Young Children Develop Foundational Skills Through Child-initiated Experiences in a Nature Explore Classroom: A Single Case Study in La Cañada, California

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A collaborative study between the Child Educational Center in La Canada, CA and Dimensions Educational Research Foundation in Lincoln, NE.
Conducted during the 2009-2010 Academic Year

Introduction

Children are naturally drawn to the outdoors (Dannenmaier, 1998; Keeler, 2008). Open any preschool classroom door and watch children come tumbling out like boulders down a mountain. They shriek with joy at the freedom they have and move with the unfettered feeling of leaves in the breeze. Historically, children and adults have spent significant time connecting with nature (Dimensions, 2005; Louv, 2005; Rivkin, 1995; White, 2004). However, as our culture's more recent shift to city living and reliance on electrical outlets has increased, individuals' needs and desire to be outdoors has decreased (Louv, 2005; Rivkin, 1995; White, 2004). Children today spend less time outdoors than they did even a generation ago (Clements, 2004; Dannemaier, 1998; Louv, 2005; McGinnis, 2003; Rivkin, 1995; White & Stoecklin, 2008). Children are experiencing an increasing disconnect with the natural world, so much so that they are developing what Sobel (1996) described as ecophobia or "a fear ecological problems and the natural world" (p. 1). Louv introduced the moniker "nature deficit disorder" to describe "the human costs of alienation from nature…" (p. 34). This reduction in outdoor time and interaction with nature means that children have fewer opportunities for unstructured play outdoors, and to learn about the natural world through active engagement and child-initiated experiences (Keeler, 2008).

We have known for decades, one could argue centuries, the importance of play and hands-on experiences for young children. Theorists, educators and child development specialists have written volumes on this topic (Dewey, 1963/1938; Elkind, 2007; Froebel, 2003/1899; Galinsky, 2010; Hirsh-Pasek & Golinkoff, 2003; Montessori, 1987/1962). We can trace the discussion of the importance of play as far back as ancient Greece when

philosopher Plato wrote "… enforced learning will not stay in the mind. So avoid compulsion, and let your children's learning take the form of play."

Children need time to explore outdoors. They need access to a wide variety of materials and to have opportunities to manipulate or "mess about" with them (Greenman, 1988; Montessori, 1987/1962). Greenman suggested that, "It is in messing about that children dream dreams and discover what they might be" (p. 27). "Messing about is when children act on the world and discover what it is made of and how it works." They are compelled to observe, handle, poke, touch, smell, manipulate and maybe even taste any new object they may happen upon. They must discover the essence of that item and what control, or lack there of, they have over it before they can understand the usefulness of it. Even after discovering the usefulness, they do not always use items the way they are intended. Children often transform materials into something else through their imagination and creativity. It is this "messing about", which adults may view as frivolous, that leads children to a greater understanding of not only the world around them but their own sense of satisfaction in discovery (University of Illinois, 2009). While it may be difficult for adults to see the intention and meaning behind what appear to be random experiences, children play with great purpose and intention (Elkind, 2007).

Walsh and Gardner (2005) identified six "Key features of experiential learning" (see Table 1) that must be present in order for young children to gain full advantage of hands-on learning. Current literature suggests that children need to engage in experiences of their own initiation (Elkind, 2007; Greenman, 1988; Jones & Cooper, 2006). Children need the freedom to explore, to direct their own play under the watchful eye of knowing adults (Almon & Miller, 2009; Copple & Bredekamp, 2009).

Table 1: Key Features of Experiential Learning

- **Children should be actively interested and engaged in their learning.**
- **Children need to be independent and have a measure of control over their own learning.**
- **Children must feel secure in their learning environment.**
- **Children should learn in the company of others.**
- **Children's learning must be holistic and must cover a variety of skills and knowledge.**
- **Children's metacognitive thinking skills must be harnessed.**

These adults help shape children's learning experiences through active observation and engagement but do not dictate what children learn (Alliance for Childhood, 2009; Dewey, 1963/1938). Several studies have highlighted both the short and long-term benefits of child-initiated learning over teacher-directed or didactic approaches (Schweinhart & Weikart, 1997; Marcon). Marcon's research revealed that children who were in programs where they engaged in child-initiated experiences "demonstrated greater mastery of basic skills at the end of preschool" compared to children in more teacher-directed or didactic programs (p.2).

Simply stated, children need more unstructured time to engage in child-initiated experiences in nature. In order to motivate educators and parents to consciously shift to having children spend more time outdoors, it is important to understand the value of

young children's experiences in outdoor environments. A growing body of research has described the importance of those outdoor environments to children's development. Miller (2007) identified several key skills children developed as they worked in a garden and greenhouse in a Nature Explore Classroom in the Midwest. These skills cross the spectrum of development from literacy to math and science to social skills and motor abilities. Similarly, research supports the notion that children learn through authentic, unstructured, child-initiated play outdoors (Miller, Tichota & White, 2009).

Our research, conducted in one Nature Explore Classroom (NEC) at the Child Educational Center in California, focused on: 1) the skills children were developing during child-initiated experiences outdoors, and 2) the roles the environment and teachers played in supporting young children's learning. The grand tour research question that guided our inquiry was, "How does young children's engagement in child-initiated activities in the Nature Explore Classroom facilitate skill development?" We defined child-initiated activities as those experiences that children came to on their own, ones in which children made the first move. These experiences came out of their own ideas and interests, and happened alone or with peers, and may or may not have involved an adult. We also considered those experiences children had in areas set up or staged by teachers who prepared the environment as child-initiated as long as the children were the instigators of the experience and led the play.

This research makes an important contribution to the current literature base, because few studies have focused specifically on preschool-age children's skill development in outdoor environments, such as intentionally designed Nature Explore Classrooms. The NEC concept is a relatively new concept with, to date, 55 certified

classrooms in the United States (and several in progress in the U.S. and other countries). Though educators know that important skill development is happening at these sites, evidence-based research on children's specific skills development in the NEC has been limited to Dimensions First-Plymouth Early Education Programs in Lincoln, NE (preschool and infant/toddler programs that serve as research classrooms for Dimensions Educational Research Foundation, and the home of the first Nature Explore Classroom). This study expands the research to another demographic region and unique outdoor setting.

The findings of this study will benefit early childhood educators (including teachers and administrators), faculty in higher education programs, funders and policy makers. Teachers and administrators will be able to use the results of this study to inform their decisions on working with children at their sites. Teachers will have concrete evidence of skill development in intentionally designed outdoor spaces for children, and will be able to use this information to reflect on how they work with children in their outdoor environments and how they can more effectively meet the needs of the children they serve (e.g., the types of outdoor spaces they might provide for children, the time allocated for unstructured play in order to allow children time to engage and explore, and the types of materials they might provide to promote children's learning outdoors). Teachers may change how they view children's learning outdoors, including making a commitment to provide greater opportunities for children to spend time in outdoor settings. Teachers will also benefit from the insights into the importance of teachers' roles in supporting children's learning outdoors and may reflect on their own practices.

Administrators will also gain insight into how to best support children's skill development with the creation and use of an outdoor classroom. They will be able to use the findings from this study to guide teachers in both their practice and interactions with children in their programs. Teachers and administrators will be able to share the results of this study with parents, in order to gain their support for developing outdoor spaces that will support children's play and learning.

The results of this research will be influential in the area of early childcare and the education of young children. The evidence presented in this paper may be used to inform and amend or alter early childhood learning standards or legislation regarding young children. It may also be used to advocate for funding to create outdoor classrooms for children. Understanding the importance of child-initiated experiences in this NEC, in relation to specific skill development, will help those who have influence over curriculum, scheduling and facilities make more informed decisions regarding young children's educational environments. This research substantiates the importance of providing intentionally designed outdoor spaces, intentionally selected materials, and time for children to explore space and materials.

Procedures

This study used a qualitative, single site case study tradition (Creswell, 2007). The "case" or site selected for this research was the Child Educational Center (CEC) in La Canada, CA (specifically the focus of this research was on preschool-age children interacting in the Nature Explore Classroom). The study was funded by Dimensions Educational Research Foundation, and was part of a larger study that included three research sites. The product of the larger study was a cross-case analysis that identified

common themes across all three sites. Each research site had designated co-site directors who were formally trained in qualitative research methods by Dimensions' Research Director, a college professor. The co-site directors were responsible for coordinating the research at their respective sites.

The initial phase of this study was conducted during the 2009-2010 academic year. Eight teachers at the CEC were selected to serve as co-researchers and the primary instruments for data collection. At the beginning of the year (August 2009) those teachers were introduced to qualitative research methods and trained in recording Nature Notes by Dimensions' Research Director and a teacher/co-researcher from Dimensions.

The focus of data collection in 2009-2010 was on children who ranged in age from two years nine months to five years nine months. Teachers closely observed children and recorded their observations on Nature Notes' forms, a protocol for recording, specifically designed for this research (Appendix A). These Nature Notes included written narratives about teachers' observations, photographs and sketches of children and materials, to help us fully understand the context of the observations as we analyzed the data (Appendix B). Data collection began on September 16, 2009 and the final Nature Note included in this study was recorded on May 6, 2010. For the purpose of this study, we analyzed 61 Nature Notes. On average, the initial analysis of each Nature Note took 30 minutes, and we returned to each Nature Note several times as we continued to make sense of our data and construct our narrative.

We analyzed the data collaboratively, using a systematic, methodological approach to examine each data entry (Appendix C). Through this analysis, common patterns emerged and we identified key themes across teachers' observations, the results

of which are described in this paper. We analyzed the skills children were developing in the NEC using a specific analysis protocol that examined key categories of skills. This structured approach helped us organize the data into categories that could then be analyzed for common themes. We examined each data entry as a single unit, and created spreadsheets for each category on the analysis sheet in order to look at the data as a whole and identify themes.

Excerpts of several teachers' observations are included in this paper. In order to protect the anonymity of the children who participated in this research, we used pseudonyms instead of their real names.

Introduction to the Site

The Child Educational Center (CEC) is a private, nonprofit program located in northern Los Angeles County in California. The program serves families with children from 6 weeks through 5 years 9 months, as well as children in kindergarten through 6th grade before and after their regular school day. Since its inception in 1979, the program has been housed in a 1950's era elementary school with surrounding grounds leased from a school district. Two of the more distinctive characteristics of this site are the amount of outdoor space children have to play in and the emphasis on natural beauty outdoors. Each age group of children, from infants through preschool, has their own outdoor space allowing the spaces to be specifically designed for the ages of children using them. From the beginning the program has recognized the importance of children learning though outdoor play and connecting to nature, both of which are reflected in its daily practice with children and through its consulting and educational outreach with the Outdoor Classroom Project, an initiative of the CEC.

The program's outdoor environment serves as a model site for the Outdoor Classroom Project and the preschool space is certified as a Nature Explore Classroom (NEC) through the Arbor Day Foundation and Dimensions Educational Research Foundation. The NEC follows the Ten Guiding Principles as described in the Learning with Nature Idea Book (Arbor Day & Dimensions, 2007) and provides preschoolers with a rich selection of opportunities for growth through exploration, investigation and child-initiated play. The space is designed to be complex and challenging, and to assist preschoolers in becoming capable and knowledgeable in the real world. The NEC size (over 15,000 square feet) provides ample space for a full range of outdoor activities that support extensive development of children's physical, cognitive, social-emotional, and language skills and abilities.

The NEC's design concept emphasizes supporting children as active, independent learners. Much of the design work was developed as a collaborative effort between the Child Educational Center staff and consulting landscape architect, Ronnie Siegel. Permanent equipment (swings, climbing structure, outdoor cabin) occupies little space relative to the whole space so that children can exercise flexibility and creativity in how they use their environment. Some areas are established to support specific child-initiated experiences, including the garden, wild grass nature area, climbing tree, nature art area, messy materials area, block area, music area and two sand boxes (one of which also includes a dirt digging area). A large, open space in the middle provides children with opportunities for whole-body movement and for children to create their own experiences using materials throughout the NEC. Trees supply shade for the NEC and provide an

opportunity for children to experience trees everyday, first-hand. Several storage areas in different locations assist children and teachers in setting up and cleaning up materials.

Teachers bring a selection of equipment and play materials outside from storage sheds and classrooms daily based on several factors: teachers' observations of and response to children's needs; children's articulation of their needs or initiative in bringing items outdoors themselves; staff members consideration of the weather or other factors.

There are four indoor classrooms with a total of 88 children who range in age from two years nine months to five years nine months. The classrooms all share the NEC and everyone contributes to the daily set up of the art area, cabin/dramatic play area, sand boxes, music area, reading area and science exploration area. Teachers also make sure there is an abundance of loose parts available to children. A wide variety of natural materials can be found around the NEC for children to discover as they move about the space or to use in their play. Natural items such as rocks, shells, pinecones, seed pods, twigs, leaves, tree cookies and acorns can be found throughout the NEC. Large branches are also available for children to carry, construct with or simply lift to feel the weight of the branches. Some of these materials occur naturally in the space and others are brought into the NEC by teachers. Each classroom has direct access to the NEC and classroom doors are open throughout the day to allow children free and easy access between classrooms and the outdoors.

Findings

Three key themes emerged in our data analysis (Table 2). First we identified specific skills children were developing during experiences they initiated. The data related to these skills were divided into specific skill areas (sub-themes), including

social/interpersonal, language/literacy, math, science, kinesthetic, construction and other cognitive skills that did not fall within those specific categories. The second theme identified key characteristics that supported child-initiated learning experiences, including how the environment was set up and what materials were available to children.

