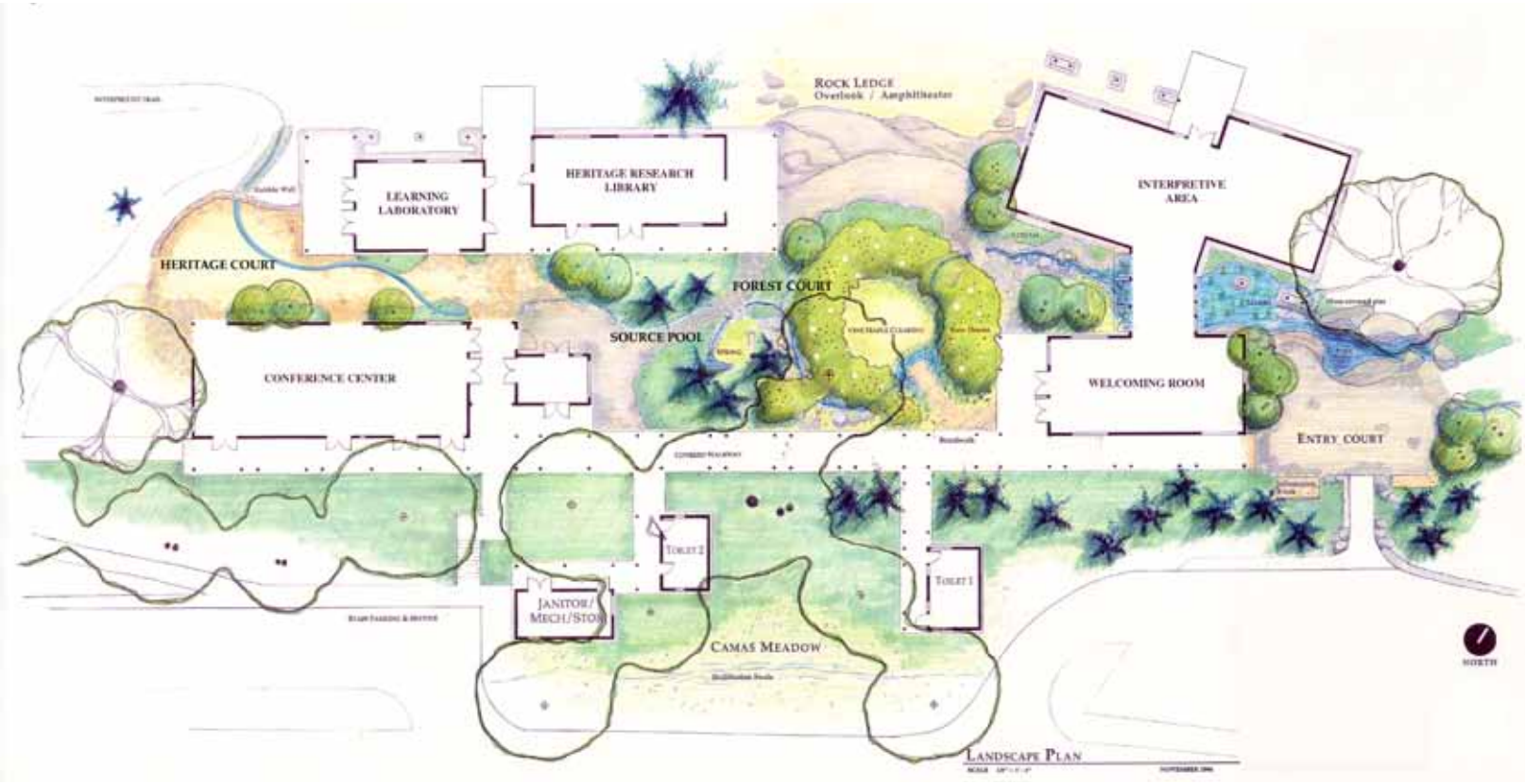

Figure 7.3: CRWEC Site Plan (Image: Rottle 2010) Original site plan generated by Jones & Jones. The wooden pier extending into the Vine Maple Clearing and the recommended Amphitheatre were never built. The Fire Circle (not pictured) lies accross the trail, to the left of the Heritage Court

The facility itself consists of a small group of buildings clustered around a series of courtyards. A broad covered boardwalk runs straight and true against the edge of the complex, paralleling the path of the old railroad. From this boardwalk, visitors can look through the complex out towards the lake. Three of the smaller buildings, the restrooms and storage, sit on the opposite side of this walkway, focusing the viewer's attention on the courtyards and buildings with a backdrop of the lake and the ridge behind it. Less conspicuous, but functionally important, a large bioswale runs along the road side of the boardwalk right up to the restrooms, capturing and processing runoff from the parking lot. The buildings all appear to face inward to the courtyards; however the breaks between the buildings offer access to extended overlooks, complete with telescopes, that frame the majestic view beyond. The design firm Jones & Jones (2010a) lists the amenities offered at the facility (Figure 7.3):

- *"Learning Labs for 100 students*

- *Multipurpose space for 180*
- *Conference Rooms and Resource Library*
- *Living roofs*
- *21 Rain Drums pulsing to nature's rhythms*
- *Water conservation and stormwater detention*
- *Water quality wetland"*

The approach from the parking lot brings visitors to a circular Entry Court and a prominent kiosk displaying a map of the center and basic information about the lake and trails. The court is pressed up against what looks like the back of two buildings, the Welcome Room and Exhibit Hall. More significant, however, is the large slow moving stream

Figure 7.4: Entry Court at CRWEC

Figure 7.5: Main Boardwalk leaving the Entry Court at CRWEC

that emerges from underneath them (Figure 7.4). Steps from the court lead to the pool and literally down to just below the surface of the water. Emerging from the other side of the court is the main boardwalk covered by an intensive twelve inch deep green roof (Figure 7.5). The incentive to follow this wide raised trail is both audible and visual. The broad roof creates deep shadows, broken by the light coming through from the interior courtyards, hinting at what may lie beyond. For the ears, the sound of musical and rhythmic dripping water beckons one to venture farther in.

The Forest Court is the next open space along the board walk. Within and amongst a stand of vine maples sit drums of various shapes, sizes, and colors, beating with a sonorous syncopation just wild enough to seem natural (Figure 7.6). Amazingly it's all quite intentional! This piece, designed and built by artist Dan Corson, uses a computer program to create music, dripping water from thin stems of copper pipe in rhythms from around the world (Rottle 2010, City of Seattle 2010). A

Figure 7.6: Forest Court and Rain Drums at CRWEC

small stream divides the space in two, opening up into a wider pool that passes underneath the surrounding buildings. Benches are provided to allow visitors to sit, or one can wander the perimeter of the plaza, across a small bridge, to a promontory between buildings that affords a full view of the lake and Rattlesnake Ridge. The court gives direct access to the Welcome Room and a path which travels around the Rain Drums to access the library and Learning Labs beyond.

Adjacent to the Forest Court, hidden behind a curtain of evergreen trees, is the Source Pool, the spring that feeds the small creek that runs through the complex (Figure 7.7). Dubbed Ruby Creek by the center's staff, after the SPU project manager Marie Ruby, this creek actually pulls water from the flushing of the center's fire suppression system, creating a free flowing artificial creek that seconds as a catchment system for surface flow and downspouts surrounding the court itself.

As visitors travel further away from the parking lot, the rich vegetation of the Forest Court and Source Pool give way to concrete and stone in the Heritage Court. This area is lined with artifacts from the former railroad camp and dismantled towns in the watershed: cobbles, bricks, pipes, and penstocks (Figure 7.8). Water is also on display here, but less naturalistically. Downspouts empty into oversized basins and connect via a recessed runnel, covered in spots by designed iron grates that hark back to another time.

A fire circle sits serenely at the far end of the complex, set aside from the buildings in a seemingly timeless setting. The trail to the lake connects here, and an interpretive sign illuminates the path of the former

Figure 7.7: Ruby Creek leaves the Source Pool and flows through the Forest Court

Figure 7.8: Artifacts in the Heritage Court at CRWEC

railway as it extends beyond the line of sight.

Most of my analysis and discussion involves the outdoor portion of the center, the landscape, boardwalks, layout, and external details of the buildings. However, it is important to note several aspects of the main Welcome Room and Exhibit Hall. Most significantly, these two buildings are connected by a hallway that forms a bridge over Ruby Creek. Windows from this crossing allow views of the Forest Court and the Welcome Court, essentially the inside and outside of the learning center. The Welcome Room greets visitors with a huge fireplace, comfortable chairs, and bookshelves, while tree roots lit with strands of lights dangle overhead (Figure 7.9). The floor has a stained concrete root system that leads one past the large welcome desk, over the bridge, and onto the Exhibit Hall floor.

I will not go into great detail on the exhibits themselves, as they are unsuitable for use in the landscape out of doors. It is worth noting, however, that the designers designated this large portion of the Center almost explicitly to self driven exploration, featuring a large relief map and strong interactive exhibits offering information at a cognitive level beyond that which can be gleaned from the experience outside.

Figure 7.9: Fireplace in the Welcome Room at CRWEC

INTERVIEWS

Nancy Rottle–Landscape Architect and Project Manager, Jones & Jones

Design

Nancy Rottle was involved with this project for close to ten years, beginning with the master plan for Rattlesnake Lake Recreation Area and moving into her role as lead landscape architect and project manager on the Cedar River Watershed Education Center. Though design firm Jones & Jones took the lead for the CRWEC, Nancy Rottle was quick to give credit to several other members of the project team, especially Marie Ruby, the Seattle Public Utilities project manager. Rottle emphasized Ruby as particularly strong in pushing for a design that captured a strong sense of place and that illustrated natural and human history on the site. It was clear to the whole team that education was the primary objective for this Center. Rottle explained their wishes:

> *"…that this site itself and the buildings would convey messages; the idea of buildings and landscapes that teach; that messages would be embedded in the design…"*

These messages would focus around SPU's mandate to provide clean drinking water to Seattle through the protection and management of the Cedar River watershed. To this end, Rottle listed the basic intentions of the design:

- *"Make people aware of the water cycle*
- *Expose the historical uses of this watershed*
- *Explain the management of water and ecological values of the watershed*
- *Emphasize the inherent value of water"*

Rottle summarized her translation of the conceptual framework for the design *"We wanted people to know: what a watershed is, that water is precious, and that the watershed is precious."* According to Rottle, Marie Ruby pushed hard for maintaining a good sense of connection with the place. Both agreed that the design also asked for a certain subtlety, one that prompted personal discovery and would keep visitors returning time and again. Rottle did make note of the team's additional focus on sustainability through water use, site selection, and materials. However, the major emphasis of her responses dealt with the design's messages about water and its value for nature and society.

To capture these ideals, the designers worked to create a microcosm of the Cedar River Watershed itself. This began with the site of the facility, chosen not only to reuse a degraded railroad camp, but also for its commanding views of Rattlesnake Lake and the surrounding topography. The prominent ridgelines, Rottle explained, allow you to see an actual watershed. Though not part of the municipal water system, it still demonstrates the powerful concept of protecting an entire catchment area and what that entails. Rottle noted the presence of three other watersheds in the design itself. First in the long bioswale capturing water from the parking lots; second, the entire large interior courtyard, draining into Ruby Creek; and finally, the Heritage Court and accompanying rooftops, draining into a decorated concrete runnel (Figure 7.10). She also mentioned a fourth, more metaphorical watershed: the 12 inch thick green roofs serve as their own separate catchment basins, however these are not often perceived by visitors as such.