Table 2: Key Themes and Sub-Themes

Key Themes	**Sub Themes**
Foundational skills children were developing	• **Social/Interpersonal** • **Language/Literacy** • **Math** • **Science** • **Construction/Engineering** • **Kinesthetic** • **Other Cognitive Skills (including visual-spatial and intrapersonal)**
Characteristics of the NEC that supported child-initiated skill development	• **Space** • **Materials:** **Abundance** **Open-ended** **Natural**
Teacher's role in supporting child-initiated skill development	• **Physical placement of teachers near children** • **Offering observations** • **Asking thought provoking questions** • **Allowing children to take the lead** • **Trusting children to make decisions** • **Facilitating children's engagement without taking over**

The third theme described the teacher's role in supporting children's skill development. We examined when and how teachers were engaged with children, where they were physically and how children responded to them. We also noted whether teachers or children initiated contact.

Theme #1: Skill Development

Children's engagement with materials and their interactions with one another and with teachers in the NEC provided opportunities for children to learn new skills and work on mastering skills they were already developing. In our initial analysis, the skills children were developing and honing were assigned to seven categories: Social/Interpersonal, Language/Literacy, Math, Science, Kinesthetic, Construction/Engineering and Other Cognitive Skills. As we categorized the skills children were developing, it became clear that each Nature Note illustrated skill development across multiple domains. It was difficult to determine which Nature Notes to use as examples of single skills because each observation included many skills that were interrelated. It is nearly impossible to examine a single skill in isolation, however, we intentionally extracted relevant excerpts of teachers' observations that addressed the specific categories of skills we have included in this narrative.

Social Skills

Children developed numerous social skills as they interacted with peers and adults in the NEC. In fact, 54 of the 61 Nature Notes (89%) illustrated specific social skills children were developing. Perhaps most notable were the ways children learned about cooperation and collaboration. Children frequently worked together sharing space and materials harmoniously, worked toward the same goal and talked with one another as they played. Their shared experience required them to listen to others in order to understand how to work together to achieve mutual goals. As children interacted in the NEC, they communicated their needs, ideas, feelings, desires, and knowledge to each other, and to adults. At times children assigned tasks and roles to others, or assumed roles

and volunteered for certain tasks. They invited other children into their play. They engaged in collaborative problem-solving and at various times, assumed leader and follower roles. As they shared space, materials and plans, they learned to take turns, negotiate, and compromise. When there was conflict (there were only 9 documented incidents involving minor disagreements), they had the opportunity to practice conflict resolution skills. The following examples illustrate some of these social skills, and were taken directly from teachers' Nature Notes.

In a rich interaction between boys and girls, the children were thinking about a significant social issue. In the open area of the NEC, three girls, all four-years old, were engaged in a discussion about what activity they wanted to do next. As each offered ideas, they seemed agreeable to each other's suggestions. When Rachel suggested building beds, Lauren replied, "Beds and no house?" Nancy then responded with a resounding, "Yeah!" They tossed questions and suggestions back and forth, each child building on another's ideas. When one girl questioned: "Where will we live?" another suggested: "We can be homeless. Homeless women." Everyone seemed to embrace this idea and began to work together, collecting boxes to use as beds. As they built and talked, three boys came by and asked if the boxes were their house. The girls quickly corrected the boys and explained that they were making beds and that they were homeless women. Oliver asked permission to join the girls and they quickly agreed. However, they realized that Oliver's involvement changed the dynamic of the social structure, and told Oliver that they would be "homeless people" because Oliver was "not a woman." When the other two boys indicated they also wanted to join in the play, the three girls turned around and huddled together to discuss this. They returned to tell the boys that they could play,

but had negotiated one stipulation: the boys had to help make the beds. The six children played together, building beds and discussing how they would keep warm if they did not have a house. After gathering sticks for an imaginary "fire", they began to discuss how people who are homeless keep warm and made the observation that the homeless they had seen did not have fireplaces to keep warm. Lauren speculated that they might use blankets, but Randy explained, "No, they don't have blankets. They just stay cold." Brian and Lauren commented to their friends that that was "sad" (L. Campaña, 12/10/09).

These children not only shared space and materials, but also negotiated the terms of their play as they decided what they would build. Throughout their discussions of what to do they shared ideas, and accepted and built on other's ideas without conflict, defensiveness or territorialism. It became evident that the children were developing a sense of social rules and adherence to those rules when Oliver approached and asked permission to join their play. The girls were inclusive, and welcomed others who wanted to join in. They used inclusive language in their conversation, such as "let's", "we", "our" and "us." The mini-conference the girls had prior to including the boys illustrates how these children found ways to incorporate additional children into their play; in this case they assigned a specific task to engage the boys (i.e., making the beds). One girl also recognized the need to shift their gender-specific language from "homeless women" to "homeless people" when the group decided to included Oliver in their play. These children had a unique opportunity to dialogue about what it was like to be homeless, to discuss how people who are homeless keep warm (expanding their understanding of what it is like to be homeless and potentially developing empathy), and to express emotion

(sadness) for their plight. It gave children the opportunity to process the larger social issue of the human condition, albeit on a very basic level.

Sharing space in the NEC provided children with many opportunities to engage other children and enter into play with them. In the previous example, Oliver directly asked the girls if he could play with them. Another way of engaging is to offer to contribute to the play, which requires initiative. For example, two three-year olds were independently moving blocks around in the block area, engaged in parallel play. Garrett observed Sonia working and politely asked, "Can I help you?" "Sure" she replied as the girls moved more blocks. Garrett repeated his question a second time verbatim and again, Sonia agreed ("Sure"). He still had not been able to successfully insert himself into Sonia's play. His question became more specific the third time; "Can I help you build?" When Sonia agreed, Garrett inquired, "What are you building." When Sonia labeled the structure "a house," Garret suggested, "Here's the door" (E. Veselack, 9/16/09). Garrett looked for a way to initiate play with Sonia and even though she repeatedly accepted his requests to help, he persisted in asking if he could help. He did not yet have the social skills to ask the right question to engage in the way he wanted, but in this child-initiated encounter, he was able to practice and hone his skills. It was not until he changed the question and asked what Sonia was building, that they moved on to an exchange of ideas and Garrett was able to contribute to their play.

Sometimes children did not ask permission to join children's play so much as there seemed to be a mutual interest in working together that the children simply accepted. For example, when Annison noticed a crack in the sidewalk and told his teacher, he then told his friend Adam, who had been swinging on the swings nearby.

Adam jumped off the swings and ran over to Annison and joined him in the conversation. A few minutes later two other children joined them seamlessly. Neither one asked permission to join, but offered suggestions and ideas as a strategy to become part of the group (O. Padilla, 5/6/10).

The social interactions during child-initiated play in the NEC also involved a great deal of learning from one another. There were many instances of teachers and children sharing their knowledge with one another. For example, as a group of children worked to push together some waffle blocks, they struggled to connect them. Megan, a three-year-old, eventually was successful and exclaimed to her teacher, "It works, look!" Briana, also three, observed her friend's success and asked her, "Can you help us too?" Megan moved to where Briana and the other children were working and, using her newly acquired knowledge (which came though the trial and error of manipulating materials), showed them how to build (A. Ivanov, 3/10/10). In another Nature Note, when children came outside on a very windy day, Amanda observed the trees, drew on previous knowledge, and cautioned the others: "Some branches, if they're not steady, they will break" (Abou Fakr, 10/27/09). On a different occasion as children observed a dead praying mantis and discussed how it died, Craig offered his explanation to the others, "It feels really, really sick and then it dies" (L. Campaña, 10/8/09). In another Nature Note, three-year-old Allen was collecting food for his worm when a peer approached to help, and added rocks and sand to the container. Allen observed his friend's contribution and shared that he was "not gonna take the sand because worms don't eat sand" (T. Gharibian, 12/9/09). In these examples, children shared their knowledge to be helpful (e.g., how to build), or simply to inform or teach others (about how the praying mantis

died, about the potential impact of the wind, about what worms eat). Peers offered information and assistance and it was willingly accepted and incorporated into their discussions and play. Some children offered more information and assistance than others, demonstrating their initiative and burgeoning leadership skills.

These leadership skills were evident in many ways as children interacted in the NEC. Sometimes there were clear leaders and other times the leadership roles in groups easily changed from one child to another. For example, a teacher observed children standing on tree stumps around the perimeter of the music area, playing instruments and singing, alternating leadership roles seamlessly. The children identified the leader by the baton she held. The teacher recorded the following observation:

> "Linda and Alison switch positions with very little conversation. Linda is now the conductor with the stick on the center stump. A little boy…joins and participates with various instruments but never speaks to or is acknowledged by the four girls. He experiments with a drum then a jingle bell stick. Cindy steps up to conduct next. The change is seamless and I'm not even sure how it was arranged." (K. Ryan 1/8/10)

A different group of four-year-olds were playing in the sandbox, working with water and sand, and a much different picture of leadership emerged. Craig announced to no one in particular, "I'm in charge." When none of the other children responded, he said it again with a little more force. Some of the children looked up at him, but largely ignored his statements. The teacher asked him why he was in charge and he told her that he was in charge because he was the one who started the play, "So I'm telling them what to do." He then recounted everyone's job. "If the sand is in the water's way, he (Patrick) gets the sand out." He continued describing children's jobs but paused to give Edwin some encouragement, "Hey, you're doing it!" and clapped for his accomplishments. When he explained what Nolan's job was he said, "Nolan is in charge of the activity like I am. We

started it first so we'll tell people what to do" (C. Vargas, 3/2/10). Craig designated himself as the leader based on his role in initiating the idea. He assumed the responsibility of assigning roles to others. He was also willing to share the leadership with Nolan and credited him for his role in beginning the activity. He also affirmed Edwin, praising him for his accomplishment.

The ways in which children worked in harmony were notable. As we analyzed the data, one of the social dynamics we identified when children interacted in the NEC was the absence of conflict. In the 61 Nature Notes analyzed for this paper, there were only nine instances of conflict (15%), and generally those conflicts were minor. Even young three-year-olds participated in groups of three to six children without major conflict, learning to negotiate and compromise as they worked toward a shared goal.

A clear example of this was when a three-year-old boy found a crack in the tricycle path and wanted to "fix it." The end result was a collaborative effort between nine children (ages from 3 years 6 months to 4 years 4 months, with 6 boys and 3 girls involved). The observation took place over the period of approximately 90 minutes. As two children worked on the crack in the path, two more children joined them and offered assistance and suggestions. They closed the "road" to the "cars" with cones and metal signs. Before long, several other children rode tricycles up to the roadblock. Annison, who initiated this play scenario, warned the approaching riders, "Stop! Stop! We are fixing the road." Noel approached on his tricycle and countered, "We need to go." The crew that was working explained to the riders that the road was closed and they were "fixing the road because it has cracks." The riders seemed to accept this explanation and watched and waited for several minutes as the workers continued working on the crack

and engaged them in dialogue. As the work continued, the riders became a bit restless, repeating, "We need to go." The workers seemed sympathetic to their plight and one asked them where they were going. "We're going to Disneyland." As the riders continued to wait for the road to open they expressed concern to the workers that it was getting late and that "Disneyland is going to close." One of the workers asked, "Are you going to wait?" "Yeah" replied one of the riders, "but it's getting late." Finally, after about 10 minutes of waiting, the workers offered alternatives to the riders. The workers suggested two options; the riders could "…use the off-ramp" or they could turn around and "...go back…". They even apologetically assisted the riders in turning their tricycles around, still directing: "This way! Sorry, the road is closed." Before long the riders appeared again on the other side of the cones (the path is a large loop around the swing area). The children engaged in more conversation about the construction and the need for the "cars" to get through to "Disneyland." After another 10-15 minute wait, Clark offered to open up "one lane" so children could go through. Annison moved the cones telling them, "I can open, but you need to go careful. Don't go fast." He moved some of the cones and children were able to move through the closed road (O. Padilla, 5/6/10).

The potential for conflict was high in this situation. Children had closed a section of the path other children were using as they rode their tricycles. But rather than confronting the workers or pushing their way through, the children on the tricycles articulated their need to use the path and listened to the response of the children who were working. They patiently waited for the work to be completed and they accepted the workers' explanations and agreed to the alternative solutions they offered. The workers were able to explain the situation to the approaching riders and demonstrated empathy for

the riders' wait. The workers engaged them in conversation in what appeared to be an attempt to keep them from getting restless. The workers continued working on the path, and even though the riders kept encountering the blocked road they accepted the situation without argument. During this lengthy play scenario, children worked collaboratively to close the road and collect supplies to fix the road; they communicated their ideas, needs and desires; they listened to and were responsive to one another; they even used creative problem-solving to arrive at possible solutions (e.g., directing children to the "off ramp", opening one lane).

Teachers' Nature Notes illustrated that children developed many social skills during their child-initiated play in the NEC. They shared space and materials, worked together on shared goals and negotiated their interactions in a variety of ways. Children had multiple opportunities to demonstrate initiative and leadership skills and they recognized other children's leadership. They learned how to enter into play with others and found ways to be useful to one another. Children shared their knowledge and expertise with their peers, and also accepted suggestions and ideas from others. Children also had many opportunities to acknowledge the needs of other children and express their understanding of that through words of encouragement, apologies, polite requests, or offers of assistance. Through all of their interactions, there was a great deal of harmony reflected in the words children used with one another, their actions, and the overall lack of conflict.