These watershed metaphors, combined with the idea of creating a *"village"* of buildings to capture the spirit of the former industrial logging camp, helped drive the layout of the design. Rottle described it as a choreographed sequence of outdoor spaces, unfolding from either the north or south entrance to the site. Water was meant to lead visitors on their journey through these spaces, more naturalistic in the Forest Court and more cultural in the Heritage Court. At the same time, there are several vantages from which to see the flowing water. One can encounter its path both outside the center and within. The stream, Ruby Creek,

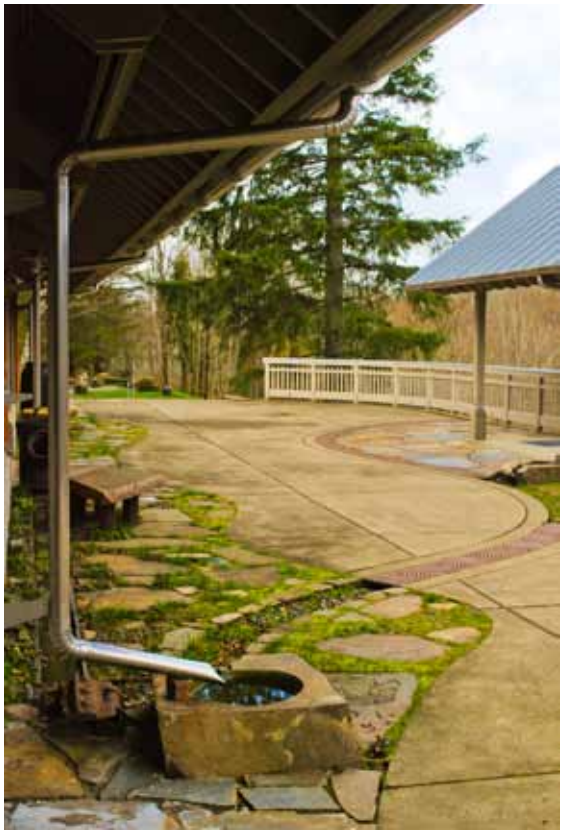

Figure 7.10: Exaggerated catchbasin and concrete runnel in CRWEC's Heritage Court

Figure 7.11: Ruby Creek leaves CRWEC and flows into Rattlesnake Lake

actually flows out beyond the complex and feeds into a seasonal stream running all the way to Rattlesnake Lake (Figure 7.11). This water leads visitors all the way from the shores of the lake to the source at the center of the facility.

Rottle recalled additional design moves used to emphasize water in the complex. The stream is intended to be small and precious, leading the visitor and demonstrating the many forms of water's journey–pools, runs, wetlands, and falls. The downspouts are all meant for display, some deliberately large and opening into exaggerated catch basins (also

Figure 7.10), others left with a full ten foot drop before hitting the splash basins below. Each of these details played a vital role in creating Rottle's watershed microcosms; however, the piece that in her eyes makes the strongest connection with visitors is the Rain Drums in the Forest Court:

> *"Of course the Rain Drums are really compelling. It's just a novelty. It's the cool factor. [The design of the Center has] this combination of being very low key and being undemanding; and at the same time it's got this spark, the rain drum element."*

According to Rottle, the general mood of the other spaces in the center had to play off of the commanding sounds of the Rain Drums, taking more understated and supporting roles.

When asked what aspects of the center best support learning and education, Rottle immediately described the many spaces of different sizes and amenities. The Welcome Court is large enough for orienting an entire group, and the board walk wide enough to address smaller groups one at a time as they enter the facility. The large porches and roof awnings offer various sized spaces with views into the Forest Court and out to the lake. There are also small spaces for children, the steps at the welcome pool; and the vegetated room around the Source Pool, intended by Rottle to feel like a secret garden (Figure 7.12).

She also mentioned meeting the programmatic needs of the center. The Learning Laboratories, library, meeting room, auditorium, Welcome Room, and exhibits were made to support school groups, visitors, and conferences. She specifically mentioned two features meant to lure people into the outdoors. First, the main doors into the Welcome Room do not face the front of the facility, with the intention that visitors will first explore the interesting and vibrant courtyards before wandering inside. Second, the restrooms are located away from any of the main

Figure 7.12: CRWEC's Source Pool is hidden behind screens of vegetation

buildings, prompting a walk in the open air for those in need.

For aspects of the center that support self directed learning, Rottle described the ways in which the design encourages exploration. *"The spaces never feel too big"*, encouraging exploration, and the grading plan within the complex is subtle enough not to require guardrails, allowing visitors small and large to wander the topography unencumbered. The paths and overlooks are easy to find and accessible, and the facility suggests, in its view and wayfinding signage, the value of a trip down the trail to Rattlesnake Lake.

Certain aspects of the original design did not survive construction, or the first few years of the center's operation, and Rottle chose to point these out as they were originally meant to reinforce the educational aspects of the center. The largest losses were two large big leaf maple trees, too close not to be damaged by construction, which had originally dictated the placement and orientation of the main buildings. The facility was meant to feel a part of the landscape, something these trees, Rottle

felt, added to considerably. Next, the interior paths that were originally done in sand-set stone (to demonstrate permeable paving) were mortared in, creating an impermeable surface in the otherwise naturalistic Forest Court. Finally, Rottle had spent a considerable amount of time developing a native plant palette with a broad range of diversity (and a solid resistance to deer browsing), that did not survive the maintenance regime implemented by the groundskeepers. The remaining native plants have been labeled with small identification signs, but according to Rottle, the great diversity present in the original plan provided a message richer than the less diverse plantings that survive today.

Process

Rottle described a fairly robust citizen involvement process for the CRWEC design. Organized primarily by Marie Ruby, the design team consulted with teachers and environmental education specialists, representatives from Native American tribal councils, and held open houses for the residents of neighboring North Bend. Rottle also mentioned working closely with the education specialists Celese Spencer (interviewed here) and Ralph Naess who would later run the SPU educational programming at the center. Discussions with these two largely bore out the needs of the facility to support school field trips, including the Learning Labs and the Exhibit Hall.

Rottle explained that no real precedents were used to inspire the design at CRWEC other than former historic structures on and near its location. The site itself, expressing connection to water, the watershed and historical uses dominated most of the design decisions:

> *"…when I did the post occupancy evaluation, that's what really came through the strongest. People kept saying that this really feels like it belongs here; it feels like part of the landscape; you know that's not just the building's design but the site design and the landscape design as well…"*

Rottle admitted that her experience as an elementary school teacher played a major role in her desire to place teaching and learning as the central purpose for the facility. She also expressed the opinion that having a landscape architect in charge of the project meant that the design responded more to cues of place and context than otherwise might have been the case. Some research on zoo design was used to inform the width of the pathways. Aside from this and the aforementioned influences, Rottle referenced no other specific research into education or education related spaces.

Personal Philosophies on Design:

When asked specifically about designing for education and wonder, Rottle responded with a well developed approach centered around sense of place and layers of experience. She described her primary goals when designing learning spaces:

- *"To engage the visitors*
- *To make them comfortable*
- *To spark interest*
- *To invite participation"*

Though specific strategies may depend upon the age ranges involved, Rottle always emphasizes creating a heightened sense of place: enlarging and framing aspects unique to the site. Equally important is making the

main messages resonate on scales larger and smaller than the site itself. She used the CRWEC to illustrate this, the many watershed references: large scale with Rattlesnake Lake, at site scale with the Forest Court, and at smaller scale with the separate pools and reaches of Ruby Creek.

For Rottle, engaging visitors has to do with presenting novel experiences, and creating spaces with many layers where this could happen over and over again. She specifically cites emphasizing ecological processes as a layers that continues to change and spark interest over time. In her mind, adults and children need to engage in different ways with the landscape. Children require messy spaces where they can play, tinker, and change their environment. Rottle addresses the sense of mystery when designing for adults by utilizing choreographed experiences that unfold one after another and allowing enough clues in wayfinding for them to navigate on their own.

Rottle did provide several other examples of designs that she finds interesting and demonstrative in terms of educative landscapes. For early interpretive centers, she appreciated those at Padilla Bay State Park near Anacortes, Washington, and Federation Forest State Park near Enumclaw, Washington. Other learning centers she ranked highly included IslandWood, Mercer Slough Environmental Education Center, and the North Cascades Institute (near Diablo, Washington). She saw their collective strength as *"speaking directly to place"* by capturing unique messages about their site and surroundings.

The experience of place is central to Rottle's vision of how we learn:

> *"Once you've experienced a place you have the visceral gestalt, a drawer you can attach everything else to."*

Citing Jensen (1998) and Caine and Caine (1994) Rottle believes we have an implicit spatial memory that our brains effortlessly refer to, sometimes without the cooperation of our consciousness. In this way, we often remember best the views, the underlying moods and the big picture from the places we visit and interact with.

As for designing for wonder, Rottle responded quickly with *"Nature is wondrous in itself!"* As a designer you must access your own sense of wonder about the environment, and create the stage for it to perform and come alive. In terms of bringing people closer to natural wonder, providing sheltered outdoor spaces for the audience is an important step. Elsewhere, designers can work to help people find wonder in places by framing them in new and different ways: making things bigger, louder, or smaller are a few of her favorites. At the bottom of it all, Rottle points out, power often lies in helping people discover wonder for themselves:

> *"I think that's really a great challenge, to present things in new ways that can be discovered…I think wondrous things can be pointed out, but it's always a little more exciting when you can discover them yourself."*

Celese Spencer–Public Education Program Specialist, CRWEC

Design

Celese Spencer began work as an educator with SPU and the Cedar River Watershed project in 1994, just as the design work began for the new interpretive center. She and Ralph Naess taught out of a small building called the Harmin House for six years, hosting school groups

for half-day excursions up into the watershed as part of their 'Seeing the Source' curriculum. Both she and Ralph were consulted for the teaching aspects of the new design, in particular: classrooms, exhibits, and some aspects of the physical structure. The completion of the new CRWEC in 2001 increased visitorship by bringing in guided tours, allowing for drop-in visitors, and creating a space for additional programming based solely at the CRWEC site. The Learning Labs provided space for a 4th-5th grade program, 'Land and Water', that ties into Seattle Public Schools science lessons of the same name, and indoor programming for 2nd-3rd graders, 'Water is Magic', that happens year round. When asked how well the design of the facility supported learning, Spencer was quick to distinguish between experience and learning, explaining that she sees the center's many experiences as successfully setting people up for learning. She wasn't sure however, if many messages besides feelings and excitement actually make it home. She was also unsure about how well the center and its environs communicated SPU's mission to manage Seattle's water. Spencer did, however, praise the facility's uncanny ability to connect people with the beauty of water and nature.

Figure 7.13: Spaces between buildings at CRWEC open up visitors to views and connections with nature

The most effective aspects of the design, in terms of setting the mood for learning, address contact with natural elements on the site, sequence of movement, and art. The design here, according to Spencer, opens up people to learning by slowing them down, by asking them to notice things they otherwise might pass by. It's largely the natural spaces within the complex, and the views of the lake that make this happen. *"It's like being on island time"*, she remarked, describing the peaceful and easy attitude brought about by the setting at CRWEC (Figure 7.13). The spaces between the buildings not only allow for increased exposure to nature, but between people as well. Spencer remarked that she and the other employees now have to wear their uniforms at all times, as they never know when visitors will approach them with questions about song birds, eagles, or native wildflowers. Teachable moments happen now on lunch breaks, or even walks to the copy machine, as curious visitors and natural beauty lie around so many corners.

Spencer also carefully described the entrance sequence for school groups and most visitors, pointing out the features of the facility that create expectation and pull people in. People are naturally drawn to the large kiosk in the Welcome Court, from where they can look straight down the wide boardwalk. From here there is clear access in, but they still cannot see the Forest Court or the entrance to the buildings. The boardwalk is wide enough to allow groups to walk together, and Spencer commonly hears people and students commenting as they walk its length. More often than not, they are remarking at the strange and musical noises of the Rain Drums, still hidden from view, but beckoning visitors onward

Figure 7.14: CRWEC's Rain Drums

(Figure 7.14). Spencer referred to the Rain Drums time and again as one of the most powerful and artful gestures of the design, utilizing in novel form the basic rhythms of our culture and demonstrating a beautiful connection between human and nature:

> *"What I like so much about the Drums is it's connection between nature and humans…that kind of artistic, musical connection…it really does slow people down and open them up to learning."*

The Rain Drums not only draw people in, but make them want to stay. Spencer described the number of groups that often come through just for lunch, including the drivers of local UPS and ice cream trucks. She also began with the drums in describing the wide age range served by the CRWEC. *"People bring their very small children here...I mean, we're raising people's children!"* Spencer notes that parents and nannies bring toddlers to the center to hear the drums outside and linger in the comfortable atmosphere of the Welcome Room. She mentioned that in addition to what she called the *"nanny circuit"*, they are on the *"senior circuit"* as well. Groups of the elderly routinely come for visits and tours, enough so that the staff find themselves balancing schedules at the center so that overly energetic youthful groups do not disrupt the center's older and more distinguished guests. She also pointed out the success they've had with 2nd-3rd grade programming, hosting children and their parents year round in the Exhibit Hall.

Since the opening of the facility, nine years before this interview, there have been a few physical changes Spencer mentioned as necessary. The most prominent was the addition of benches in the Forest Court, so visitors could sit and listen longer to the drums. Telescopes and furniture were installed on the overlooks, and the door handles were changed. Evidently the doors themselves are quite massive, and younger visitors were having trouble opening them given the particular orientation and shape of the original handles. Signs on the native plants surrounding the buildings have also been added; however, Spencer believed these were too small for most visitors to notice.

One critique offered of the original design concerned the orientation of the Welcome Room main doors. Spencer described them as sometimes hard to find and visitors, mesmerized by the Rain Drums, walk right by them. She also thought their lack of prominence makes the facility look more private, and causes some visitors to assume they have to pay to enter. The interior of these spaces she found quite successful; however, their most popular exhibit, which follows rain drops through the water cycle, requires the use of stairs, limiting its use for some of their visitors. The rest of the facility, even the trail down to the lake, is ADA accessible and quite heavily used by all.

Spencer also mentioned having challenges teaching the sustainable design aspects of the CRWEC. Though adult visitors do ask questions

along these lines, Spencer has found that younger students, especially in school groups have considerably less interest in exploring sustainability issues, instead latching on to wildlife as a major motivator for learning. Spencer also pointed out that even the basic concept of 'watershed' is difficult to grasp for many of their younger visitors, even the 4th-5th grade groups, because they are being introduced to it for the first time here. The sustainable design features of the facility were addressed by specific programming in 2009, which unfortunately attracted few participants. Nonetheless, Spencer and the staff at CRWEC believe the audience is out there, most likely college age students, and they will continue to find ways to showcase the sustainable building concepts presented in this design.

Visitor/Teacher Experience

The factors Spencer sees people engaging with differ depending upon age. The center's older visitors, 50yrs+, tend to be drawn to the written material in the Exhibit Hall, often reading it out loud. She mentioned that their participation actually engages and benefits others in the vicinity, as people will stop and listen or begin to read themselves. People in their 30's, particularly those with small children, often ask about the safety of the water, how it is cleaned, and how it is protected. Children, on the other hand, immediately ask questions about the green roofs, the waterless urinals, and opportunities for wildlife viewing. In the outdoors, people seem most attracted to the Rain Drums; however, Spencer did place particular emphasis on the draw of wildflowers and birds during the spring season.

Spencer saw the learning intention in the design as coming through clearly for visitors. *"People come here to learn…"* she commented, in reference to the myriad of tour groups that sign up every season. Even for those walk-in visitors, she believed that the teaching aspects of the facility were transparent. *"People get the connection to their faucet,"* Spencer described how three levels of experience–staff, programming, and exhibits–hammer home the watershed's significance for Seattle's drinking water.

Spencer also explained that the exhibits inside help reinforce concepts she strives to teach in the field. The water cycle, in particular, becomes evident through activities in the courtyard and down at the lake, but often does not become clear for younger visitors until they follow a water droplet through the interpretive portion of the Exhibit Hall. The water drop activity is a series of pneumatic tubes that suck water droplets (ping pong balls) to various sections of the room, representing clouds, rain, ground water, and other aspects of the water cycle.

As far as using particular aspects of the design for teaching, Spencer admitted that access to Rattlesnake Lake was most significant for the bulk of their educational programming, particularly the 'Land and Water' unit for 4th-5th graders. The courtyards of the facility and the view help prepare the students for learning, but most of her teaching happens at the lake, the streams that feed it, and in the Learning Labs at the center. That being said the design of the buildings do influence her teaching. The large alcoves and awnings in the roofs extend student's exposure to the outdoors by providing additional shelter (Figure 7.15). *"We never let them eat lunch indoors!"* she explained, describing their program's basic emphasis on developing comfort and appreciation for being outside.

Spencer believes a few aspects of this current facility have hindered some of the programmatic aspects of the center. She recognized the project team's choice to keep the footprint of the buildings at or under 10,000 square feet, but explained that this was not enough for the

Figure 7.15: Large awnings allow students and visitors to remain outside at CRWEC

programs they run. In particular, the Learning Labs do not adequately accommodate an average public school classroom group, forcing them to use both labs per group, and cutting their expected capacity in half. She also lamented the limited office space for the educators themselves, expressing the need for a little more privacy.

Lastly, a criticism that appears largely the result of insufficient funding, the radiant floor heating has never been installed, changing the use of the auditorium for educational programming. The space is too large and cold without proper heating, and the staff of CRWEC are still looking for the best place to present the slide show that's a vital piece to their 'Seeing the Source' program. At the time of this interview the staff were planning on converting a portion of the library into a cozy spot for a group to sit on the floor and watch the show.

Personal Philosophies on Design:

Advice Spencer would give designers working on educational spaces addressed slowing people down, creating novelty, and demonstrating connections between humans and nature. She mentioned water features as powerful for achieving these goals, and also the success of the Rain Drum feature at CRWEC. She also mentioned the importance for drawing people outside, creating large covered spaces that are conducive to this, and the surprising opportunities presented by having a bathroom separate from the main facilities (Figure 7.16). Spencer couldn't count the numerous conversations about nature or the facility she'd had

Figure 7.16: CRWEC's Restrooms
Their location separate from the facility forces people to venture outside. This figure also illustrates CRWEC's extensive green roof.

with conference goers who were outside on a break, or waiting for the restrooms!

Spencer also commented on an interesting phenomenon, noticing that people upon arriving at CRWEC become immediately more observant and in tune with nature. She couldn't explain exactly why, but mentioned that this also happened at Mercer Slough. To illustrate, she described being at University Village, an outdoor Mall in Seattle, and noticing a bald eagle flying overhead. No one stopped to stare or even seemed interested. Had that same eagle been spotted at CRWEC, she explained, you would hear someone yell *"eagle!"* followed by shushing and shuffling as entire groups gathered and pointed to the sky. Spencer used this story to make a case for creating more transitional spaces, like CRWEC, within our cities. In her eyes, urban areas in the Pacific Northwest, have not totally lost their opportunities to connect with nature have, and these need to be interpreted and brought to peoples' attention.

In closing, Spencer mentioned two interesting points that were surprises to her in regards to the design and its impacts. She did not anticipate just how much work would be involved in maintaining a forest in the middle of the CRWEC grounds, nor did she expect the number of opinions and disagreements that surfaced around the issue of aesthetics, weeding, and native plants.

POST OCCUPANCY EVALUATION–CRWEC

As described in Chapter Three, Nancy Rottle was able to return to CRWEC during 2002-2003 and conduct a series of interviews shedding light on the center's efficacy as a tool for teaching and learning (Rottle 2005a). Significant for this case study was the positive connection she found between new perceptions, learning, and experience of place at the CWREC. Her results were summarized from interviews of 45 randomly selected respondents over the course of twelve separate days. Rottle mentions most were drop in visitors, with a few volunteers for special programs:

"Survey respondents overwhelmingly felt the facility helped them to:

- *understand the concept of "watershed" :74% yes, 22% already familiar, 4% no*
- *helped them understand the Cedar River Watershed better: 80% yes, 10% already familiar, 10% NA*
- *fostered awareness of natural or cultural resources: over two thirds, with five specifying the watershed, four wildlife, and another 'history'"*

(2005a, pg. 3)

These results strongly support the CRWEC's ability to communicate messages about water and watersheds. There appears to be less evidence for success in communicating messages about the history of the area. People responded positively in terms of connection between water, people and nature, particularly in response to the Rain Drums, however the data Rottle produced regarding the perception of historical uses of the watershed is not nearly as robust. Of the two thirds who responded positively regarding awareness of cultural and natural resources in the watershed, only ten gave any sort of specificity for their answer. Of these ten, only one mentioned history, while nine respondents mentioned watershed and wildlife related perceptions. During all of the interviews, 15 total remarks were made related to history, and more than half

were given by three people during a CRWEC archaeological awareness program (Rottle 2005a).

In her discussion, Rottle also points out the overall variance in responses, suggesting that this demonstrates the constructivist idea that all people will respond differently to places based upon varying backgrounds and prior experience. Her results provide support, with varying degrees of strength, for all of the listed CRWEC design messages outlined at the beginning of the study:

1. *"Reflect and resonate with the local environment and surrounding 90,000-acre, protected watershed.*

2. *Heighten awareness of water and the water cycle.*

3. *Honor cultural stories and display ecosystems of the watershed.*

4. *Express the managing agency's mission: to protect the municipality's source of clean water, while managing the watershed preserve for its ecological values.*

5. *Demonstrate conservation and sustainable building and gardening practices"*

(2005a, pg. 1)

This post occupancy evaluation provides overwhelming evidence for the success of designs like CRWEC to communicate messages imbedded in structure and layout. This center, according to Rottle's study with adults, is easily interpreted as a place to learn, and its intentions are transparent and accessible to most. An interesting addition would be a similar evaluation process with a younger cross-section of visitors. In addition to revealing the success of the design overall, Rottle's work here gives some insight into how best to design spaces that teach:

" Linking stories to the physical environment may be an especially effective way to retain narratives, especially when novelty or distinctness is employed: almost a third of the visitors felt that the Rain Drums–features that are unfamiliar as well as multi-sensory–would stand out in their memories."