Language and Literacy Skills

We identified several language/literacy skills children were developing as they interacted in the NEC (59 of 61 Nature Notes/97% illustrated these skills). Children used

complex sentences to communicate ideas and tell their stories. There was a poetic nature to some of the dialogue, and it was rich in imagination. Children also noticed and used print as a way to learn/process information and communicate with others.

Rich descriptive language, complex sentences and large vocabulary were evident in many of the teachers' observations. For example, a group of three-year-olds were playing their version of *Snow White* in the playhouse/cabin on the far side of the NEC. Their play consisted of making a "poison" for the "witch." To do this, children piled wood chips, sticks, rocks, bowls, containers and a doll on the ground. Each child contributed to the pile of "poison" they were making from the area surrounding the cabin. As they worked to collect items and add them to the pile they narrated their play. "A witch is here! A witch is here, Angela!" "A witch is here." "Terrible, terrible, terrible things." "Here is a giant rock to put here. We need some of those rocks to make the witch sneeze." The "owl-elves" were in the poison. At this point, one child suggested the "poison" needed "decorations" and the children piled on more objects such as rocks and stones. One child directed, "Okay, get more decorations" as they continued to put objects onto the pile to decorate the poison. "These are the little owl elves." Finally, a child introduced their final product: "Okay guys, here is some poison." And another child added, "We are going to poison the witch" (M. Heywood, 12/18/09).

This Nature Note illustrates several language/literacy skills children were developing. These young (three-year-old) children were using complete and complex sentences and developing their vocabulary, descriptively labeling words such as "decorations", "poison" and using adjectives such as "terrible." Their invention of the term 'owl elves' demonstrates the creative language skills they were developing. As they

played together, these children engaged in reciprocal conversation, listened and responded to one another, and built on each other's ideas.

Teachers' observations provided many examples of children engaged in rich, meaningful conversation. For example, a teacher documented the following dialogue between two four-year-old boys (this example also illustrates social interaction, the use of math language, visual-spatial skills, and sharing science knowledge):

Bengy: "I want to find a ladybug."

Brian: "I'm looking for a ladybug, too!"

Teacher: "What will you need to catch them?"

Brian: "A bug catcher, and uh, uh…a magnifying glass."

Bengy: "Yeah, so we can see them. The ladybugs are really small."

Brian: "Yeah, and some can be babies."

Bengy: "Yeah, and babies are smaller."

(By now both boys were walking all over the garden and raised planters looking through their magnifying glasses for ladybugs.)

Bengy: "I love ladybugs."

Brian: "Yeah, I brought a ladybug to class before."

Bengy: "I saw one at my house before."

Brian: "I have lots at my house, and in my garden, and I saw some at the store. My mom brought a lot of ladybugs to class."

Bengy: "Did you know ladybugs are boys too?"

Brian: "Yeah, boys and girls." (L. Campaña, 12/7/09)

In another example, three four-year-old children were trying to save what they thought were “dying” trees (trees that had dropped their leaves in fall). Nolan speculated that “the tree (was) hungry.” Sheila thought about a solution and suggested that they could “cook for the tree.” They stacked two car tires on top of one another and made a second, identical stack next to the first one. They filled the tires with leaves they had collected from the ground. Sheila explained to her friends, “This will turn into maple syrup and we can feed it to the trees.” Lauren added, “And the maple syrup will make the tree grow and get new leaves” (L. Campaña, 12/2/09).

A teacher observed two four-year-old boys working in the sand area, piling sand, adding sticks and creating what they labeled a “spider mountain.” Hal explained, “This is a mountain made of nature. It’s a spider mountain.” After putting some sweet gum tree pods (prickly balls) on the sand he said, “The spider has no head because it is very spooky” (E. Enriquez, 11/6/09). Our data illustrate the many opportunities children had, in the context of play in the NEC, to develop strong verbal language skills. Through their dialogue with peers and teachers children expressed their ideas, expanded their vocabulary, used their imaginations in creating inventive language, narrated their play, and offered explanations to others. They engaged in the rhythm of conversation, maintained the context of the conversation and described their play to others.

In addition to the complexity of the language children used, children engaged in poetic or imaginative phrasing. For example, a four-year-old girl was sitting under a tree on a windy day and thoughtfully said, “Sometimes I dream I’m a butterfly and I’m flying” (M. Abou Fakr, 10/27/09). A few minutes later another four-year-old ran outside and, running through the NEC with arms spread wide-open, head up, exclaimed, “It’s

raining popsicles. It's raining popsicles. It's raining strawberry popsicles" (M. Abou Fakr, 10/27/09). Another child, three-years-old, was swinging on a swing alongside her teacher. She had closed her eyes, and when she opened them, said to her teacher, "Wow…It's bluer than I imagined it would be. When I close my eyes the sky is bluer than I imagined it when I open them again" (K. Ryan, 9/30/09). These rich images that children described are manifestations of the ways in which experiences with nature influence and enrich children's language skills.

Our data illustrate that children use environmental print to enhance their literacy skills. For example, when Garrett, three years old, noticed a stop sign on the door to a classroom he stopped and exclaimed, "Hey, a stop sign. I didn't know there was a stop sign" (E. Veselack, 9/16/09). Though not a conventional reader yet, he recognized the shape and color of the sign and associated the letters with a stop sign and interpreted that the sign meant that the room was closed. In an example used earlier in this paper (when children were fixing the "road", i.e., tricycle path), Noel, who was waiting for the road to be opened, explained to the other waiting riders, "The sign says 'stop' see, S-T-O-P, that means stop" (O. Padilla, 5/6/10). Noel was not only familiar with the sign but also recognized the letters, spelling them as he explained to the others what the sign meant. In a Nature Note from January, a child who had been playing in the sand and water said she wanted to wash her hands. Another child returned with a bucket half full of water and said, "This is water for washing hands." She then pointed to the words preprinted on the bucket and pretended to read, "This is a bucket that is used for washing hands" (K. Ryan, 1/8/10). Similarly a child who was looking at an empty box with a picture of a car seat on the outside announced, "Maybe it's invisible. There should be a car seat in here" and

pointed to the picture and words on the side of the box (S. Walsh, 2/24/10). Children were also highly motivated to "read", based on their initiation of activities that interested them, such as carefully examining plant stakes, to learn the names of the plants that were growing in the raised planter beds, or examining books teachers intentionally placed on the table in the garden area. In all of these examples, children were developing an understanding of print and its function and of letter/sound relationships; important skills in becoming readers.

Math Skills

Interacting with natural materials, peers, and teachers in the NEC provided children with many opportunities to develop early math skills, the third sub-theme of the "Skills" theme. Children explored patterns, the attributes of objects, and shapes. They encountered opportunities to estimate, measure and count. Children explored concepts of quantity and used quantity words, explored size and whole-part relationships, demonstrated one-to-one correspondence, and counted frequently. These early math experiences were especially meaningful for children because *they* initiated them. They engaged in math that was part of the context of the activities they *chose* to initiate.

Children used extensive early math language such as "more", "less", "enough", "lots" and "bigger" in their conversations with peers and teachers. For example, as two four-year-olds played with plastic dinosaurs on a rug in front of their room, they commented to one another about the "long" parade and, as they examined the number of dinosaurs, estimated that they needed "more" food to feed the babies (M. Abou Fakr, 11/09). In another scenario, children made "bread" with sand and water. One child cautioned her friend about the quantity of water to use: "Pretend the water is yeast, the

water will puff up if we use too much" (K.Ryan, 1/8/10). In an earlier example, children closely observed trees in the fall and noted that "all" the leaves had fallen from them. Children who made beds from boxes used the word "lots" both to let others know how many logs they needed and to describe how many of them (children) there were, "We need a big fireplace because there's lots of us" (L. Campaña, 12/10/09). Children who had created a spooky "spider mountain" in the spacious sandbox noted there were "more" dinosaurs inside the green castle and "lots" of spider eyes (E. Enriquez, 11/6/09).

Children often used one-to-one correspondence. This is a skill children need to master as they learn to count. It is important to understand the assignment of one number for one object for an accurate count. For example, five children from three to four-years-old, pretended to be babies in the grassy area of the NEC. Each of the children had one crate, which became their "crib." They recognized that they needed to have the same number of crates as they had children: one baby, one crib (A. Ivanov, 1/20/10). In another example, two four-year-old boys had gathered a big stack of dinosaur books. As they sat on a cushion on the deck in front of a classroom, they poured over the books. When they examined a page with 12 to 15 dinosaurs on it, Bruce pointed at each one and said, "this one lives right here, and this one lives right here and this one lives right here", assigning one home for each dinosaur (K. Ryan, 4/12/10).

Children used counting as a way to identify and describe their play. Penny, playing hockey with a pinecone and a stick, explained to two children who wanted to join her that this was a "game for one" (S. Walsh, 1/26/10). A child playing with dinosaurs said, "Those two dinosaurs are statues in the green castle" (E. Enriquez, 11/16/09). Children also used counting to convey information to others and to solve problems. When

two girls discovered ladybug eggs on a leaf in the garden they not only counted them but also told the teacher there were eight eggs (C. Vargas, 3/4/10). A group of three and four-year-olds, playing with plastic dinosaurs, had sorted them by the type of dinosaur they were (i.e., classification by attribute). The teacher observed them as they counted each group of dinosaurs, recalled the name of the dinosaurs and then determined which group was the largest (T. Gharibian, 3/1/10). In an example used earlier, the children who fixed the tricycle path needed cones to "close the road." As they carried cones over to the "road" they estimated how many they might need. Carl counted the cones they placed on the path: "One, two, three, four, five, and six" (O. Padilla, 5/6/10).

Children also developed an understanding of quantity through experimenting with number words. Theo, a three-year-old, recalled recent wildfires in the area in a conversation with his teacher. He said, "There was a huge fire and it burned a million-thousand-hundred houses and a thousand-hundred people had to evacuate" (S. Walsh, 9/14/10). As the group of three and four-year-olds repaired the crack on the tricycle path, Amanda discovered another "long" crack. She decided she needed to measure the crack and retrieved a measuring tape. "It's 42 hundred." Amanda announced. Adam said, "That is how much we need." Annison asked, "How much?" and Clark answered, "Like 7, 12." Amanda disagreed and countered, "No, it's 100" (O. Padilla, 5/6/10).

Children sat outdoors one day conversing, trying to outdo one another with tales of what the Easter Bunny brought them. One child said she had received "two lollipops." Another child chimed in that she got "a million lollipops" and "a million candies." The numbers continued to increase to "a million, trillion, thousand, hundred" (K. Ryan, 4/6/10). Children were trying out words that they had heard. They knew the words

represented very large numbers but had not yet developed an understanding of how much those numbers meant.

Children also observed different sizes and lengths of materials and objects in the NEC, which helped them develop estimation and comparison skills. In a Nature Note cited earlier, children (who made beds with boxes) estimated the size of boxes they needed to fit their bodies inside (a spatial relationship that also relates to volume). They also estimated that they needed a "big" fireplace to keep all of them warm (L. Campaña, 12/10/09). In another Nature Note, Patrick, who was three, made a size comparison: "Animals are nature; blue whales are the largest animal. Bigger than a t-rex." In April a teacher observed two children comparing the sizes of their hands: "At the other end of the table two children reach across the table and press their hands together to measure whether or not there is a difference. 'They're the same!' they exclaim" (K. Ryan, 4/12/10).

Children also explored time concepts as they worked in the NEC using many words such as "late", "soon", "now", "still" and "yet." The three and four-year-olds who worked on the "road" estimated that it would take a "long time" to fix it ("about 10 days"). The children who waited for the path to be fixed were cognizant of time concepts and expressed concern that it was getting "late" and they would not reach their destination before it closed (O. Padilla, 5/6/10). In another Nature Note, Brian and Illia, both four, played with dinosaurs when Illia lamented that "soon the island (would) be empty…" (M. Abou Fakr, 11/09). In another example, a four-year-old boy who had built a museum with crates told his teacher that he had "spent a lot of time working on it" (K. Ryan, 1/8/10). A teacher observed three children, all four-years-old, on the tire swing

spinning around and around. Aware of the length of time they had been spinning in relation to the speed, a child remarked, "We are still going fast" (A. Ivanov, 4/12/10).

As young children engaged in mostly child-initiated activities in the NEC, they used math in multiple ways; to explain themselves to others, to recount recent events and to help solve their problems. They physically experienced many mathematical concepts because of the nature of the space, the configuration of the areas, and the specific materials available. Those concepts included volume, area, perimeter, diameter, circumference, length, height, width, size, and geometric shapes. They observed whole-part relationships first-hand (e.g., parts of trees within the context of a whole tree; parts of plants/flowers within the context of the whole plant/flower). They used math concepts naturally, in the context of their play, which allowed them to begin to understand the function of mathematical concepts in ways that were meaningful to them, build on prior knowledge and explore new ideas.

Science Skills

The fourth sub-theme we identified as we examined children's skill development in the NEC related to their development of scientific knowledge and skills. Fifty-four Nature Notes (89%) identified specific science skills children were developing. As children in this study explored the NEC, they used many of the same skills scientists use. Children observed closely, asked questions, hypothesized, tested their hypotheses, made adjustments and formulated conclusions. They also engaged in debate about their findings with others. They experienced weather first-hand, including rain, thunder, wind, and temperature fluctuation. They experimented with water and learned about flow, pressure, force, and absorption. They physically experienced scientific concepts such as

gravity, weight, and cause and effect (cause and effect was most frequently cited – it was identified in 21 Nature Notes/34% of the observations).