Rottle (2005a, pg. 5)

SUMMARY AND LESSONS LEARNED

Given the rich stories and perspectives offered by these interviews, how well were the designers able to meet the needs of an educative landscape? Did their design moves intended to educate visitors and personify the learning center's mission find success?

How well did the design goals of the project align with the observed performance by teachers and staff?

In terms of relaying the importance of water, its precious nature and the value of the watershed, Spencer, Rottle and the post occupancy evaluation speak to the CRWEC's success. The Rain Drums in particular hold a powerful place in the design, capturing a sense of wonder and prompting reflection on water and its importance for humans. The exaggerated downspouts, some enlarged, some simply allowing water to fall freely on the forest floor, are also effective in drawing people's attention to water.

The design of the Center also prompts interaction with nature. The spaces between buildings and the lushness of the Forest Court encourage contact with plants, wildlife, and topography, be it by views of the lake or a walk to the Source Pool. The deep awnings and separation of restrooms and other amenities give motivation and accommodation for

lingering outside just a little bit longer. These aspects also prompt greater interaction between staff and visitors, increasing the interpretive value of the experience.

The design becomes less clear in illustrating the cultural and sustainable aspects of the site. Rottle's post occupancy evaluation revealed some recognition of the railroad heritage woven into the buildings, but to a much lesser degree than connections made with water. Spencer described challenges the center has had with interpreting sustainable aspects of the buildings, particularly for a broad range of visitors. Though Rottle described the choreography of the design to flow from both entrances, the majority of visitors enter through the Welcome Court (as intended from the main parking lot), drawn in by the overwhelming sights and sounds of Ruby Creek and the Rain Drums. The Heritage Court on the other hand lies on the far side of this dominant experience, and is smaller in size with fewer amenities for seating or viewing. Though this court is more heavily used during events such as weddings and demonstrations, its size and location render it a secondary space in the design. The historical and sustainable aspects of CRWEC add layers for interpretation; however the focus of the design remains with the value of water.

SPU's mission of water management also sits in the shadow of the Rain Drums and other water oriented design elements. This message and the cultural history of the site are addressed more powerfully by the exhibits inside. Rottle's evaluation did demonstrate strong visitor recognition of SPU's authority and its dedication to protecting Seattle's water supply. This idea appears to have been conveyed by the obvious care taken in facility design and maintenance, as well as the strong message for the precious nature of water. Greater details on SPU's management, however, only become apparent through the more didactic exhibits in the center's interior.

The challenges in the facility as described by Spencer revolve less around the design's ability to communicate the mission and philosophy of CRWEC, and more with programmatic functioning. Despite the participation of educators in the design of the center, certain aspects such as the auditorium and Learning Labs are not providing the amenities expected. The small size of the Learning Labs was intentional; the idea was to split classes in half, with one section in the field and the other indoors. This formula has not proven effective and the educators currently struggle with how best to use these rooms. The use of the auditorium for slide presentations was dependent upon radiant heating and carpeted floors, neither of which are in use today, and the large space has proven too cold for students to cluster on the floor around the screen. Finally, the office space was designed for two full time employees. Now, due to its success, CRWEC has three full time staff and two seasonal volunteers. These challenges appear to stem less from the design itself than from an unfortunate lapse in funding and unanticipated logistical issues with programming needs.

The alterations made to the design in order to improve its function are small: the addition of benches overlooking the Rain Drums and telescopes on the decks overlooking Rattlesnake Lake.

How well does the design support the 10 principles of educative design?

1. Strives to Instill Wonder: The Rain Drum piece at CRWEC has proven a very powerful gesture, tapping into music, culture, nature, and rhythm in a way that draws people in and promotes contemplation.

Figure 7.17: Steps at CRWEC's Entry Court lead down to Ruby Creek

Given the reactions described by Rottle and Spencer, as well as my own observations on several occasions, this element successfully captures a sense of wonder and fascination. The grand view of Rattlesnake Lake and the ridge behind, as well as the native plants woven into and around the facility, offer opportunities for contact with the natural wonders of the region. I would also include the Source Pool, magically bubbling up from the center of the facility, as a space that strives to induce fascination, contemplation and wonder.

2. Provides Manipulable/Interactive Elements: CRWEC provides several opportunities for interaction with water. The Forest Court has no boundaries and invites a certain degree of exploration. Ruby Creek also has no boundaries that keep people from interacting with its waters, which run at grade in the Source Pool and are within arms reach in the Forest Court. After it passes under the Welcome Room, steps actually lead straight down into the creek, deliberately asking for contact and encouraging a search for critters and tadpoles (Figure 7.17). From my own observations, it is the younger, less inhibited guests, particularly toddlers that take advantage of these opportunities. In the Forest Court, older children and especially adults keep to the pathways. To these visitors, the clear maintenance regime may indicate that the planted areas of Forest Court are off limits. The Rain Drums also produce a similar phenomenon. On numerous occasions I witnessed younger children creeping through the vine maples and proudly banging away on their favorite drums. No one stopped them, though it was clear that adults stayed away of this type of activity.

Telescopes on the lookouts allow visitors to individually frame and explore the views of the lake and surrounding ridge tops. Well marked trails lead visitors to the shores of the lake, where they have access to a more openly manipulated and explored environment. Aside from these two, there are few outdoor examples of invitations to manipulate or change the venue for learning.

The Exhibit Hall abounds with interactive maps and models. As mentioned before, the strongest, at least for the younger visitors, is the model of the water cycle, where students follow 'rain drop' ping pong balls along vacuum tubes that encircle the entire room.

3. Allows for Observable Change/Comparisons: Though Spencer did mention that walk-through traffic is significantly reduced during a drizzle, certain aspects of the design come alive on gray, rainy days. A strong visual comparison is set up between metal roofs of the main buildings and the green roofs covering the walkways and restrooms. Even on a dry day, the twelve inch thick extensive plantings on the green roofs tell visitors something different happens here when it rains. In contrast, the slick metal roofing on the buildings leads to exaggerated downspouts, some letting water cascade a full 10 feet before hitting the ground. If the message wasn't obvious before, the rain makes the different effects of these roofs literally loud and clear.

Given the thick deciduous plantings in the Forest Court, the change in seasons brings noticeable differences in mood and vegetation cover. The same plantings attract seasonal wildlife per Spencer's description of springtime birdwatchers. These are all examples of strong qualitative changes and comparisons, but little is measured quantitatively for the public to witness and compare.

Figure 7.18: The approach to CRWEC crosses Ruby Creek

4. Balances Clarity and Mystery, Novelty and the Familiar: The CRWEC design clearly illustrates its mission to its guests via signage and the heavy use of water metaphors. People who arrive know already, or soon discover, the educational intention in both the physical and programmatic design of the center. Navigation to and from the lake is clearly marked; the view from the center makes this destination appear clear and obtainable.

At the same time, intentional sequencing in the circulation patterns onsite creates a sense of mystery that pulls visitors into the facility. The approach from the main parking lot, where school busses would drop off students, deliberately crosses and then follows Ruby Creek, using the running water and glimpses of the buildings through the trees as hints of what will be seen in the Center itself (Figure 7.18). Similarly, from the Welcome Court, the wide boardwalk hides the Forest Court just enough to tease visitors to pull them onward, beckoned also by the sound of the Rain Drums. Public access to each building (particularly the library) may not be evident to all visitors, yet the open layout of the facility prompts exploration nonetheless.

The design of CRWEC also utilizes a balance between the novel and the familiar, embodied singularly in the Rain Drums and the exaggerated downspouts. The same concept dominates the Welcome Room, where a familiar fireplace and comfortable upholstery sit beneath a ceiling of electrified tree roots.

5. Supports Self Directed Learning: The Center provides many layers of narrative experienced easily without the aid of a teacher. Most significant are the watershed metaphors and the reference to the precious nature of the resource, as demonstrated in Rottle's post occupancy evaluation. The inclusion of the Exhibit Hall speaks to the expressed desire for self directed learning activities, though they have been concentrated in indoor facilities. Some key signage is placed outdoors. Identification tags on native plants were noticed and appreciated by some of the visitors in Rottle's study; however Spencer's observations indicate that these small signs meet with mixed success.

6. Supports Teacher Facilitated Learning: The choreographed approach from the bus parking lot, the Welcome Court, and wide boardwalk create effective spaces for managing, guiding, and presenting to groups. The fire pit offers a space for larger group reflection, and the large awnings and various covered areas allow for smaller group work as well. The presentation of the green roofs, easily seen from the Welcome Court, has become a standard introduction to the facility and low impact building practices. Much of the teaching, however, focuses more on the easily accessible lake and activities in the Learning Labs.

The programming at CRWEC may have outgrown the interior teaching spaces. Though the Exhibit Hall has allowed for expanded educational programs, the Learning Lab and auditorium appear to have been less flexible than the staff had hoped. Regardless, the presence of the Exhibit Hall allows for teachers to strike a useful balance between their formal lessons and informal self discovery.

7. Creates Multi-Layered Experiences: CRWEC creates a strong, varied experience that connects with visitors of a wide range of ages and backgrounds. The multiple narratives woven into the design–rail road history, watershed metaphors, sustainable building, native plantings–create different access points for individuals with different backgrounds and interests. The design successfully surrounds the visitor with sounds, smells, textures, and views that speak to the center's mission and the precious nature of water. The sounds of water, running, falling, and playing drums summon visitors into the Forest Court, where the smell of wet earth hangs in the air and delicate leaves sway at arms reach.

8. Invites Collaboration: Spencer offered an observation which I also found supported by research in museum literature (Falk 2001), that middle age to older visitors tend to read interpretive signage out loud, prompting others to listen and follow activities. This appears to be happening in the Exhibit Hall, and could possibly occur at the other interpretive signs on the trail to the lake and near the Fire Circle. The other aspect of the facility that seems to generate interaction between people is the open nature of the buildings. This has apparently increased contact between staff and visitors in the shared spaces of the courtyards and covered walkways.

9. Invites Play: In a similar fashion to how the facility allows for manipulation, the age of the visitor affects the invitation for free play. Again, toddlers run rampant in and amongst the drums, trees, and waterways in the Forest Court. Older visitors are more reserved. Certainly in the Welcome Room and Exhibit Hall the tenor is one of relaxed and free activity; however, the ambiance on the grounds is more

one of reverence, a tone set by the mesmerizing sound of the Rain Drums. Aside from the beach at the lake, there is no outdoor space appropriate for vigorous physical games or activities. The need for this appears to be met by the interactive exhibits indoors.

10. Provides Social/Cultural Relevance: The CRWEC maintains inherent cultural relevance as the gateway to the source of Seattle's drinking water. The center affords cultural relevance on a family level by welcoming the general public and creating avenues for return visits by program participants and their families.

The design references many common cultural forms and archetypes, using them to connect with people and illustrate the center's mission. This includes the downspouts and roofs and the fire place and upholstered chairs in the Welcome Room. The Rain Drums balance a sense of novelty with familiarity, layered with powerful cultural narratives of simplicity, rhythm, and music.

What observations (from myself or interview subjects) offer significant new lessons for the design of educative landscapes?

The strength of the CRWEC design lies in its many layers and its ability to resonate with the landscape on many levels. A sense of place weaves through the facility with reference to history, ecology, and the mission of the organization to teach the value and appreciation of water resources. The buildings and courtyards here are knit into the site, via their form, embedded artifacts and the views framed by their loose arrangement. The constructed Ruby Creek uses water from the Cedar River (from the fire suppression system) and empties out into Rattlesnake Lake, tying the facility to the local landscape. The Cedar River watershed stretches up into the Cascade Mountains, connecting the Education Center with the regional landscape. Within the facility, the bioswale, rooflines and Ruby Creek create watersheds of their own, nested in smaller and smaller scales. Part of the power inherent in the design is its ability to channel so many aspects of this very special region onto one concentrated site.

The Rain Drums at CRWEC demonstrate the power of art and culture to link people with nature. They create a reflective space by filling it with sounds we associate with human hands and instruments, but seemingly played by the landscape with the percussion of falling water. The drums themselves represent a human-nature connection, and work to provide a transcendent, moving experience, compelling the public to sit and listen.

The struggles the staff have had utilizing the indoor spaces represent less any shortcoming of the design, and emphasize more the great need to consider flexibility when planning spaces for educational programming. It is hard to determine where a program will be or what it will need after significant growth or change in personnel. Possibly the best design solution may be avoiding fixed-use areas altogether, making rooms with removable walls and multiple functions.

Unique to the CRWEC are the highly detailed indoor exhibits. The inclusion of such a space in the original design of CRWEC demonstrates value for different styles of learning. This aspect of the center invokes the importance of spaces that support a range of activities from teacher led to self led exploration and Howard Gardner's *"multiple intelligences"* (2006). The Exhibit Hall creates powerful reinforcement for teacher led activities, providing self led discovery that enriches even more of the cultural and natural heritage onsite.

CHAPTER EIGHT | CONCLUSION

This thesis began with a broad look at the meaning of learning and the ability of spaces and places to influence our growth and understanding of the world. This discussion produced the ten Principles of Educative Design, which summarized the philosophies from education, museum design and landscape architecture as they apply to the design of spaces for learning. These principles then formed the basis for a more specific analysis of the three case studies: Cedar River Watershed Education Center, Mercer Slough Environmental Education Center, and IslandWood. These environmental learning centers represent award winning designs and provided insights for refining the ten principles, as well as a window into the process of how designers approach creating educative spaces. Here, after reviewing the above methods, I present the findings from this investigation. In conclusion, this section summarizes lessons learned from the case studies, discusses patterns discovered in the application of the principles, and offers ideas for further research into educative design.

The methods review begins with examining the choice of literature and three fields of emphasis. Next, I critique the principles themselves and how clearly and readily they could be applied. Lastly, I examine limitations of the interview and site visit methods used, as well as the challenges in comparing the three chosen case studies.

The summary of findings starts with a comparative analysis of the three designs–CREWC, MSEEC, and IslandWood–and an examination of those principles which appear to be more influential at these environmental learning centers. This breakdown corresponds with the learning cycle diagrams offered in Chapter Two, and helps reveal some basic challenges faced by educative landscapes. I finish my conclusions with ten examples of particularly powerful design moves which support the educative design at these award winning ELCs.

Finally, there are several loose ends to address: questions that have been floating in the background but not yet fully identified. The first is a question of the efficacy of educative design in general. This thesis operates under the assumption that design is an effective tool for supporting learning experiences (Falk and Dierking 2000, Bell et al. 2009), but does not investigate when and where other factors may be more effective. Also, this study was written from the perspective of landscape architecture, with the aim of deepening the profession's relationship with educational spaces. A logical extension is to look at how the approach and ideas used here could support pursuits in the related fields of education and museum design. In closing, I point out again how close educative design is to the heart of landscape architecture, and offer these principles and ideas so that they may help the lessons in landscapes come alive for us all.

METHODS REVIEW

Methods Review–Literature

The choice of all three bodies of literature–education, museum design, and landscape architecture–proved appropriate for the thrust of this investigation. I tried to remain theoretical in my approach, looking for ideas that would transfer and connect between the three fields. This met with success, especially in terms of Constructivist principles (Vygotsky 1978, Piaget 1985, Dewey 1963, Cavallo and Marek 1997, Hein 1991, Falk and Dierking 2000, Nassauer 1995), value for free play (Falk and Dierking 2000, Nicholson 1971, Brett et al. 1993, Louv 2005), and the relationships between novelty, mystery and legibility (Berlyne 1960, Falk and Dierking 2000, Kaplan et al. 1998). More applied strategies from Gutwill's *Fostering active prolonged engagement: the art of creating APE exhibits* (2008) and Nancy Rottle's post occupancy evaluation of CRWEC (2005) offered insights for design strategies that were not available in the more theoretical literature. Such practical applications provided interesting context, but were kept to a minimum due to issues of space and time. Design standards and case studies for playgrounds, schools, and children's learning environments abound and represent a possible area for ongoing research and application for the Principles of Educative Design.

I did not draw very heavily from periodical literature in education or museum design, working instead with more established and canonical theories in theses fields. Given the general nature of this study, this avenue provided sufficient information. More pinpointed studies of factors such as curiosity or novelty would require the use of more recent and specific peer reviewed literature.

Essences of the relevant theories in education, museum and landscape architecture are encapsulated in the Principles for Educative Design. Naturally, these principles are somewhat intuitive to the disciplines from which they were derived, as they represent theories central to each of the three. It is the synthesis of these three disciplines that is significant, providing a systematic approach for the analysis of educative landscapes as well as research based guidelines for their creation. The Principles of Educative Design fill a void, connecting ideas from empirical research in education and museum design with the practice of landscape architecture.

Methods Review–Principles of Educative Design

The principles themselves were received well by both designers and staff members interviewed for the three case studies, most commenting that the list appeared quite complete. Most were able to use the principles to critique their own institutions, identifying strengths and weaknesses similar to my own findings. Several interviewees directly or indirectly suggested the inclusion of a new principle. Clancy Wolf and Apryl Brinkley made the same suggestion to add *"a place for reflection"* to the list. Celese Spencer and Denise Dumouchel mentioned the power of places that *"slow you down"* and provide peace. These appreciations for reflective or peaceful places fit in well with Louise Chawla's description of *"transcendent experiences"* and Louv's discussion of wonder found in nature (both in Louv 2008). For lack of a better place, I began grouping similar uses of the term *reflection* with the first principle: **Strives to Inspire Wonder**. This proved useful, but a specific place for focused and quiet reflection is not completely within the spirit of inspiring wonder, and a new principle may be worth considering. Aside from this suggestion, the principles proved a thorough and sound tool for evaluation, producing

enough variation to elicit patterns in the successes and challenges of the three case studies.

Even though these ten principles appear to represent a complete picture of educative design, it is difficult to determine their predictive power given the amount of evidence at hand. They identify patterns of success within the three case studies: however, the fact that all ten are reflected in each of the ELCs implies they may be too broad to be effective predictors of success. The principles can be used to reinforce good educative design, but would they successfully reveal poor design as well? Application of the principles to a wider variety of designs, producing a more mixed variety of results, may be necessary to realize their ultimate efficacy as evaluation tools. A more ambitious process may enable the development of a rubric, or ranking system within each principle, allowing for another layer of specificity and more powerful applications.

Such an exercise may help sort out challenges I found in applying some of the principles in the case studies. Each principle, at its heart, stems from a distinctly separate idea, but enough overlap occurs so that several principles appear linked, making their application more difficult. This may indicate a need for distinction, particularly with the several principles linked to **Supports Self Directed Learning**. Other principles are only applicable in a certain range of settings. For example, **Provides Manipulable/Interactive Elements** operates successfully during programmatic activities such as teacher driven investigations, but is otherwise weakly supported in the case studies. Lastly, **Strives to Instill Wonder**, arguably one of the more central principles, is also one of the least objective factors to measure or predict. This principle is inherently subjective and defies ranking to a certain degree, as it affects everyone differently.

Supports Self Directed Learning was particularly hard to isolate, as it became very dependent upon the presence of two other principles: **Provides Manipulable/Interactive Elements** and **Invites Play**. The absence of these supporting principles severely hampered the ability of a design to support self directed learning at all. Effective techniques that did not involve play or manipulatives were the inclusion of interpretive signage or the use of easily recognizable or culturally relevant features. Again, these moves are also part of other principles: **Balance Clarity and Mystery, Novel and the Familiar** and **Provides Social/Cultural Relevance**. To isolate **Self Directed Learning** I tried to downplay aspects of the design that only provided tangential support and appeared to be driven by other principles. I focused instead on the intentions of the designers and any emphasis expressed in our discussions on the importance of self led discovery. In retrospect, the heart of this principle has more to do with the idea that affordances need to be made for *both* teacher and self directed learning, and that only providing for one inherently weakens the design. A better approach may be to combine the two, specifying a condensed principle: **Affords Teacher *and* Self Directed Learning**.

Provides Manipulable/Interactive Elements also became difficult to apply. All of the case studies afford great opportunities for experimentation, but, for the most part, only with equipment or activities supplied by a teacher. Wet labs, classrooms, and even storage areas for scientific equipment all enhance the ability of a design to support interactive investigations, but they are created to facilitate teacher directed learning. Such affordances help manage a group and keep activities organized. They provide a staging area for manipulative and interactive activity, but are not inherently manipulable or interactive themselves.

The heart of this principle lies more with the degree of user choice and their ability to explore and control cause and effect relationships. Most powerfully applied, this principle creates experiences that are alterable and repeatable, allowing for prediction and re-application in other forms. This is most easily demonstrated by creative play–building a fort in the woods, diverting or damming water with sand–and the APE exhibits listed by Joshua Gutwill at the Exploratorium (2008). A ranking or rubric system as suggested above may help clarify details in the application of this principle. For this principle it is still important to note the advantage of both self and teacher driven learning. A more appropriate modifier here may be 'degree of supervision' as these types of activities are inherently learner driven and too much teacher direction detracts from the experience. A possible rating system could include:

1. Low/Med/High degree of supervision necessary
2. Low/Med/High degree of choice
3. Cause/Effect relationships apparent
4. Allows for repetition and prediction
5. Allows for alteration and re-application

Despite these challenges, the ten principles of educative design helped articulate rich analysis of the three case studies, identifying areas of strength, weakness and overlap amongst the three. Application to a broader range of designs may help refine their articulation and further define their ultimate predictive power. For the purposes of this investigation, these ten principles produced enough variation within the case studies to provide for interesting discussion, analysis, and conclusions.

Methods Review–Interviews and Site Visits

My original goals for the interview process were twofold: first, to examine the process with which designers approach the creation of places for learning and second, to identify challenges and successes of educative designs themselves. The outcomes I was looking for included not only an evaluation of the design, but a critical look at how the designers chose to prepare themselves for the task: Are there gaps in the landscape architecture profession that could be filled by a more dedicated study of education related fields? Or are the lessons to be had already inherent in good design?

On the whole, the methods used to gather information, the case studies chosen for comparison, and the ten principles used for evaluation yielded a rich data set for analyzing the concepts outlined above. The interviews, ranging in length from 45–90 minutes, captured testimony from the lead landscape architects for each case study (as well as architects in the case of IslandWood and MSEEC), and staff members intensely familiar with educational programs and daily operations at each site. Additional interviews of children and adults visiting these ELCs coupled with longer observation times would have enhanced the depth of this study, but an investigation of such scope proved too large for this project. The final narratives derived from these interviews offer considerable insight and information: enough to extend beyond the analysis of the Principles of Educative Design and inform discussion of environmental learning centers in general (Rottle 2010?).