Many of the science skills children developed centered on learning about nature and often involved telling others what they knew about nature. On two different occasions children were engaged in a debate about nature items they had discovered in the NEC. For example, Christy, three, picked up an eight-inch piece of bark from the sand where she was playing and said to her peers, "Look, it's a big treasure." Patrick, hearing this, repeated Christy's statement, then speculated about its attributes and labeled the item: "I think that's bark (a scientific classification)." Christy ignored Patrick, and repeated her statement to the other children: "Look guys, it's a big treasure." Patrick did not want the perceived error to go unnoticed and replied "No, it's not a treasure, it's bark." Christy continued to ignore Patrick's correction and held up a golf ball sized rock and said, "I found another treasure." Imogene, who had been listening to both children's debate and perhaps anticipated that Patrick might again correct Christy, offered a compromise: "Hey, that's a rock. It's a rock treasure" (S. Walsh, 10/27/09).

Patrick engaged in another debate about nature at a later time. Harriet found a rock slightly bigger than her fist and announced, "This is my special rock." She carried it around, then became interested in something else. As she placed the rock on the ground she announced: "I can put this rock here because it's nature." Upon hearing this, Patrick ran over, picked up the rock and corrected her: "Actually, Harriet, that's not really part of nature, it's a rock." Hearing this exchange, the teacher interjected with an open-ended question, "What is a rock if it's not a part of nature?" Patrick quickly replied, "It's from the ground. " The teacher probed further, "What is nature?" Patrick answered, "Tigers

are nature. Lions are nature." Harriet countered with, "No. Nature is plants." Patrick told her, "Animals are nature." Harriet repeated, "Nature is plants." Patrick acquiesced and said, "Plants are nature. Animals are nature. Blue whales are the largest animal. Bigger than a t-rex." Harriet said, "I know that!" (S. Walsh, 3/18/10). Dialogues such as these with peers and teachers assisted children in better understanding the natural world around them. They came to each experience with knowledge from past experiences and continuously added to their knowledge through their exploration and speculation. Through their dialogue, children also had the opportunity to learn from their peers and teachers.

Children had multiple experiences with nature that furthered their knowledge about the natural world and how it works. For instance, they observed different kinds of weather. A group of children were outdoors when it began to rain. All but one child ran for cover, as they excitedly exclaimed, "It's raining, it's raining!" Charlene, who was four, shouted to her friends, "Hey guys, it's just rain, it's just rain, it's not like a thunderstorm or lightning, it's just rain!" (K. Ryan, 12/7/09). On a windy day, a child ran outdoors, observed the wind and speculated that (based on observation and previous experience), it was "a great day for flying kites" (M. Abou Fakr, 10/7/09).

Children often collected natural items around the NEC (e.g., rocks, leaves, twigs, branches) and used those items in their play. For example, a group of children who played with miniature dinosaurs collected sweet gum tree pods and pretended they were "dinosaur eggs." Children who constructed "spider mountain" used leaves, sand, sticks and sweet gum tree pods for the various parts of the mountain. Tactilely interacting with natural items allowed children to gather information about those items using multiple

senses. They also explored the weight, color, shape, size and texture of the items as they handled and sorted them. They used close observation skills to compare the attributes of items and determine which nature item(s) best fit their needs.

Children's experiences with natural materials included interacting with plants that were intentionally selected and planted in the NEC. As children encountered plant life, through their close observations they learned to identify plants and also assumed some responsibility for caring for those plants. For example, four-year-old Rachel and Charlene had been exploring the garden. Rachel reached down, picked up a flower and ran to tell her teacher, "This flower fell on the ground, but I think I found the plant it fell from!" Rachel and her teacher walked back to the garden and confirmed that the single flower Rachel found had come from that plant she had identified (this also related to math – matching and whole-part). Charlene opened her hand to reveal a flower bud. Rachel examined the bud her friend held, and pointed out to her that she had a "flower" from the plant and Charlene had a "bud" from the plant (K. Ryan, 11/9/09). These flower parts represented two different stages in the growth of the plant. Rachel used close observation skills to determine which plant the flower had come from. She also shared her prior knowledge about plants, which enabled her to accurately name the item Charlene held as a "bud."

In another observation, a teacher noticed Kathy (2 years, 10 months) at the drinking fountain, holding an uprooted plant in her hand. The teacher asked Kathy what she was doing. "I'm watering the plant," Kathy answered. The teacher explained that the plant needed to stay in the ground but suggested that they could use a watering can to bring the water to the plants. They walked to the garden and found where Kathy had

taken the plant. Together they put the plant back into the ground, and when they were finished, gently patted the earth around it. The teacher asked Kathy to touch the soil and tell her if it felt wet or dry. Kathy told her it felt wet so they decided to find a garden bed that felt dry and needed water. Together they filled the watering cans and watered the garden (S. Walsh, 8/18/09). Kathy closely observed the plants in the NEC, and using her almost three-year-old logic identified a plant that she thought needed water. She relied on previous knowledge that plants need water and formulated her own plan for taking care of the plant. Through gentle coaching by the teacher Kathy learned how to water a plant more appropriately, and that the plant needed to stay in the ground to continue to grow.

A group of eight children (three and four-year-olds) sat with a teacher as they discovered some "green and soft" moss on the side of a tree. The children asked several questions about the moss, including, "How did it get here?" and "Why is it wet?" At the teacher's suggestion, they examined the other side of the tree and noticed that the bark on the opposite side was dry and no moss was growing on it, and discussed the conditions that contributed to the growth of moss. The children wondered if moss might be in other places around the NEC, and began to look for dark, moist places where moss might grow. Though they did not find more moss, they kept going back to their original discovery to investigate it. At one point, they asked the teacher if the moss was poisonous, and when she assured them it was not, touched it gently (M. Bohan, 12/14/09). These children used close observation skills to discover a living organism that they learned was moss. They examined both sides of the tree and noted the difference in growing conditions. They formulated questions to learn more about the moss and its origin, speculated that there might be more moss around the NEC in places that met a certain criteria (dark, moist

spots), and followed through on their line of inquiry. These encounters with plant life in the NEC, and discussions about plants, gave children first-hand experiences with natural habitats and opportunities to further develop their knowledge of plant life.

Children had many opportunities to investigate and physically experience the scientific concepts of gravity and weight as they explored objects and their bodies and physically manipulated materials in the NEC. In January, children experienced the force of gravity as they worked with water. Jay used a funnel to scoop water out of a water table near the mulberry tree. He held the funnel over the ground as the water poured out onto the ground. A small pool formed at his feet. Water flowed down the small hill he was standing on, forming a larger pool at the bottom of the hill. Jay explained that he was making a "lake" and a "waterfall" (S. Walsh, 1/11/10). In another observation, a group of four three-year-old children playing in the sand box had placed two five-foot lengths of vinyl gutter on a sand mound and used a hose to send water down the gutters. They held the hose at the top of the gutters, initially alternating between the two gutters, sending water down both. Soon they focused their attention on one gutter, letting the water flow freely down it (S. Walsh, 1/29/10).

A teacher described a group of three-year-old girls burying each other in sand. They experienced both gravity and weight as they piled the sand on the child they were burying. The sand slid down as they mounded it on the child's legs and the child under all of the sand felt the weight of the sand on top of her (S. Walsh, 10/27/09). In an observation from November, Adam (three-years-old) found a six-foot branch in the NEC. As he lifted it and carried it to his classroom, he experienced the weight of the long branch as he manipulated it through space to his destination (S. Walsh, 10/29/09). In an

earlier example, the children who wanted to save the "dying" trees used their whole bodies to lift and stack full size, heavy tires as they felt the weight of those objects. They experienced the contrast of weight as they collected leaves to fill the tires. Although the children in these examples did not yet have an understanding of weight measurements, or a name for gravity (or even understand the concepts), they physically experienced and observed these through their actions and interactions with materials in the NEC.

Swinging was one way children physically experienced the pull of gravity and centrifugal force, depending on how children used the swings. Four-year-old Nancy was swinging back and forth on the swings when she called a teacher over and asked for a push. The teacher began pushing Nancy as high as she could, so high that Nancy's head touched the tree. Nancy told her teacher that when her eyes were closed she felt as if she were flying (K. Ryan, 9/30/09). When three children were on the swings and their teacher was swinging with them, they observed different rates of speed, and when they were going higher or faster than each other. They also noticed when their motion was synchronized (S. Walsh, 10/6/09). On another occasion, three four-year-olds who sat on the tire swing called to a teacher to push them. The teacher began spinning the tire swing the children were on – she pushed them faster and faster. As they spun around and around their bodies were pulled out by the centrifugal force. George observed their body positions in relation to speed and said, "If we bend over, we are still going fast." The other children followed George's lead and they all bent over toward the center of the tire swing, which caused it to continue to spin without additional pushes (A. Ivanov, 3/10). The children physically experienced the pull of gravity as they swung to and fro on the

swings, and gravity brought them back toward the ground each time they reached the high point.

Children also explored cause and effect, developed hypotheses and tested theories as they played in the NEC. For example, in November, Nolan and Nora (both four) busily shoveled sand into a water table. They added water to the sand with a hose. Nora remarked, "Nolan, mix it, let's see what happens." As he stirred the mixture he said, "It's a mixture of dirt." Nora responded, "What color do you think is coming out?" "Brown," Nolan answered (M. Haroian, 11/18/09). Nora and Nolan watched the color and properties of sand change because of their actions. In March, Adam (three-years-old) found a piece of string about 8 inches long with a loop in it. He experimented with looping the string around branches and other long objects. Sometimes he was successful and sometimes he was not. The teacher noticed that he seemed to attempt to balance the objects he lassoed, using only the string. As he looped various objects and picked them up he developed and tested his theory about where the string needed to be placed around the object for it to balance. He experimented several times and became more adept at getting the string into a position that created balance. At one point he walked around the NEC with a small plank balanced at the end of his string (L. Cain-Chang, 3/17/10). He did not verbally articulate his learning through trial and error to anyone at that time, but his actions demonstrated the skills he was developing.

Earlier in the year, Adam found a long branch and carried it to his room and said to his teacher, "Look at this stick. It fell off the tree when it was windy. It was really, really windy and the wind was going like this" at which point he leaned his upper body to

the side and made a whooshing noise to indicate the sound of the wind (S. Walsh, 10/29/09). Adam observed and described a cause and effect relationship to his teacher.

Children in earlier examples also experienced cause and effect and tested theories through experimentation. The children on the tire swing intentionally moved their bodies toward the center of the swing in unison, and discovered the effect on the spinning tire swing. They observed that their actions could continue their spinning momentum. In another example, Jay had observed the effects of water as it flowed down to the ground from the funnel and down the hill, as it formed a puddle a few feet away. In these examples, children had the opportunity to witness cause and effect, i.e., reactions that could be directly attributed to their actions.

These young scientists explored the NEC as if it were their laboratory and engaged in scientific discovery. They explored nature and natural habitats, and examined various properties of the items they found. They asked questions and formulated and tested theories; they experienced physical properties such as gravity and weight. They had opportunities (and time) to pursue their inquiries, and experiment over and over (as Adam did when he balanced branches and planks with a string) until they had satisfied their curiosity.

Kinesthetic Skills

The space and nature of the materials in the NEC provided many opportunities for children to purposefully move and use their bodies (evident in 59 Nature Notes/97% of teachers' observations). Most of the skills children developed centered on whole body experiences as they moved around the NEC. They walked, ran, twirled, crawled, danced, balanced, climbed, jumped, pushed and pedaled tricycles, and used their arms and legs to

create momentum on swings. As they exercised their muscles, they developed strength, agility, balance and confidence in their own abilities.

Children were very active in their play. They frequently carried items from one area to another, filled and pushed the wheelbarrow to carry objects, and built structures with items such as large branches, sticks, rocks, and crates. For example, a teacher observed three children, all nearly five-years-old, engaged in creating an obstacle course with plastic stepping stones (hollow semi-spheres with a hole in the top for storing on a pole) in the grassy open area in the center of the NEC. Once they decided which materials they wanted to use, they needed to decide how to collect and transport those materials to their workspace. They stacked the stepping-stones on sticks to carry them from one area to another, threading the stick through the holes. They set up the obstacle course (bending, lifting materials, carrying them, placing them on the ground), and when they finished, carefully stepped from stone to stone, tongues out in concentration and arms stretched out from their sides for balance (A. Ivanov, 12/4/09). These children physically repeated their actions many times, which gave them opportunities to use motor planning skills to complete purposeful movement, and develop coordination and balance. The repetition of movement in completing the obstacle course several times helped children develop muscle memory and body competence.

Children also had many opportunities to use fine motor skills and practice eye-hand coordination. They grasped, grabbed, pinched and fingered many objects. For example, the two boys who marched around the garden looking for ladybugs gripped magnifying glasses tightly in their hands (L. Campaña, 12/7/09). In another example, children returned to a sculpture built with branches the day before and added more sticks.

They tied strings around the branches (or attempted to), which helped develop their fine motor skills (N. Dubuc, 1/30/10). Similarly, two children worked to create "spider mountain" in the sand area. They gathered many natural materials and then piled the sand into a mound. They placed sticks into the sand and carefully leaned them together at the top to create a triangular shape, making them balance. Then they used string and passed it between the sticks, tying it in several places to secure their structure (E. Enriquez, 11/6/09).

Children also engaged in tactile experiences that helped them learn about the properties of various materials. For example, they touched cold water and warm sand, and handled prickly sweet gum tree pods, leaves, pinecones, small flowers and rocks. When children discovered moss growing on the side of a tree, they kept coming back to touch it gently. Children went outdoors in the rain and felt raindrops on their heads, hands and bodies and experienced wind on a windy day. These hands-on experiences helped children more fully understand the properties of nature and the objects they were in contact with.

Children who spent time swinging experienced the back and forth movement of the swings as well as spinning in circles on the tire swings. Their whole bodies moved with those objects, which provided children with important opportunities for vestibular input as they experienced the back and forth movement and gentle arcing of the swings. Several teachers documented children's movement on swings. Children's small bodies developed strength, coordination, body control and balance as they held their bodies in place against the force of the swinging motion. They also learned about cause and effect,

in direct relationship to their purposeful movement (e.g., the direct result of pumping and how to create momentum on the swings).

Several of the opportunities for children to develop kinesthetic skills were accompanied by music. For example, a four-year-old girl brought a CD player into the NEC. She requested a specific song from her teacher and as soon as the music started she began to move her body to the rhythm of the music. Her movements were fluid and practiced, as if she had danced many times before. When the song ended, she asked for it to be played again. The teacher showed the child how to repeat the song as many times as she wished. Soon a peer, also four, joined her friend. As they danced, their bodies moved and swayed in time with the music as they felt the rhythm. They twirled, waved their arms, moved their feet from side-to-side and demonstrated several dance moves. They often coordinated their dance moves together, sometimes without discussion, just moving together to the music. They also thought about ways to move, and shared ideas with each other: "Let's twirl around" or "Do this with your arms." They repeated movements and steps over and over as they mastered their dance skills (K. Ryan, 1/7/10).

The next day a different group of four-year-old girls gathered in the music area (the perimeter of the area was defined by a circle of stumps about 12-20 inches tall) to play instruments and dance. Audry stood on a stump in the middle of the circle holding a stick in her hand, telling the others: "You have to have a stick to be the leader." All of the children had instruments; drums, rain sticks, or jingle bell sticks. They took turns being the conductor as they played their instruments, sang and danced. When it was Cindy's turn to conduct, she stepped up onto the center stump and began to wiggle, wave and march in place (K. Ryan, 1/8/10). These children used their motor planning skills as they

danced and planned where and how they stepped and how they moved their arms (purposeful movement). They developed muscle memory as they learned dance moves, then practiced them over and over.

Construction/Engineering Skills

The space and materials in the NEC provided multiple opportunities for children to develop construction and engineering skills as they engaged in a variety building experiences (evident in almost half of the Nature Notes – 30/49%). Some of the specific skills we identified in the data analysis included: learning the concept of sturdy base through experimentation; creating enclosures, walls, tunnels, and bridges; emptying and filling, balancing and bracing objects as they experimented with weight and stability, and basic skills such as propping, piling, and stacking.

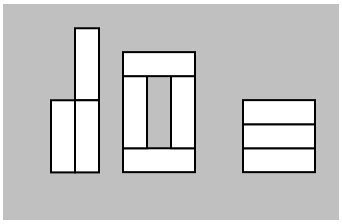
For example, Hal used plastic milk crates on and around the tricycle path to create "a museum", (the teacher used the word "sprawling" to describe his structure). He stacked a variety of crates to put objects on display. He collected nature items such as pieces of wood and branches, and other items such as a scarf, plastic animals, a helmet and a child-made paper sculpture. These all became exhibits in his museum (K. Ryan, 1/8/10). In an earlier example cited, as children collected leaves to feed the "dying" trees, they stacked car tires on top of one another, creating equal size stacks parallel to each other, to create large containers for food. In the example of children creating an obstacle course, they used a long stick and stacked the domes on it vertically to make carrying them easier.

Children were developing a number of important engineering skills as they built with blocks in the NEC. The Visual Construction Typology developed by Dimensions

Educational Research Foundation identifies a wide range of construction skills Dimensions' teachers observed as children worked with blocks and other three-dimensional materials. As we analyzed the data, we used this typology to help identify specific construction skills children were developing in the NEC at our site.

For example, Figure 1 represents three of the structures that two three-year-olds built with rectangular-shaped cardboard blocks as they worked side-by-side in the block area. Garrett and Sonia discovered a way to balance the blocks, as they worked to find stable positions, so the blocks would not fall. At one point Garrett leaned a long wooden board on his cardboard block structure, and it all tumbled down (E. Veselack, 9/16/09). This was predictable to the observer, but not to Garrett. This experiment allowed him to learn about differences in weight, and the load the lighter cardboard blocks could handle. While this example appears to be fairly simple, the three-year-olds who were working with the blocks were developing and refining various construction skills as they learned about weight, balance and positioning. In the first example in Figure 1, the children created a small, stepped structure by turning the blocks upright and stacking them vertically, one stack two levels high. Next they created a rectangular-shaped enclosure vertically with negative space in the center. Finally, they stacked the blocks horizontally, three levels high, centering the blocks and making the stack even.

Figure 1: Three Structures Built by Three-Year-Old Children



A more sophisticated exploration of balance happened when Adam looped various objects with his string, as noted in a previous example. He looked for the spot where the branch or plank balanced on the string. It took him several tries, but he finally discovered that putting the string in the middle gave him the results he was looking for.

Children made lines and walls with various materials such as blocks, rocks, sticks, crates and stepping-stones. They made enclosures, experienced elevation in their building and explored concepts of propping, ramping, bridging and positioning. In each of these experiences, children developed skills as they interacted with materials, observed the construction process and refined the results through experimentation. In our analysis we noted that sometimes children built with specific intention and functionality in mind (e.g., Hal, intent on constructing museum displays), while other times children built for the sheer enjoyment of experimenting with the materials (e.g., the children working with cardboard blocks).

Cognitive Skills

As we analyzed our data we identified several other key skills children were developing as they interacted with adults, peers and materials in the NEC. For the purpose of this paper, this sub-theme addresses three specific cognitive skills, including the use of: critical thinking/problem-solving, creativity/imagination, and visual-spatial skills.

We noted that children used critical thinking/problem-solving skills in 34/56% of the Nature Notes we analyzed. They encountered obstacles as they worked and most often sought answers not from teachers but through experimentation, exploration and testing. For example, when Annison noticed a crack in the tricycle path, he and several

other children embarked on a 90 minute play scenario to" fix the crack" (completely child-initiated). They had to determine how they were going to fix it, what materials to use as tools, and how to keep other children from riding their tricycles through their work area. Several children initiated ideas that contributed to the process and children worked collaboratively. Amanda suggested they needed to close the road and Clark brought the cones to help block it. They also retrieved several metal street signs, ("one way" and "stop") to help the children on tricycles understand the need to stop. When the children on tricycles became impatient because they needed to get through before Disneyland closed, the children who were working generated multiple options to address this, including suggesting the use of an "off ramp" and eventually opening one lane. In another example, Megan encountered a problem as she worked to snap waffle blocks together. After repeated unsuccessful attempts, rather than give up, she considered alternative ways to complete the task. As she closely observed the materials, she noticed that there were two different kinds of waffle blocks. She sorted them by type and was then successful in snapping the like blocks together (A. Ivanov, 3/1/0/10).

Both critical thinking and visual-spatial skills were evident when two girls discovered ladybug eggs. They were not looking for ladybug eggs; they were dancing about the NEC, when they noticed the ladybug eggs on a leaf. They used close observation skills and figure-ground discrimination in locating the eggs on the leaf. Then they considered what it was they were examining, identified what they found as eggs, questioned what insect might lay small eggs, and deduced they were "ladybug eggs." They provided their teacher with a rationale – they had deduced that the eggs were ladybug eggs "because they (were) yellow" (L. Campaña, 12/7/09).

Adam's use of critical thinking and problem-solving skills was evident as he explored the concepts of balance and angles, using a loop of string as he worked with sticks and planks. He had to think through his plan; what he wanted to accomplish, and how he would approach the task. He began to experiment and when he was mostly, but not consistently successful, he had to closely observe what was happening, sort the information and deduce what made those successes possible.

Thirty-six (59%) of teachers' observations of children in the NEC provided evidence of children's use of creativity and imagination. They engaged in pretend play and created imaginary scenarios as they used materials and interacted with one another. When a group of three-year-olds played in the open area using crates and rocks, they pretended to be "families", assuming different family roles. Beverly and Warren said they were "brothers and sisters." George and Amy were the "children." All of them climbed inside milk crates, which they pretended were their beds. They also covered overturned crates with rocks, which they pretended were their "babies" (A. Ivanov, 1/20/10). In another example, Garrett, Warren and Janet, all three-years-old, dug in the sand box. They mixed sand and water in a bowl and created "chocolate mud pie." They discussed what else to put in their pie and suggested items such as "organic sugar" and "lemon sugar", using natural materials to represent the ingredients (T. Gharibian, 2/23/10).

In January, a teacher observed two four-year-old boys playing in the open area. They had found a metal basketball hoop and turned it on its side on the ground. Joshua stated, "It's our pirate ship. It's the driving part." He grabbed the hoop by the small end and rotated it back and forth as if it were a steering wheel. He then stood the basketball hoop upright and the two of them added items to their ship, including a wheelbarrow,

balls and a vase. Joshua explained, “This is our pirate ship.” He added: “These are the cannons” (referring to the wheelbarrow handles that were sticking out) (S. Walsh, 1/8/10). A few days later two other four-year-old boys found the same basketball hoop lying on its side. The teacher asked what their plan was and Oliver replied that they were building “a spider web.” Randy quickly added, “Yeah, a spider web” and they ran off to collect “flies” for the web. They returned with pinecones and tree cookies and threw them into a crate they had placed in the center of the basketball hoop shouting, “Flies! Flies!” (N. Dubuc, 1/25/10). In another Nature Note, children recreated their version of the story *Snow White* in the cabin in the far corner of the NEC. Kamila wore a purple dress she identified as a “Snow White dress.” Angela and Craig helped Kamila make a poison for the witch. They piled materials that they had collected from the area near where they played to put into the “poison.” They said that the “poison” was where the “owl-elves” were (M. Heywood, 12.18/10). With their imaginations and the materials available on the NEC, children created stories, characters and objects. They imagined themselves in other roles and sometimes in other places. These stories, characters and materials helped shape the rich play scenarios that children engaged in. They often used materials in very creative, non-standard ways; materials could be anything – transformed by children’s imaginations.

We identified children’s use of visual-spatial skills in 37/61% of our Nature Notes. For example, children used visual mapping skills as they created an obstacle course with stepping-stones and then walked the course over and over. Children who climbed trees used visual-spatial thinking to identify where to place their hands and feet to climb higher and avoid falling. In one such example, Bruce was climbing a well

establish Aleppo pine tree. The base of the tree had grown up from the ground in three directions, creating a gently sloping 'Y' at the base. Bruce climbed into the tree and stood with his feet on two of the outstretched branches about three feet off the ground. He called to his teacher, "Look…I'm making a bridge. This is how I get out." He demonstrated his exit for his teacher in one fluid movement. He brought his right foot over next to his left, brought both hands down and jumped to the ground. It was evident that Bruce had prior experience climbing that tree in order to so skillfully negotiate getting down. He remembered his past experiences in climbing the tree and visualized in his head what movements to make to successfully jump out of the tree, such as where to place his hands and feet and how to move his body to jump from the tree and land on his feet. He also exercised his visual memory in recalling that a bridge spans two points, and positioned his body accordingly in the tree.

Children developed visual-spatial skills when they built with blocks and, through practice, gained an understanding of where to place blocks without toppling them. They had to visualize in their minds how to rotate the blocks to stand them up on end and to see where to place them to create the structure they wanted. Children who carried long branches developed their visual-spatial skills as they moved through the NEC. They needed to have a sense of where the ends of the branches were and how to move them without making contact with others as they negotiated their bodies through space, and through and around objects.

It is also important to note one additional skill that children regularly used, which is the foundation for this paper, and that is individual initiative. Fifty-seven (93%) of the observations recorded by teachers focused on CHILD initiated activities; only four (7%)

were teacher-directed activities. In the NEC, children had many opportunities to exercise initiative, which included initiating activities and conversations, making plans, choices and decisions, and following through on those. Specifically, our Nature Notes described children initiating conversations (36/59%), engagement with peers (30/49%), engagement with teachers or adults (32/52%), and creative problem-solving (34/56%).

Theme #2: NEC Characteristics that Influenced Skill Development

The second theme that emerged in our analysis related to the key characteristics of the NEC that supported children's skill development. There were two related sub-themes within this second theme: 1) the design of the space, and 2) the types and quantity of materials available to children. The NEC was intentionally designed to allow children the freedom to use their whole bodies. The NEC is spacious, and has clearly defined areas to provide children with opportunities to engage in a variety of experiences (e.g. a nature art area, a block building area, a messy materials area, a climbing/crawling area, a dirt digging area, a sand area, an open area, a wheeled-toy area). The NEC is over 15,500 square feet, more than two and a half times the minimum required by California state licensing. The size allowed children to move freely throughout the NEC, to manipulate the space to support their desired experiences and to have ample room to play without the need to constantly negotiate space with their peers. Having designated areas encouraged children to consider their interests and make choices about their activities, helped them know where to find certain materials, and made the NEC a fairly predictable space to use.

During the analysis process, we identified the three areas in the NEC where Nature Notes were most often recorded. The area cited most often in our data was the open area (in 14/23% of the observations), a very spacious area where several children

could gather and multiple materials were accessible. Ten of the 61 Nature Notes (16%) were recorded in the garden area and nine (15%) were recorded in the sand area. These spaces were open and flexible and provided opportunities for children to manipulate the space as they engaged in their play scenarios.