Several factors, however, prevent completely clean and unqualified conclusions to be drawn. In several situations the constructed project did not reflect the original intentions of the designers, making it difficult to evaluate the effectiveness of their full vision. For example, the loss of two

large maple trees during the construction of CRWEC disappointed Nancy Rottle and her design team, as their preservation was integral to shaping the buildings and knitting them into the landscape. Similarly, Dave Goldberg regretted the loss of energy meters displayed in each lodge at IslandWood, meant to reveal factors about the sustainable design. These changes, due to logistics and budget realities, made it difficult to use all of the staff responses to directly critique the designer's skill and preparation in creating educative landscapes.

Many of the staffs' largest concerns about their facilities appear to have been addressed somehow in the original designs and then lost during construction. Apryl Brinkley expressed her disappointment with the size of the sinks and lack of a larger field at MSEEC, factors she noted were present in the design, and value engineered out during construction. Clancy Wolf, similar to the designers of IslandWood, also expressed a desire for energy meters in all of the rooms, items again dropped for budget reasons.

The institutional memories at these centers proved somewhat hazy, also making it difficult to critique the designers' process or intent. The original lack of open fields at IslandWood was highly critiqued by the staff during my time there in 2002, and pointed out by Goldberg during his interview. Linnea Ferrell, on the other hand, described in detail the time and effort spent engineering soils to support a large turf field at the center of IslandWood's campus. Similarly at CRWEC, Celise Spencer and other naturalists described malfunctions in the facility's radiant heating and its effect on their programming, while Rottle pointed out that radiant heating was not part of the original schematic design. Other problems at CRWEC, such as the size of classrooms and staff offices, appear to have stemmed from unanticipated program growth. Classroom and office size were determined by collaboration between the educators and the designers, making it difficult to fault the designers for this current critique of the facility.

These issues represent a very small percentage of the staff commentary in these interviews. The reactions of staff members to the design of their institutions were on the whole positive, illustrating the general success of the techniques and expertise of the designers. This disconnect between staff expectation and finished product calls for better consultation of educators during the construction process, as well as designing for as much flexibility as possible to accommodate unanticipated program needs.

Methods Review–Case Study Choice

At the beginning of this document I justified my choice of case studies, citing similarities in mission, programming and intent of design. In retrospect, each case study chosen successfully provided grounds for analysis and application of the Principles of Educative Design. Directly comparing the three case studies, however, became more of a challenge because of IslandWood's distinct differences in terms of physical size and needs for programming. The fact that IslandWood provides a four day overnight experience and chooses to restrict access to its 255 acres creates distinct design constraints and opportunities:

- Need for more buildings/services: dining hall, residential lodges

- Opportunity to interpret a larger, more diverse landscape (all 255 acres)

- Opportunity to utilize a large trail system as part of the design

- Greater focus on 4th-5th grade age student clientele[1]

The great depth of material culled from the interviews at each of these institutions removed the necessity to compare each facility outright, as each provided narratives with interesting conclusions on their own. Differences inherent at IslandWood do provide a basis for comparison in terms of audience and process: how a more child centered approach created different experiences. IslandWood also provides comparison in terms of a design that covers a full 255 acres of property, versus CRWEC and MSEEC, which focus more intently on one spot in the landscape. All three institutions interpret factors on a regional scale–CRWEC the region's drinking water; MSEEC the 320 acre slough and Bellevue's urban edge; and IslandWood the entire Mac's Creek Watershed. CRWEC and MSEEC represent concentrated, singular gestures, while the hand of the designers at IslandWood stretches more heavily across the length and breadth of the landscape. These three designs offered excellent reinforcement for the Principles of Educative Design, but as previously mentioned, a broader study encompassing institutions with smaller budgets and varying levels of design sophistication would add interesting perspective.

1 Some residential ELCs such as the Olympic Park Institute and North Cascades Institute maintain smaller properties, and utilize the public lands within neighboring National Parks for their interpretive programming. Similar to IslandWood, YMCA Camps Coleman, Seymour, and Orkila maintain 150+ acres of private land where they can better control and maintain interpretive facilities and safety concerns (YMCA of Greater Seattle website 2010, OPI website 2010, North Cascades Institute website 2010).

FINDINGS

Case Studies–Comparative Summary

Each of the design teams in these case studies demonstrated different yet successful approaches to fulfill the educational goals of their respective clients. On the whole, the staff of IslandWood, MSEEC, and CRWEC were satisfied, if not exuberant, about the ability of the designers to meet the missions of their institutions and thus support learning activities onsite. This is particularly significant considering that aside from Nancy Rottle, who had been a grade school teacher, none of the designers claimed any experience studying or working in education themselves. Though Mark Johnson and Nate Cormier witnessed the design process at CRWEC, neither they nor any of the designers on these projects had prior experience creating environmental learning centers. It appears that their inherent philosophies on design and an effective research process contributed greatly to the success of their work.

IslandWood appears by far to have applied the most in-depth process of research and community involvement. Debbi Brainerd spearheaded much of this by collecting information on 25 ELCs nation wide and organizing charrettes and focus groups with teachers, community members, children and others (IslandWood 2010b, Goldberg 2010). CRWEC did conduct a public process with similar constituent groups, but not nearly as robust as that of IslandWood (Rottle 2010). MSEEC made observations of students and teachers at the original facility, but otherwise did not utilize an intensive community input process (Johnson 2010). These latter two designs, however, possessed much more established teaching programs and curricula than were present at IslandWood.

Despite the differences in approach, all three centers produced effective designs. I contend that having previously established programming and curricula helped the designers of CRWEC and MSEEC better capture the mission of these institutions. Likewise, the focus on children and their complete access to 255 acres prompted the most powerful aspects of IslandWood's educative design to manifest differently than those of CRWEC and MSEEC.

All three of these institutions were built and designed with cutting edge, sustainable technology for their time. Each of the design teams set out with the desire to showcase this technology; however, IslandWood is the only of the three that included directly interpreting these details as part of its mission. As it stands, all three attempt to share their sustainable designs, and struggle to a certain degree because of the technical nature of the subject and the age range served by their programming. IslandWood remains more heavily criticized for the struggle given its priority for sustainability education. The staff at IslandWood openly admit the challenge in making connections for 4th and 5th graders with sustainable building practices, and instead appear to utilize their access to 255 acres of forest more often than the $32 million teaching facility. In 2002, during my time teaching at IslandWood, there was no firmly established curriculum, sustainability oriented or otherwise, and the resident naturalists and graduate students worked with what we knew–teaching in the woods. Had a stronger vision been in place for IslandWood's sustainability curriculum during the design phase, I must wonder how it would have manifested differently in the facility we see today.

What did manifest from IslandWood's child-oriented design process was a facility based heavily on the experience of the young visitor: how and where they might feel awe and wonder. The size and diversity of natural systems on the property, combined with the teacher supervision of visitor groups, allowed the designers at IslandWood to create a myriad of singular experiences capitalizing on novelty and mystery. The trail system successfully loses the visitor in beautiful but mysterious woods, punctuated with field stations that uniquely engage height, suspension, whimsy, and locomotion in ways that are not easily done in more public spaces. Elements of danger or delicacy of materials are not as much of an issue with a supervised learning group, allowing intricate structures such as the Bog Tree House, Forest Canopy Tower, and Floating Classroom to embellish student's experiences and quite literally, their views on nature.

CRWEC and MSEEC, on the other hand, serve much more diverse clientele and control much smaller slices of property. Their messages resonate with their larger context, but stem from a rich expression of place within the relatively small bounds of their site. They are not able to provide the diversity of perspectives or experiences offered at IslandWood; however, each provides a cohesive and tightly expressed message, clearly interpreted by their visitors. The designers at these sites spoke less about singular experiences for the individual and more about capturing ecological processes and unique features of the local landscape.

When comparing my personal experiences touring the three sites, it was the simplicity of the message, the cohesion of the design, and the reflection of the larger landscape that set CRWEC and MSEEC apart from IslandWood. In trying to identify these factors, I began to mentally remove each facility from its setting in the surrounding landscape, and ask myself if it would still have the same power or efficacy it currently possesses. In these terms, CRWEC and MSEEC are undoubtedly linked with place. Their success and relevance rely significantly on the fact that they were created to interact with one specific location in the landscape.

The mission of managing Seattle's water becomes infinitely more tangible and powerful with SPU's Cedar River Watershed Education Center located at the gateway of the 90,000 acre watershed that gives it its name. Its placement on the shores of Rattlesnake Lake, with the ridges looming overhead, creates a powerful metaphor for nested watersheds: from the Cedar River Watershed itself, to the lake, to the eaves and awnings of the courtyards finally feeding into Ruby Creek. These are just the ecological tie-ins with the landscape. The layout of the facility, character of the buildings, and the embedded artifacts in the Heritage Court speak very specifically to the early twentieth century railroad camp where CRWEC was eventually sited. Mercer Slough is rooted even deeper into the landscape, with the sides of the buildings brushing the trunks of living trees, and the slope of the site reflected in the long legged platforms and hovering buildings standing silently on their stilts. The identity of this facility and its mission are captured in the view across the slough, over historical blueberry farms and recovering wetlands, and to the skyline of downtown Bellevue. This facility also embodies its mission via the porous soils underneath and its lightly stepping pylon structures that leave the water flow intact. Placed elsewhere, neither of these two facilities would carry as much power, but where they are, the results are astounding.

IslandWood does not show the same cohesive dedication to place. This could largely be due to the fact that its design covers such a large diverse area, or because each structure or group of structures was designed more uniquely with visitor experiences in mind. The design at IslandWood does have several features that bind quite nicely to the landscape; however, few of its structures depend upon their particular location for success. The Forest Canopy Tower would produce an immense experience, climbing up 120 feet in any forest, and the Floating Classroom would be a fun and unique ride on any rural pond. The Bog Tree House and the Suspension Bridge, though again singular experiences, do express an inherent relationship with the landscape, given the rarity of the bog ecosystem (Where else might you find a *Bog* Tree House?) and the specificity with which the bridge measures the span of the ravine. The lodges, however, and most of the other buildings are built with enough power and detail to bring the feeling of the forest with them wherever they are placed[2] . I believe the two things that create the strongest sense of place at IslandWood to be the trail system and the narratives the institution creates for itself. The design of the trails at IslandWood truly captures its delicate and unique natural amenities, creating paths that transport the traveler farther than expected into the landscape; and *The Tree That Came Home* could only come home to one place.

2 I cite Mithun's REI flagship store in Seattle, Washington (Figure 8.1) as evidence of this. With architecture very similar to that found at Islandwood, this building creates a small piece of the Cascade mountain range on the corner of Yale and John Streets

Figure 8.1: Mithun's REI Flagship Store, Seattle, Washington
(Photo: http://images.businessweek.com/ss/06/06/wonders_retail/source/9.htm)

Principles–Challenges and Opportunities

The application of the Principles of Educative Design to the case studies revealed both challenges and opportunities for the creation of ELCs and educative landscapes in general. Three of the ten principles are consistently underrepresented in each design. Likewise there are three high performance principles that, when present, appear to provide more than their fare share of educative power. The situation presented by these six principles ties in with the Learning Cycle for Educative Design introduced in Chapter Two, reinforcing its value for guiding the creation of places for learning.