For example, six three and four-year-old children spread out in the open area with several milk crates and rocks. They needed a significant amount of space to create their role-play and manipulate materials. They lined up crates and placed rocks (their "babies") on them as they pretended to be a family. They gathered and used materials and negotiated their roles without conflict. They were able to find a place large enough for six children to congregate without worrying that their peers would infringe on their space, because there was plenty of room for multiple groups of children to play in the open area. In another example, children who built beds out of boxes (as they pretended to be homeless) had the space they needed to spread out in the open area. There were eventually six four-year-olds working with boxes and branches, which required a large amount of space. They used large materials that they could physically climb inside, without worrying about the space limitations that are often present in indoor classrooms. In December, a teacher observed four girls, all four-years-old, build an obstacle course in the open area. They placed the semi-spheres on the ground in a long, curving line across the grass. The space they worked in was large enough to accommodate their needs and allowed them to work together without encroaching on other's space. In all three examples, because children were not confined by space, they had the freedom to create rich play scenarios, use their whole bodies to physically interact with each other and materials, and incorporate both small and large materials into their play.

Children had enough space in the NEC to choose to work independently or in small groups, without overlapping with peers during their play. Children had room to be away from others who chose to engage in different activities. For example, there is a small cabin in one corner of the NEC, about four feet by six feet, including the deck on the front. It is made of wood and has three windows and a door. Long red curtains hung in the doorway and on this particular day, the curtains were blowing in the wind. A four-year-old boy spent time alone, exploring how the wind blew the curtains. No one interrupted his quiet observation as he watched how the curtains moved and fingered the fabric (K. Ryan 12/10/09). This child had the time and space to take a break from the group and follow his interest as he explored the affects of the wind on the fabric.

A teacher watched another child for an hour as he gathered natural materials into a wheelbarrow to feed his pretend "pet worm." He walked all over the NEC, pushing a wheelbarrow and picking up sticks and pods from the sweet gum tree. About halfway through this activity, a friend joined him and the two of them continued to collect natural items from around the NEC (T. Gharibian, 12/9/09). The large space allowed these two children to spend a significant amount of focused time following their interests, and to explore what materials they might discover in different areas of the NEC. They worked without conflict over materials or space; there was enough for both children.

The second sub-theme related to key characteristics of the NEC that support children's skill development relates to the type and quantity of materials available to children. The materials were open-ended, meaning they could be used in many different ways, depending on children's plans. The materials included both manufactured items (e.g., milk crates, boxes, rain gutters, milled planks) and natural items (e.g., sticks,

branches, seed pods, pine cones, leaves, rocks, wood chips). The loose parts available to children in the NEC (i.e., those items that were easily manipulated and moved) played a significant role in the richness of children's play. During our analysis we identified the materials most often documented in teachers' observations. They were: sticks, twigs and branches (19 references), sand (9 references), rocks (7 references), leaves (7 references), and water (7 references).

Access to a wide variety of open-ended materials enhanced children's opportunities for rich, authentic play. For example, Brian and Illia, both four, collaboratively made a plan to create what they named "dinosaur island." They began with plastic dinosaurs that teachers had set out in the NEC (these perhaps sparked their interest and the idea to create a habitat for dinosaurs). The children very purposefully collected rocks and leaves to create a space where dinosaurs could live. Their play was rich and imaginative – they pretended the rocks they'd collected were refrigerators and the leaves were food (M. Abou Fakr, 11/09). In another example, two four-year-old boys created what they called "spider mountain" in the sand area. They collected leaves, sticks, string, and sweet gum tree pods. They heaped sand into a mound, then added sticks, pushing them into the soft sand until they stood upright and extended out like spider legs. They added sweet gum tree pods to give "spider mountain" eyes, and added a flag – a stick they had attached a leaf to and placed upright in the sand (E. Enriquez, 11/6/09).

In May a teacher observed a group of three and four-year-old children working to "fix the crack" in the tricycle path. They thought about the process, and collected a variety of materials to help with the repairs and traffic control. They gathered plastic cones and metal signs to alert travelers that the "road" was closed. They found plastic toy

tools to “break” the path so they could fix it. They collected woodchips to use as “cement” to fill the crack and a two-foot length of a vinyl downspout became a tool to flatten the “cement” they put in the crack (O. Padilla, 5/6/10). In another example, when Adam discovered an eight-inch length of string with a loop in it, he began a 25 minute exploration of balance. He lassoed the end of a branch and lifted it up. It hung down toward the ground. He observed the problem, put the branch down, and moved the string closer to the center of the branch, lifting it up again, until he found the point of balance. He lassoed and lifted several different sizes (i.e., length and diameter) of branches and planks of wood as he moved around the NEC (L. Cain-Chang, 3/17/10). In some of our observations, children purposefully gathered specific materials they needed for their plans, as the latter example indicates. Other times, they noticed items in and around the NEC that inspired and sometimes influenced the direction of their play.

Many of the materials that children used were natural items including sand, water, pinecones, sticks, twigs, branches, and rocks. The availability of natural materials encouraged children to use their imaginations and creative thought in their play. For example, when two boys wanted “flies” for their spider web, they gathered small tree cookies and pinecones and scattered them into the web, shouting, “Flies!” (N. Dubuc, 1/25/10). In another example, three children, all four-years-old, played with a collection of dinosaurs. They arranged the dinosaurs in a half-circle around a pile of sweet gum tree pods they had collected. They explained that they were, “welcoming the new babies”, and explained that the babies were “hatching from these eggs” (pointing to the pile of pods). The boys took take care of the babies by feeding them leaves they had collected (T.

Gharibian, 3/1/10). Table 3 illustrates how children used the skill of creative representation (transference) to symbolically transform materials into other objects.

Table 3: Examples of Creative Representation/Transference of Objects Documented in Teachers' Nature Notes

The Objects Children Used:	What Those Objects Symbolically Represented:
1) Rocks	1) Babies
2) Stick	2) Trumpet
3) Block Structure	3) Fire Engine
4) Pine Cone	4) Hockey Puck
5) Waffle Blocks	5) Computers & Houses
6) Prickly balls	6) Eggs
7) Sand/Water	7) Chocolate Mud Pie
8) Loose natural materials & yarn	8) Soup Ingredients
9) Sticks and natural items	9) A Mountain ("spider mountain")
10) Two twigs	10) A Crane
11) Sticks & rocks	11) Ingredients for witches poison/decorations
12) Sand	12) Yeast
13) Logs	13) T Rex dinosaur and dinosaur bones
14) Pinecones & small tree cookies	14) Flies (to feed imaginary spiders)
15) Wet sand	15) Chocolate Water
16) Leaves	16) Maple Syrup
17) Tires	17) Pot to Cook Maple Syrup
18) Wheelbarrow	18) Pirate Ship/Handles were Cannons
19) Detached metal hoop	19) Steering Wheel of Pirate Ship
20) Fibar	20) Cement to Repair Cracks
21) Sidewalk	21) Freeway
22) Sweet gum pods	22) Dinosaur Babies
23) Stick, string, leaves	23) A Flag

Sometimes children simply explored the materials that were available in the NEC. For example, on a sunny day in September, two girls, both four, quietly explored the discovery table near the garden. They found the remains of a pumpkin shell. They fingered it, touching the smooth outer shell and the soft flesh inside. They also found a very large pinecone (about 7-8 inches long) and a seashell and lifted them up – turning them over to inspect them closely (E. Veselack, 9/16/09). The supply of natural materials in the NEC not only provided children with opportunities for close encounters with nature, but also encouraged them to think more creatively.

Theme #3: The Teacher's Role in Supporting Children's Skill Development

The importance of the teacher's role was the third theme that emerged as we analyzed the data. As we examined each data entry, we noted all the ways teachers supported children's skill development in the NEC. We found it interesting that, while teacher support was key, it did not necessarily occur in traditional ways (which originate from more didactic, teacher-driven curriculum). While only four (7%) of our Nature Notes represented teacher-initiated activities, teachers supported children in a variety of ways, and that support was evident in 60 (98%) of our Nature Notes. For example, 38/62% of our Nature Notes documented the importance of teachers providing enough time in the NEC for children to engage in activities they were interested in, to pursue their interests and experiments without interruption or time constraints.

Thirty-four (56%) of our Nature Notes illustrated that the richness of children's experiences was linked to teachers' intentionality in preparing the environment for children, including providing materials to support children's learning experiences.

Almost half (30/49%) of our Nature Notes documented the role of teachers' communication with children, in particular asking open-ended questions to help children think more deeply and articulate their viewpoints. A third of our Nature Notes (21/34%) illustrated one of the ways teachers engaged with children. Rather than asserting themselves into children's play, or directing their play, teachers responded to children's cues, in particular invitations to join in the play. When this occurred, teachers assumed roles assigned to them by children and engaged in work and pretend play with them. At times, teachers assisted children with specific parts of their activities, often at children's request for assistance (evident in 19/31% of the data). When teachers provided assistance, they did so without taking over the activity. We also noted that teachers allowed children to take appropriate risks, for the sake of the inquiry or experience (evident in 19/31% of our Nature Notes). Some of those risks included challenging themselves physically in order to learn new kinesthetic skills (while teachers monitored for safety) and experiencing inclement weather. We also noted that on specific occasions (in 13/21% of our Nature Notes), when teachers could have interjected themselves into activities to provide direction or solve problems, they intentionally stayed out of the way to allow children to explore, observe, experiment, question and problem-solve. Finally, in the examples cited earlier of children's use of materials symbolically (i.e., transference/creative representation) teachers also supported children's use of materials in imaginative ways.

One of the unique characteristics of the teacher's role in this research was that teachers were primarily observers. This gave children freedom to engage in activities that were meaningful to them and allowed them to learn through experiences that they

initiated rather than didactic instruction or teacher-initiated activities. The physical placement of teachers near and around children made it easy for children to include teachers in their experience or to seek assistance. Teachers routinely sat near children so they could not only observe them but hear their conversation. Teachers got down on children's level, in positions that encouraged children to engage them. Children were comfortable having teachers observe them and offer comments or ask questions. They frequently initiated engagement with teachers by asking questions, narrating their play to teachers, making declarative statements or asking for help. Teachers offered observations and thought provoking questions, responded to children when approached and engaged with children when they were invited but did not take a lead role in the experiences, but instead deferred to children's leadership.

Children's skill development in the NEC was successful in part due to teachers' ability to know how to best support children without interfering or taking over. Teachers made informed decisions regarding when and how to engage children, what questions to ask to spur children's thinking and when to step back and allow children to experience on their own. Teachers used open-ended questions to extend children's thinking, allowing them to be the experts (i.e., showing what they knew) and encouraging them to articulate their thoughts. We noted multiple examples of this in teachers' Nature Notes. For example, when a child picked up a large wooden block and asked his teacher what it was, she could have easily indentified it for him. Instead, she asked, "What do you think it is?" allowing him to use his imagination in identifying it as "a step" (M. Heywood, 12/18/09). In another example, when four children, all four, were observing two praying mantises, comparing the one that had died to the live one nearby a child asked the teacher, "How

does it die…?" Rather than answering his question the teacher responded, "How do you think it dies?" (L. Campaña, 10/8/10).

Teachers trusted children to make decisions and to act on their theories, and allowed them to use materials in unconventional ways, recognizing the learning that was possible for children as they exercised their imaginations and made visual analogies. For example, as children made a "poison for the witch" they very purposefully collected many items from around the NEC, including plastic bowls, play food and a baby doll and piled them into a heap of materials (M. Heywood, 12/18/09). The teacher's acceptance of this unconventional use of the materials (and the collection of these items from other areas) allowed children's rich imaginative play to continue. In another example as children began to fix the crack in the tricycle path, they scooped up some of the fall zone material under the swings nearby. The teacher could have redirected them to leave it there but instead observed their play, noted the intentionality with which they worked and allowed them to use the woodchips (O. Padilla, 5/6/10).

Teachers acted as facilitators and allowed children to initiate and maintain the lead in their play. Even when teachers initiated the activity, they still allowed children the opportunity for processing and problem-solving. Teachers communicated to children that they were willing to let them lead in the exploration of ideas and solutions. For example, on a rainy day in February, a teacher was in the NEC with two four-year-old girls. Initially the girls complained that there was not anything to do in the rain. Rather than list all of the things they could do, the teacher simply picked up a stick and began stirring a puddle. The girls became intrigued and asked her what she was doing. "Stirring the soup," she told them. The girls asked if she needed more ingredients and immediately

began collecting nature items such as sweet gum tree pods, grass and bark and added them to the "soup." For the remainder of their experience (i.e., stirring the soup), the teacher followed the girls' lead (K. Ryan, 2/5/10). In another example, a teacher, began tying two branches together and invited two boys who were nearby to help her make a "sculpture." The boys began gathering branches to add to the sculpture. The teacher encouraged ownership and involvement by allowing the boys to decide where the branches and twigs should be placed. She modeled how to tie the branches by tying them where the boys indicated they should be tied (N. Dubuc, 12/29/10). While the teachers in these examples initiated an activity, all of them allowed children to take ownership of the activity by following their lead once they became engaged.

Teachers also encouraged children to expand their thinking and knowledge through their own observations. For example, a teacher (Shannon) was invited to swing with three children. As they were swinging, Shannon noticed that she and the child next to her were swinging in unison with one another and said, "Hey Oliver, we're swinging together." Oliver said, "No, I'm going faster." Shannon explained to Oliver what she meant by swinging together. Moments later Oliver was swinging in unison with his friend Nolan and he said to Shannon, "Hey, now Nolan and me are swinging together." The boys continued to notice when they were in unison with one another – they commented to each other and to Shannon each time they were in unison (S. Walsh, 10/6/09).

Teachers also intentionally stayed out of children's play and trusted them to problem-solve, create, hypothesize, test theories and collaborate alone or with one another. They understood the importance of children directing their play experiences and stayed back, observing in close enough proximity to be engaged by the children or to step

in if needed. For example, on a brisk, breezy afternoon, Brandon, who was four, was in the cabin watching the flowing red curtain flutter in the doorway. He caught it as it blew toward him then let it go. He walked through it and let the fabric glide over his body and head. When the wind died down he took the corners at the bottom and straightened it and waited for the wind to catch it once again (K. Ryan, 12/10/09). This child was exploring cause and effect, and the impact of wind on the fabric curtains. Our data suggests that children were willing to thinking logically and creatively and problem solve on their own without relying heavily on teachers for information or input. Children spent time working through problems, sometimes narrating that process or their discoveries to teachers. For example, a group of three-year-old boys were on the tire swing spinning around and around when George observed, "If we bend over we are still going fast." The boys spent the next several minutes bending over and sitting up in unison as they spun around on the tire swing, experiencing how their bodies affected the speed of the spinning tire swing. The teacher was there to listen as children shared the information, but allowed them to make the discoveries as they experienced centrifugal force without her instruction or direction. When children realized they had some control over the spinning of the swing and did not need constant pushing by a teacher, they joyfully exclaimed, "We can do it all by ourselves," capturing their sense of pride in their discovery (A. Ivanov, 3/10/10).

Children often engaged teachers with questions or declarative statements. When two four-year-old girls discovered ladybug eggs under a leaf in the garden, they shouted their teacher's name four times to draw her over, and then shared their discovery with her (L. Campaña, 12/7/09). During play in the sandbox a child called out to her teacher, "…we're digging for diamonds!" The children's play continued without the teacher's

input, but through their communications to her they made sure she knew what they were discovering and thinking (K. Ryan, 2/2/10). In another example, a teacher was sitting near a group of children who were watching some repair work on the climbing structure. The teacher was bending a small stick back and forth when a child noticed and said, "You made a zigzag. Zigzags are like thunderbolts. Thunderbolts are the things Zeus uses for power" (L. Cain-Chang, 3/17/10). This was an unsolicited comment yet it provided the teacher with insight into what that child knew about lines, her ability to use a simile in comparing zigzags and thunderbolts, and what she knew about thunderbolts.

Teachers routinely asked open-ended questions that provoked children's thinking and often led to expanded learning. For example, several children were out in the open area of the NEC when Lauren, a four-year-old saw leaves falling from the trees and said to a friend, "All the leaves are falling." Sheila, also four-years-old, responded, "Yeah the tree is dying." Nolan joined his peers in the conversation, "We need to save the tree." Their teacher then asked, "How can we save the tree?" an open-ended question that provided children with opportunities to think and problem-solve. Children formulated theories and she listened as they offered suggestions. One child speculated, "we need to feed the tree." Children spent the next 35 minutes discussing how to save the tree. They gathered food and other items in a collaborative effort. In a different Nature Note, a teacher observed a child who was not quite three, with an uprooted plant in her hand standing at the drinking fountain. Instead of scolding the child for pulling up the plant, the teacher gently asked her what she was doing. When she explained that she was "watering the plant", the teacher took the opportunity to teach the child how to appropriately water a plant. She showed her how to replant it, gently patting the earth to

pack it gently in place. The teacher also helped the child learn how to test the soil for dampness (S. Walsh, 8/18/09). In another example, when a child discovered a crack in the tricycle path, his teacher simply asked, "What are you going to do about that?" Her question launched children into an extended (90 minute) experience that involved collaboratively working together to "fix the crack." Teachers' open-ended questions and observations assisted children in better understanding the world around them, and encouraged creative thinking and problem-solving.

Teachers observed children and responded in ways that were supportive to them. They stayed close to where children worked and made themselves available to them. Children engaged teachers with questions and invitations to join in their play. Teachers trusted children to problem-solve, engage with one another and use materials unconventionally. They gained insight into what children knew, how they worked with one another and when they needed assistance. While their instructional role (in the traditional sense) was not always highly visible, the teachers' role was critical in supporting children's skill development in the NEC.

Discussion

This study supports prior research that suggests that young children develop important skills when they engage in authentic, unstructured play in a Nature Explore Classroom (Miller, 2007; Miller, Tichota & White, 2009). Similarly, our data (collected at one Nature Explore Classroom in Southern California) illustrate that children developed a wide range of skills as they participated in hands-on activities that they initiated, and that teachers supported children's skill development in a variety of ways. This section discusses the implications of our findings, including: 1) the value of unstructured play that children had the freedom to initiate and direct; 2) the importance of foundational, age appropriate learning that occurs through play in a Nature Explore Classroom; and 3) the role of intentionally designed outdoor space(s), intentionally selected materials, and teacher support in scaffolding children's learning.

The Significance of Child-Initiated Experience

Initially the primary goal of this study was to explore the skills children were developing as they worked and played in our Nature Explore Classroom. It was only as we began to analyze the data that we recognized the significant role of children's initiative in making their learning relevant and meaningful for them. As a result of the analysis process, children's initiative became a key lens though which we viewed all of our documentation. Initiative, in itself, is a foundational skill young children must develop to successfully navigate the world.

So, what is so significant about child versus teacher initiated experiences? When children initiate activities, they make plans, choices and decisions, and act on those. When they encounter challenges, they engage in problem-solving and critical thinking.

They exercise their recall skills, remember past experiences and draw on their current knowledge. They exercise their reasoning skills, and use creativity in their play. Most importantly, children get to practice using these skills over and over, and are highly motivated to do so, because they are pursuing their ideas and plans. This contributes to children's understanding of themselves in the context of their working knowledge of the world.

Galinsky (2010) identified seven essential life skills that young children need to develop. They are: focus, self-control, perspective taking, communicating, making connections, thinking critically, taking on challenges, and ***engaging in self-directed learning***. Hirsh-Pasek and Golinkoff (2003) discussed the need for children to develop similar skills, and suggested that while these skills are not measurable on tests, they are life skills that enable children to become competent, capable and engaged learners.

Children's self-directed experiences in the Nature Explore Classroom (NEC) encouraged them to choose what they wanted to do, where they wanted to do it (i.e., areas in the outdoor classroom) and how they wanted to go about doing it. They decided what materials they needed to carry out their plans. They made thoughtful decisions about what they needed and why and even who they wanted to play with. These kinds of experiences helped children develop their sense of self and gave them the opportunity to develop confidence in pursuing their plans and engage in activities that were important to them. Children learned to plan ahead and to ask *what if*, rather than rely on teachers' directives and a standard approach to learning (i.e., "*this is how we always do this"*). Having these kinds of opportunities to make choices and exercise creative thinking helps children's brains develop. Conversely, children do not have to do much creative thinking

when teachers tell them where to sit, what to do, and why and how to complete a task. There is little room left for imaginative thinking and creative problem-solving.

Our data illustrate that the space, materials and interaction in the NEC encouraged children to repeatedly use problem-solving and critical thinking skills. Children offered ideas to peers and teachers and proposed strategies for accomplishing challenges. They experimented and revised their plans. As young children, they had rare opportunities to critique their own work. These opportunities for problem-solving and deep thinking may have occurred for several reasons. One reason may have been the unpredictable nature of children's play in this rich environment. Children's play in the NEC often changed, even in a short period of time. It became richer as children engaged in deeper conversations with peers and teachers, as the number of children engaged in play scenarios changed, and as children experimented with multiple ways to use materials and tools. As children's play changed, often opportunities for critical thinking and problem-solving increased.

In more structured, didactic programs children typically have fewer opportunities to engage in meaningful problem-solving that ***they*** initiate. These didactic programs are largely based on the philosophy that children gain and retain knowledge best by directed teaching; to be filled up with information from adults. An alternative philosophical approach views children as capable learners who are constantly taking in information, who learn, practice and hone their skills through experiences and build their knowledge from one encounter to the next. The children documented in this study created their own learning opportunities and developed skills primarily through their own initiation. As they played and worked they encountered obstacles and were innovative in finding multiple ways to be successful. They gathered information from their surroundings, other

children, teachers, and from their own experiences, and used this new information in their play and problem-solving. They were not directed toward "right" or "wrong" answers but instead had an open-ended view of problem-solving that encouraged creative thinking and multiple paths to solutions (i.e., divergent thinking).

Our data illustrate that children were able to stay focused for extended periods of time on activities they initiated because those activities were meaningful to them. It is far easier for young children, or adults for that matter, to attend to tasks or activities that are of personal interest to them, than it is to invest in activities they are less interested in. Young children's short attention span is often the result of lack of interest, stimulation and/or ownership. We live in a culture where even the most intelligent children use "boredom" as an excuse for lack of engagement. Often parents feel the need to entertain children with "things" (e.g., toys, electronics) and to fill their time with structured activities. Often adults assume the responsibility for solving children's "boredom" when the most valuable gift they could give to children would be to ignite their imaginations and interests in ways that inspire children to become fully engaged in the purest, most simplistic form of play.

Because children in the NEC had the freedom to initiate and follow through on activities that were interesting to them, they got to follow threads of inquiry and discovery based on their questions and speculations. Their active engagement and emotional investment led children to focus for long periods of time. Children were intrinsically motivated and empowered to act on their ideas, choices, and plans. The learning that occurs when play is self-initiated and meaningful, may be deeper and longer lasting and may help children apply and generalize the knowledge they are acquiring.

The variety and versatility of the open-ended materials provided for children in the NEC allowed children to use those materials in improvisational ways, which encouraged innovation, creative representation, making comparisons and making analogies. When materials can only be used one way, the opportunities for creative problem solving are nearly zero. When materials are about the "right" answer and getting to that right answer in a specific way, they limit children's thinking and problem-solving. Open-ended materials, however, encourage children to think outside the box, and to explore multiple possibilities. Children then have the freedom to create solutions that are based on and test their current and emerging knowledge. If they are not successful they go back to the drawing board, having learned something about what did or did not work, and start the process over. Each time they do this, they have the opportunity to learn through practice and continually refine their knowledge. This helps children develop foundational habits of inquiry and encourages them to look within for answers. They become more confident in their abilities to problem-solve, which allows them to take necessary intellectual risks.

Skill Development in the NEC

One of the most significant insights we gained as we examined the skills children were developing as they interacted in the NEC, was that children were developing multiple skills simultaneously. It was often difficult to determine which Nature Notes to cite as examples of a single skill, because each observation documented several skills children were developing. For example, we will use one, brief Nature Note to illustrate this. As three girls, all three-years-old, played in the sandbox, Christy found an eight-inch piece of bark and said to her friends, "Look, it's a big treasure." Patrick, who was nearby

and overheard Christy's comment, came over and said, "It's a big treasure (repeating what she had said, then adding). I think that's bark." Christy repeated, "Look guys, it's a big treasure," telling the other girls and ignoring Patrick's remarks. Patrick responded, "No, it's not a treasure, it's bark." A short time later Christy held up a golf ball sized rock and said to the others, "I found another treasure." Ingrid replied, "Hey, that's a rock. It's a rock *treasure*" (S. Walsh, 10/27/09). This simple dialogue between these children illustrates a number of different skills children were using. They practiced their social skills as they interacted and debated about their discoveries (e.g., engaged in reciprocal conversation, listened and responded to one another); exercised their visual/spatial skills (e.g., in particular through close observation as they identified objects in the NEC); used creative representation skills (i.e., tree bark and a rock symbolically represented a "treasure"); used math vocabulary (e.g., "big" and "another"); practiced language/literacy skills (e.g., labeled items such as "bark" and " treasure", and engaged in dialogue using complete sentences); and learned about science (in their exploration/classification of bark and a rock). This single Nature Note illustrates that children were not learning single skills in isolation. All 61 Nature Notes we analyzed identified multiple skills children were developing simultaneously as they engaged in play and work in the NEC. This whole-child learning occurred in the context of meaningful, child-initiated activities that met the needs of every learning style.

Social Skills

The freedom children had to choose their activities and to spend long periods of time together in shared experiences created an environment that was rich with opportunities for social skill development. They learned to negotiate, collaborate,

cooperate, and problem-solve with others. They naturally encountered peers as they played and learned how to enter other's play or include others in theirs. They learned from peers through their social interactions. Previous research has substantiated that when children are in environments that provide opportunities for shared experiences and inquiry, there are greater opportunities for developing social competence. Having opportunities to experiment with social strategies in the context of play helps children gain the skills they need to initiate and sustain effective social engagement (Katz & McClellan, 1997).

Teachers documented a great deal of inclusive language as children played together (e.g., "we", "us", "our", "let's"). The spaciousness of the NEC, the designated areas (e.g., sand, dirt digging, messy materials, garden, climbing/crawling) and availability of natural materials meant that children did not engage in frequent conflict over space and materials; instead they had conversations about the materials they were using, and their ideas and plans. This is significant, because typically children who are not worried about defending their space and materials feel a greater sense of security and community, which allows them to include others in their play more easily and frequently. The openness of the space offered opportunities for children who were playing near another group of children to blend their play easily and naturally. When children initiated activities they were interested in, they took ownership of those activities, often directing peers and teachers in ways to participate. We identified specific leadership skills children were developing in more than a third of our Nature Notes (22/36%). When teachers assumed a less directive role there were more opportunities for children to take the lead. Teachers also recorded several observations where children shared leadership (and took

turns) during an activity, switching roles as it seemed necessary. When children constructed their own play and assumed roles they created, they were in charge of their experience and did not rely on teachers to tell them what to do. Taking the initiative to exercise leadership skills through play helps children develop confidence in their knowledge and abilities and gives them the courage to act on those.