Weakly Supported Principles

The principles weakly represented by the case study designs all relate to a visitor's opportunity to freely control and manipulate his or her experience (Table 8.1).

Table 8.1: Weakly Supported Principles
Supports Self Directed Learning
Provides Manipulative/Interactive Elements
Invites Play

Though IslandWood eventually addressed all three of these principles by installing Wild Zones (see Chapter Five), they were not present in the original design. CRWEC does support these principles quite powerfully in its indoor exhibits: the ping-pong ball water cycle game was described as a powerful self directed activity (see Chapter Seven). The outdoor and unsupervised portion of CRWEC, however, shares the same struggle as the other two sites.

I believe this challenge is largely a product of how difficult it is to maintain an area or an element that is meant to be changed and altered by every individual who passes. Few materials or structures can withstand this kind of exposure without constant expense, maintenance, or degradation. Water features do serve this purpose well with MSEEC's hand rail rills (see Chapter Six) offering a creative example; however, this may not be feasible or appropriate for all educative landscapes. Another reason for this challenge lies with the contentious nature of interpretive signage. All three institutions mentioned signage as an important tool, yet none chose to display it prodigiously in their outdoor settings. Given the emphasis on these three principles in the literature from education, museum design and landscape architecture (see Chapter Three), it is not surprising that when they are supported well, these principles create quite powerful learning opportunities. Evidence for this can be seen in the popularity of the indoor facility at CRWEC, the hand rail rills at MSEEC, and the Wild Zones and Floating Classroom at IslandWood (see Chapters Five and Six).

Easily Demonstrated Principles

Several principles appeared to be quite easily supported by all of the designs studied (Table 8.2) :

Table 8.2: Easily Demonstrated Principles
Allows for Observable Change/Comparisons
Supports Teacher Facilitated Learning
Creates Mulit-Layered Experiences
Invites Collaboration

It should be noted that for **Allows for Observable Change/ Comparisons** qualitative comparisons and observations were plentiful, but none of the designs possessed elements that helped or aided in the

measurement of change. **Invites Collaboration** was not necessarily explicit in these case studies either, but it was effectively implied by the abundance of group learning spaces and social interactions prompted during movement between buildings and in open-air break out spaces.

High Performance Principles

Three additional principles were present in each design, but carried more weight than those mentioned above. Based upon staff interviews and Nancy Rottle's post occupancy evaluation (see Chapter Seven), these high performance principles appear to possess the most power to aid in educational experiences (Table 8.3).

Table 8.3: High Performance Principles
Strives to Instil Wonder
Balance Clarity and Mystery, Novelty and the Familiar
Provides Social/Cultural Relevance

Strives to Instill Wonder: Creating transcendent experiences that bring peace and reflection were cited in interviews at all three ELCs as powerful drivers for learning. Exposure to nature and natural processes remind us of its fragility and force, generating feelings of wonder, caring, and stewardship. Evident in the delicacy of Ruby Creek at CRWEC and the grand stature of the Douglas fir trees swaying so close to the buildings at MSEEC, the power of wonder is in the large and the small. This principle taps into the affective side of learning, creating positive associations with places and concepts that support curiosity and cognitive learning for years to come.

Balance Clarity and Mystery, Novelty and the Familiar: Simple coherent patterns, utilizing repeated references or familiar structures, held particular power in these ELC case studies. This is illustrated well at MSEEC and CRWEC in their focus on flowing water, revealing in many different ways how water moves over, through and around each site. The clear, repetitive message in these designs sets an affective stage for the cognitive ideas in the missions of SPU and Bellevue Parks and Recreation.

Twisting together the novel and the familiar proves supremely effective in the rain drums at CWREC, an installation that captivates visitors through its powerful blend of nature and culture. This principle is also expressed in each case study with questions and curiosity regarding low flow or composting toilets and waterless urinals. In our culture, the bathroom and its accompanying technology are virtually ubiquitous, and people notice and become curious about small shifts and details. Likewise, green roofs and interesting downspouts, if placed visibly, seem to generate consistent visitor interest.

Provides Social/Cultural Relevance: The strength of this principle was evident in the pride expressed by educators at CRWEC and MSEEC when describing how visitors return again and again, oftentimes bringing family, friends, and co-workers. Its effectiveness is also evident in the collective culture created at IslandWood via story and characters such as *The Tree That Came Home* and Wade, the weigher of waste, as well as the power of the IslandWood garden and food curriculum. Lastly, each of these ELCs provides some sort of cultural connection or amenity that brings comfort and eases the transition from urban to natural, transporting its guests from the familiar to the new and unknown.

Return to the Learning Cycle

At the beginning of this thesis, I introduced the idea of the learning cycle, defining learning as a process of activities that build upon one another, generating knowledge and new understanding. In the Learning

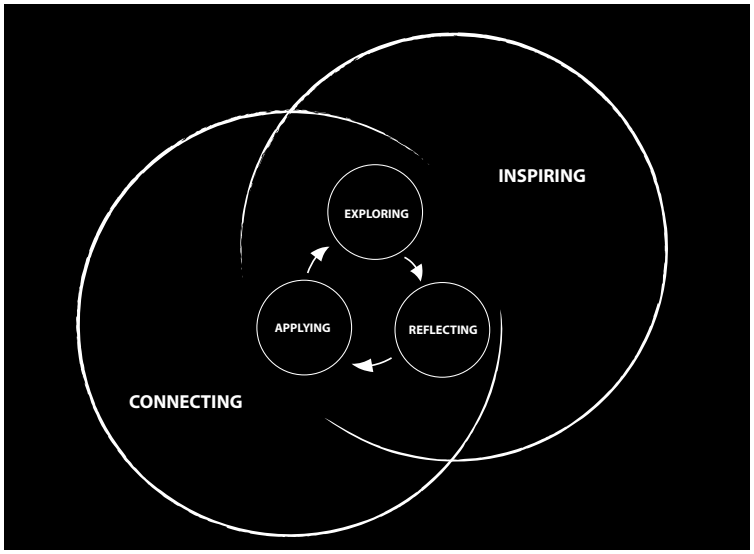

Figure 2.3: Cycles of Affective and Cognitive Learning

Connecting and Inspiring represent cycles of Affective Learning, while Exploring, Applying and Reflecting are activities more closely linked with Cognitive Learning.

Cycle for Educative Design I proposed five activities to be addressed or supported by features in educative landscapes (see Chapter Two, Figure 2.2). Each of these activities are also inherently supported by the Principles for Educative Design (see Chapter Three). More importantly, however, the relationships between these functions appear to be linked with challenges and opportunities in the design of educative landscapes.

Figure 2.3 (shared again here) shows the activites of Connecting and Inspiring as larger cycles that draw upon prior experience and carry on to future learning opportunities. These are the more affective functions of the Learning Cycle, linking feelings and memories to experiences on a given educative landscape. They are also fully supported by the three high performance principles in terms of how wonder and mystery inspire, and how clearly defined social and cultural relevance help us make meaningful connections. These two activities–Connecting and Inspiring–are inherently supported by current practices in landscape design: creating sense of place, connecting with culture, and wayfinding (Kaplan et al. 1998, Hester 1980). Designing for Connecting and Inspiring appears to be where the landscape architecture profession is already most successful, a skill that should not be ignored.

The three weakly supported principles–**Supports Self Directed Learning**, **Provides Manipulative/Interactive Experiences**, and **Invites Play**–outline areas for growth and experimentation in educative design. The first two are also more closely linked with the three activities that serve more of a cognitive purpose–Exploration, Reflection, Application–indicating that educative landscapes may struggle more with conveying cognitive learning in general. Unlike the other two, **Invites Play**, is cited in the literature as a key aspect of affective engagement (Bell et al. 2009, Falk and Dierking 2000). If addressed properly, this principle may act like one of the high performers, as the literature also lists free and playful activity as one of the most important and powerful factors that sets informal learning spaces apart from classrooms. These three principles are more consistently discussed in education and museum literature (Cavallo and Marek 1997, Gutwill 2008, Falk and Dierking 2000), and this may be an appropriate place to continue looking for further guidance.

Universal Challenges for Educative Design

Based largely on the difficulty of the case study designs to address principles surrounding free play and manipulation, my own experience, and discussions in the interviews, three basic challenges appear inherent to educative design. I believe these challenges will present themselves persistently at every site and educative landscape. Their solutions will

rely upon individual judgment and must to be addressed one project at a time:

Balancing fragility and public interaction–Too much sharing equals broken toys.

Discussions at IslandWood during the design process and later during curriculum development forced the institution to choose between preservation and experience. How intensely can every visitor explore nature on this property when their mere presence changes it for the next? Likewise, with my own work on Brighton Science Park (see Preface), striking a balance between richness of experience and materials/design that could withstand heavy use and possible misuse in a public park severely limited our choices. Denise Dumouchel of IslandWood pointed out the potential power of selectively restricting access to certain places, preserving them and making their experience inherently more special (see Chapter 4). This balance between access and preservation, intensity of use and richness of experience, can only be struck on a case by case basis, dependent upon project goals, visitor traffic, supervision onsite, and opportunities for maintenance.

Degree of specificity–When does educative design become esoteric design?

Many aspects of the three designs examined here point to the power of simplicity, working to tap into emotion, curiosity, and wonder to provide a platform for learning more complicated material. All of the designs struggled with interpreting more technical aspects of their sustainable building strategies, raising the question: How much cognitive or factual information can be communicated from the physical forms on a site? What is reasonable to expect and what is wasted effort? Quark Park in Princeton, New Jersey, was born from collaboration between Princeton University physics professors and teams of artists (Stroud 2006). The resulting display is a massive and beautiful testament to science that provides incredible depth of technical knowledge. It would be fascinating to find out how much of this detail comes to the surface for the lay visitor, and which details are producing the most profound experiences. Like good teachers, designers of educative landscapes must work to include opportunities for learners with levels of experience above and below the target audience, with the challenge being where to set the middle ground.

Competing Messages–Clutter versus communication?

Somewhere in their original design process, each of the three case studies experienced a difficult conversation on interpretive signage, and at each of these institutions this same discussion continues. The struggle appears to be between the cognitive benefits offered by the clarity and detail in signage versus the affective power of a clean, uncluttered presentation, speaking with language deeper than words. In prior conversations with teachers, the interviews here, and casual conversation with former graduate student naturalists at IslandWood, the ability of interpretive signage to access another form of intelligence is a necessary and appropriate part of design. Designers, and some staff as well, worried about signage removing mystery. They also worried about intimidating visitors with experiences too formally linked with language and formal education, thinking it too didactic. An important question to ask is whether or not there has to be a conflict between interpretive signage and the affective experience of place. I believe the answer is no, however, the balance is difficult to strike, depending upon the particular aesthetic

vision and preference for academic detail possessed by the design team on a project. In the end, this question seems to become one of personal preference.

Strategies for Success

Despite challenges, the three ELCs provide excellent insights into successful educative design. My own observations as well asl testimony from staff produced several examples, some of which are present in all three designs, some of which are best illustrated by a single case study. These innovative and creative elements offer concrete examples for the more powerful aspects of the Principles of Educative Design. Ten such strategies are listed here with references to their associated principles (numbered in Figure 8.2):

1. Focus on affective learning: Both the designers and educational staff interviewed strongly linked design with wonder, reflection, and comfort in the educational experience. Tapping into emotions and creating positive memories and associations seem to be the most powerful foundation a design can create for learning. To quote seminal education theorist John Dewey *"….formation of enduring attitudes, of likes and dislikes, may be and often is much more important than the spelling lesson or lesson in geography or history that is learned. For these attitudes are more fundamentally what count in the future. The most important attitude that can be formed is that of desire to go on learning." (1963 Pg 48)* (Principles 1, 10)

2. Design to interpret place: The term *"Earth Instrument"* was used by Nate Cormier and Marc Johnson to describe projects that capture deep natural rhythms and cycles that run through a particular site. Nancy Rottle spoke of an *"exaggerated sense of place"*, describing a key strategy for the design of CRWEC. Indeed, the one design factor that best connects the educational missions of the three ELCs to the experience of their visitors is the concentrated expression of place, ecology, and natural process onsite. This is evident most readily in the treatments of water at CRWEC and MSEEC and the response of these designs to site level details such as trees, slope, views, and drainage. (Principle 4)

3. Coherence: Simple messages are powerful: Mercer Slough's design does not hold the same level of detail or historical reference as CRWEC; nor does it present the same diversity of experience as the grounds at IslandWood. However, I found its simple, precise message moving in ways not present at the other two facilities. The messages of water movement and stepping lightly on the land pervade every aspect of the facility, creating a rich and clear message. (Principle 4)

4. *Design to be: "Perforated and Penetrated", "Folding and Unfolding"*: Each of these phrases was used by designers to describe designs that pull natural spaces into the built environment. The designs at MSEEC and CRWEC pull the buildings apart to force interaction and movement between them, prompting greater exposure to nature and the outdoors. Outside amenities–deep awnings and eaves, separate restrooms–invite people to leave the buildings and stay outside and also provide spaces for social interaction. (Principles 4, 7, 8)

5. Provide views both out and in: Views out of a space, of the surrounding forest, lake, slough, or mountains create powerful experiences; but views into and through a facility are powerful as well, calling visitors to move through and explore. MSEEC presents the best example of this with its multiple levels, many vantage points, and spaces between buildings. (Principles 3, 4, 7)

6. Enable transcendent experiences: Places that make you pause

or slow down, that give a sense of peace or calm were mentioned many times by educational staff. There appears no formula for creating this, but successful elements in these designs involve rhythm and the exposure to nature, as seen in the rain drums at CRWEC and the swaying bog tree house at IslandWood. (Principle 1)

7. Resonate on multiple scales: CRWEC presents the best example of this with the many watershed metaphors from grand to small scale. Such nesting of scales helps people make connections between regional, landscape and site scale messages. (Principles 4, 7)

8. Tell stories: IslandWood presents the strongest example with *The Tree That Came Home* and Wade, the weigher of waste. Other references to stories are less literal, but touch upon common subjects of childhood: the 'journey' in the water cycle at CRWEC and the Tree Houses at MSEEC and IslandWood. (Principles 4, 10)

9. Capitalize on the novel and the familiar: Already described as a high performance principle, this idea came up successfully over and over in the case studies. Making things bigger, louder, more complex, or placing them in new context elicits curiosity and questions. This was powerfully demonstrated in downspouts, rain drums, hand rail rills, suspension bridges, and towers. (Principles 4, 10)

10. Create spaces large and small: The most successful singular aspect of all three designs in supporting teaching programs is the numerous and variable nature of space. This strategy draws directly from the Continuums of Educative Landscapes discussed in Chapter 2. Flexibility is key for successful educational spaces. Providing many small and medium spaces, as well as at least one large, allows teachers to manage groups and manipulate their environment to create more successful learning experiences. (Principles 5, 6, 7)

LOOSE ENDS AND FUTURE APPLICATIONS

In her interview, IslandWood designer Linnea Ferrell hesitated before relating a story about her family's experience at an overnight camp setting whose facilities were meager in comparison to the award winning designs covered in these case studies. Despite their apparent dissatisfaction with the sleeping facility, Ferrell recounted the response of her daughters: *"They had a ball! They couldn't have had a better experience!"* Ferrell's story reveals an important question not yet addressed in this thesis. The research and discussion here may have elucidated powerful aspects of educative design, but how much is necessary? What other factors were at play in Ferrell's story, and would her daughters have had a more powerful learning experience at an IslandWood?

This question is not easily answered. A visitor's cultural background, familiarity and interests will often dictate as much if not more of their learning experience than the design of the space itself (Falk and Dierking 2000, Cavallo and Marek 1997). Ferrell mentioned her daughters already had considerable outdoor experience before this overnight camp. A different student may have required a more familiar or comforting place to sleep. Without such amenities, any lessons and connection with nature may have been lost for the child. This kind of evaluation is also complicated by the power of good teaching. A creative and resourceful staff may mask inherent weaknesses in the design of a teaching facility, or not require a facility at all. An objective analysis of this question–How much does design make a difference?–would require a strict comparison and examination of institutions with very similar missions, settings and programming, but disparate levels of sophistication in design. A fascinating study, but beyond the scope of this thesis.

PRINCIPLE		DESCRIPTION	EXAMPLES
1	**STRIVES TO INSTILL WONDER**	*Provokes positive emotional connection and drive to investigate. Interest extends beyond immediate reaction.*	*Natural Beauty: Butterfly wings* *Power and Awe: Volcanoes* *Magical Phenomena: Magnetism*
2	**PROVIDES MANIPULABLE/ INTERACTIVE ELEMENTS**	*Easily altered by observer to create interesting effect. Allows for prediction/problem solving.*	*Controlling water flow, Changing shadows and shapes, Building & constructing, Gardening*
3	**ALLOWS FOR OBSERVABLE CHANGE/COMPARISONS**	*Distinct differences in variables, possibly revealing cause/effect relationships.*	*Sun Dial, Windmill, Solar cells w/ volt meter, Rain gauge, Ecological processes*
4	**BALANCES CLARITY AND MYSTERY, NOVELTY AND THE FAMILIAR**	*Easily understood educational intent. Easy to navigate, with 'previews' of what's to come.*	*Repetitive themes, Orientation/Interpretive signage, Winding paths, Peakaboo veiws, Landmarks, New takes on familiar ideas*
5	**SUPPORTS SELF DIRECTED LEARNING**	*Visitor can initiate and lead self through discovery. Multiple levels of sophistication.*	*Skate boards and ramps for physics learning, Using familiar situations to extend understanding*
6	**SUPPORTS TEACHER FACILITATED LEARNING**	*Affordances for gathering & presenting. Opportunities for individuals to share. Multiple levels of sophistication.*	*Seating Walls, Amphitheaters, Connections to more abstract or specialized curriculum*
7	**CREATES MULTI-LAYERED EXPERIENCES**	*Diverse, vivid approaches to promote cognitive and embodied learning.*	*Zoo/Aquaria exhibits that extend beyond the animal enclosure:* *'visitor immersion experience'*
8	**INVITES COLLABORATION**	*Affordances for two or more people to observe or explore together.*	*Bird blind with multiple viewing windows.*
9	**INVITES PLAY**	*Free choice, few rules, no pressure to perform. Fun.*	*Playground equipment/atmosphere, Ease of movement/exit/entry between stations or experiences*
10	**PROVIDES SOCIAL/CULTURAL RELEVANCE**	*Connected to larger themes. Significant w/in personal, regional, or global context.*	*Narrative Stories, References to culturally significant or familiar elements, Stewardship opportunities, Family participation*

Figure 8.2: Principles of Educative Design

A more constructive analysis lies with CRWEC and MSEEC. The narratives generated by thier case studies make a clear case for the importance of educative design. CRWEC and MSEEC have direct before and after comparisons, as they housed programming for years before the construction of their current facilities. At both centers the staff indicated that the new facilities strengthened their programming and the experience of their visitors in many ways. Much of this came from providing spaces that expand teaching opportunities such as classrooms and wet labs, as well as awnings and covered walkways that extend the outdoor experience. Design improvements also expanded the diversity of their visitors, providing comfort and access to those who, for physical or cultural reasons, might otherwise not be drawn to more natural settings. Staff at both centers described their facility not only as a threshold to the outdoors, but also as a place where people come to 'hang out'; a condition afforded as much by the design of the centers as their beautiful surroundings. Finally, the obvious expense and care taken with each of these facilities has translated into perceived value for their missions. Both Apryl Brinkley of MSEEC and Celese Spencer of CRWEC expressed that the simple existence of their facilities prompts visitors to take a second look at watersheds and wetlands.

IslandWood presents a more difficult situation. There are no opportunities for a before and after comparison, as this is the only iteration of the facility. Students freely interact with the design of the Lodges and the Dining Hall, but I was unable to find any pointed evaluations of how these sleeping and eating facilities contribute to the overall learning experience. Aside from this, the interaction of students with the design at Islandwood is largely teacher led, determined by the choices and skills of their naturalist. As pointed out by Denise Dumouchel and Clancy Wolf, most naturalists take their groups away from the main facility, choosing to teach in the surrounding outdoors. Therefore, the universal, teacher led experience of IslandWood's design lies in the site planning and trails: offering groups access to diverse and unique ecosystems, while maintaining an immersive and isolated experience. My own observations and the responses from IslandWood staff support the ability of the design to magically transport students to many different worlds. Despite this success, other feedback indicates that the Field Stations distributed throughout the landscape can actually distract from a student's experience of connection with nature. Again, this largely depends upon the prior expectations, experience and culture of the student, and may not be a solid measure of the efficacy of the design. More focused comparisons with other more traditionally designed facilities, particularly those which also serve inner city populations, would provide useful perspective on this issue.

Another area for more research is the application of lessons from this study to disciplines outside of landscape architecture. The discussion in Chapter Three revealed significant overlaps between education, museum design, and landscape architecture, making lessons learned from the case study analysis transferable to them all. The concepts of free play, wayfinding, and cultural relevance were represented strongly in all areas of research, however the power of place and placemaking was not heavily referenced in the literature on museum design. Place based learning already has strong theoretical basis and solid precedence in the world of education (Dewey 1963, Boyer 2006, personal experience), but I did not see it referenced in regards to zoos, aquaria, and museums. Many such institutions already address local wildlife and ecosystems, such as Seattle's Woodland Park Zoo and the Seattle Aquarium, as well as the

aquaria in Vancouver, British Columbia and Monterey Bay, California. It would be interesting to investigate how well the physical structures, siting, and grounds of these institutions reference these same systems in the landscape that surrounds them. How much power may be gained from an aquarium that accesses the sea, or a zoo that places its visitors within the exhibit?

The Principles for Educative Design and the discussions generated in this thesis may bring interest and power to a wide variety of landscapes and places beyond those explicitly dedicated to learning. The ideas here are not meant to be restricted to the design of schoolyards, zoos, and environmental learning centers. Almost to the contrary, my hope is to create a methodology applicable to a multitude of situations and public spaces, which in the end becomes a necessary factor of good design. I believe all sites provide learning opportunities for families, children, and larger groups. Good design attempts to interpret these opportunities, often through capturing a sense of place, history, or artistic expression. My hope here is to convince designers that they've already accepted the mantle of teacher, and that they will apply method and thoughtful consideration when designing the *"three dimensional textbook"* (Taylor 1993) where we live, work, and play.

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