Language/Literacy Skills

Our findings suggest that the NEC provides a language-rich environment for children to engage with peers, teachers and other adults. Children frequently dialogued about their play with peers or teachers. They discussed what they wanted or intended to do, described how they were going to do it and what materials they needed, and narrated what they were doing as their plan unfolded. Plus the richness of the materials available to children meant that they had multiple opportunities for discovery and inquiry, which nearly always resulted in conversations with others about what they had found, what they were going to do with the materials, and what the materials symbolically represented.

The richness of the outdoor classroom gave children so much to talk about with others. They shared joy in their discoveries, told stories, asked questions, shared information, created elaborate "pretend-play" scenarios, and often processed their thoughts verbally. Children created their own dialogue, rather than using a prescribed script, which made their conversations richer and more meaningful. Children had lots of opportunities to experiment with language, and learn new vocabulary. Teachers frequently asked open-ended questions or made verbal observations that prompted children to formulate and express their thoughts to others.

Children also had access to environmental print in the NEC, and it was material that was interesting to them. Children found words on signs, in books, on plant stakes and seed packets near the garden, on boxes and on buckets. They incorporated the print they found into their play, sometimes reading it conventionally and sometimes making interpretations based on other cues. Authors have suggested that it is important for young children to see and use print as they are becoming readers. These experiences help them understand the function of print, associate letters with meaning, and give them meaningful, predictable print to read (Harste, Woodward & Burke, 1984). There is more to learning to read than letter/sound relationships and this exposure to environmental print allows children to gather more information such as what letters look like, how letters are combined to form words and what kinds of information words convey (Harste, Woodward & Burke, 1984).

Math Skills

Children had many opportunities to explore math concepts, both physically and cognitively, as they engaged in child-initiated experiences in the NEC. It is important that children truly understand math concepts and how to use math to solve problems in order to become "mathematical thinkers" (versus practicing rote memorization of numbers and numerical facts) (Copple & Bredekamp, 2009). Young children need lots of varied math experiences because they develop math skills the same way they develop other skills; through repetitive, active engagement with their environment (Copley, 2000).

Children had many opportunities to observe and experience size comparisons in the NEC, particularly because of the availability of natural, open-ended materials. Many

of the materials in the NEC are simply not available indoors. Children used twigs, sticks and branches of all sizes and had first-hand experiences comparing them or choosing the size(s) that met their needs. They frequently estimated and made size comparisons. They explored concepts of weight as they lifted heavy car tires, or moved large rocks or large branches, which gave them first-hand experience with what "heavy" felt like. They created lines (e.g., single, multiple, parallel, perpendicular) out of large materials (e.g., planks, stumps, logs, crates) and observed first-hand what the concepts of "long" and "lines" looked like. They had the opportunity to understand whole-part relationships, because of the nature of the environment (e.g., whole and parts of trees, flowers, and plants). Children regularly engaged in dump and fill activities, which helped them learn about quantity and volume. They counted, sorted and classified materials THEY collected and were interested in. Children experienced time concepts first-hand, as they observed living organisms in the NEC and their natural growth cycle.

The materials available to children in the NEC created opportunities for them to become mathematical thinkers. Children encountered real problems that required math as they played and were motivated to find solutions to those problems. They naturally, through play, used math to solve problems and used math language to describe their experiences, materials, and surroundings.

Science Skills

Chalufour and Worth (2003) described several guiding principles for young children's scientific exploration. It is important that science content comes from children's experiences, and that it is interesting and engaging to them. Children need opportunities to explore science content experientially and over time. These principles

were evident in the NEC. Children were fully engaged in science learning as active explorers (hands-on, with their whole bodies). They used their prior knowledge as a basis for processing their discoveries. They experienced the natural world with multiple senses, had the time to become immersed in their exploration, had opportunities to speculate and experiment, and to revisit concepts over and over. They hypothesized, tested their hypotheses, and formulated conclusions.

Developing science skills involves much more than rote memorization. Children must experience science concepts first, before they can truly understand and articulate the scientific principles. They need to see the principles in action, and explore every aspect of those principles in order to develop a working knowledge of science (Chalufour & Worth, 2003). The NEC was a rich science laboratory for children. They primarily directed their own discoveries and fully explored the space and materials. They learned about the natural world intimately through first-hand encounters with nature. For example, they developed an intrinsic understanding of moss as they explored it with their senses, touching it and noticing its surroundings. They more fully understood the effects of raindrops or wind on their bodies and on objects in the NEC as they encountered the phenomenon of weather. They felt the breeze and water in their hair, and listened to and observed the wind blow leaves, branches, and curtains. The unpredictable nature of the NEC kept children inquiring, and in the process, helped them develop a greater understanding of natural systems.

Children used all of their senses in their explorations of the NEC, which created a much richer understanding of the world around them. When children held branches and felt the bark, looked at the lines and shapes of the branches, felt the textures and noticed

the colors of them and experienced the weight of them, they developed a deeper understanding of branches and their properties. This learning was richer because they saw the branches in context, with the whole tree, and all the parts. Contextual, hands-on experiences with nature help children develop a deeper understanding of and appreciation for the world around them. Children also shared space in the NEC with living creatures (e.g., lady bugs, butterflies, insects), which allowed children to learn about species in their natural habitats through first-hand observation.

Kinesthetic Skills

Children developed kinesthetic skills (related to body competence) naturally in the NEC because they had numerous opportunities for whole body movement. Because the space and layout of the NEC is well planned and designed intentionally, it encouraged children to use their whole bodies in a variety of ways (e.g., running, dancing, climbing, digging, swinging, transporting materials in and across areas). Many of these movements are not only impractical indoors but are much less safe compared to outdoors. Areas designed for specific purposes encouraged specific types of movement. For example, the open area provided lots of space for children to run and dance. The crawling/climbing structure provided opportunities for children to climb, balance with their bodies, hang from their arms, jump and experience a variety of levels. The sand, digging, and building areas (and the materials available in those areas) provided opportunities for children to develop both fine and gross motor skills as they manipulated materials and learned to manipulate tools. The variety and unpredictability of surfaces in the NEC also created opportunities for children to develop greater body competence, because they negotiated the terrain and found secure footing and balance. The NEC provided the space for

children to *really* move; to use their bodies to the maximum and challenge themselves physically.

The time children spent outdoors afforded them opportunities to repeat kinesthetic experiences over and over, which helped them build muscle memory, and develop body awareness, strength and agility at a critical time in their physical development. By nature children are active learners. The spaciousness and design of the outdoor classroom and variety of materials and tools provided allowed them to respond to their bodies' need to move, in ways that could not have happened indoors.

Construction/Engineering Skills

Teachers documented children building with both natural and manufactured materials in the NEC. In our analysis, we noted that the more organic-shaped, natural materials children manipulated in the NEC were less predictable than manufactured materials, which required children to use their imaginations more, and do much more problem-solving and critical thinking (compared to when they worked with more predictable building materials, which are often what is available indoors). The spaciousness in the NEC contributed to the kinds of building experiences children had, because it was large enough for children to spread out, for multiple children to work together on building projects, for children to use more and larger building materials and build on a much grander scale (compared to building indoors).

Unit blocks or table-top blocks indoors provide important opportunities for children to develop construction and engineering skills. However, when these same materials are available in the NEC, they provide children with a new level of challenges and a wider range of added materials to incorporate into their imaginative play. The use

of tree cookies, sticks, stumps, planks and rocks as building materials gave children opportunities to use a variety of construction skills. Building with large, natural materials (e.g., stumps or long branches) is not practical indoors. However, in the NEC children had access to those and other materials, which broadened the range of skills they were developing. The availability of unpredictable materials (such as planks, branches, stumps, and twigs) meant that children needed to think more deeply about how to work with those materials and test and refine their theories as they honed their construction skills.

Because children had large, open space outdoors to build sprawling structures, they did not have to curtail their imaginations or their sometimes elaborate designs. They could spread out and build large-scale as well as small-scale structures. The unpredictable nature of the various surfaces outdoors also provided children with opportunities to gain construction and engineering skills (e.g., balancing objects, stacking, creating a sturdy base, using fasteners). They had to think about how to build on the grass, on the wood chips or the sand.

Key Characteristics of the Nature Explore Classroom that Supported Children's Skill Development

This research substantiates that children were successful in the Nature Explore Classroom (NEC) for three reasons: 1) the intentional design of the space (including the spaciousness); 2) the intentional selection of materials (including type and availability); and 3) teachers' support of children's learning through primarily child-initiated activities. The NEC was designed to allow a large number of children to move freely and work simultaneously without the need to defend their space and materials. Children need enough space to run, explore and spread out. Outdoors, children do not walk calmly from

activity to activity; they move at a gallop. The spaciousness of the NEC allowed children to use their whole bodies; to run, dance, balance, climb, jump, twirl or roll. They could move without interfering with the activities of other children using the space, which reduced conflict and allowed children more opportunities to work in harmony. The space was designed to encourage independence and self-initiation through thoughtfully planned areas where children could make choices and easily access the materials they needed to pursue their plans.

The design of the space, divided into specific areas (e.g., music and movement, block building, dirt digging, sand, messy materials, nature's art), provided structure for children to plan their activities. Children could depend on the predictability of the space to support their play. They knew the function of each area and the materials that were available there. If, for instance, their plans involved musical instruments, they moved to the music area where the space was designed for musical experiences and instruments were readily available. They did not need to seek the assistance of a teacher to gather materials for them, they simply went to the area where they knew those materials existed. This enabled children to spend time focusing on their experiences, to get to the heart of what children do best – play. Children learned the structure of the NEC, what materials were available in specific areas, and what their bodies could do in those areas (and with the materials). The spaciousness of the NEC provided opportunities for children to interact in groups or choose to spend time alone, quietly observing. Overall, the predictability of the space allowed children to feel safe and exercise ownership as they engaged in activities within the parameters of the NEC's organizing structure.

Materials, intentionally selected by teachers, fully supported children's skill development in the NEC. In particular, natural materials encouraged children's exploration, creativity, investigation and problem-solving. Many of the materials existed naturally in the NEC, while teachers intentionally placed other materials there. The open-ended nature of materials (e.g., pinecones, sticks, rocks and leaves) encouraged children to think creatively about how to incorporate them into their play. This is significant because if the materials in the NEC had been primarily manufactured (e.g., plastic food, pre-formed toys with specific functions), the opportunity for creative representation would be mostly lost. It was the accessibility of open-ended materials (also called "loose parts") that allowed children to fully engage with their minds and create new uses for those materials; to transform them through their imaginative play and to explore their properties in new ways. The variety of materials provided also encouraged children to develop both fine and gross motor skills (e.g., handling small items such as pebbles, sand, twigs, acorns, versus using their whole bodies to manipulate logs, stumps, large rocks, long branches, and tools).

Children's access to natural materials helped them connect with the natural world and understand and appreciate it more fully. They explored the properties of sand and water. They observed leaves falling from the trees and touched moss growing on a tree trunk. They explored plants in the garden and learned to care for them. Each sensory experience gave children a better understanding of nature and promoted a sense of curiosity and wonder about the world around them.

Teachers' Role in Supporting Children's Skill Development

Though a key focus of this research was on children's initiative, teachers played a critical role in children's skill development in the Nature Explore Classroom. One of the key factors that contributed to children's success in the NEC was teacher presence. There were enough teachers (intentionally) in the outdoor space to ensure that children had access to teacher support and engagement. The ratio of children-to-teachers in the preschool age group was 7:1. This low ratio allowed teachers to be focused on individual children or groups of children, whether quietly observing or actively interacting with them. Had there been fewer teachers, their main task would have been watching children to ensure their safety rather than observing them, engaging in activities and conversations with them, and documenting their experiences in the NEC.

Children learned from teachers' thoughtful and caring involvement. Authors have suggested that children benefit from interacting with teachers who are responsive and caring and need teachers who are available to them both physically and emotionally (Biber, 1984; Copple & Bredekamp 2009). Teachers in the NEC were in close proximity physically to where children were playing, and children trusted teachers to be there when and if they needed them. This gave children the confidence to initiate and follow through on their plans, explore materials and take risks. Teachers supported children's initiative, and frequently (intentionally) chose to stay out of children's way to empower them to direct their activities. Our teacher/co-researchers modeled curiosity for children, especially with their "I wonder" statements and their hands-on exploration of materials alongside children. Teachers fostered inquiry and critical thinking when they asked

open-ended questions. These questions were often the impetus for deeper exploration and greater skill development for children.

The teachers who documented children's learning in this study had a unique role as participant-observers in the setting. In their primary role, as teachers (participants in the setting), they were responsible for their children's learning and safety. In their secondary role, as co-researchers, they were the human data collection instruments, trained to pay close attention to children's actions and words and to record those using a specific documentation protocol. This level of close observation elevated teachers' awareness (documented in focus group interviews with teachers) and was important in scaffolding children's learning. Teachers' close observation helped them make decisions about when and how to engage children. It also provided opportunities for authentic assessment, so they better understood where their children were developmentally, and could scaffold them to the next level. This allowed teachers to tailor their support to children's individual needs, rather than using a "one size fit's all" approach, which is not effective in working with young children.

Children were aware that teachers were closely observing them, and initiated interaction with them in a variety of ways. They specifically requested teacher assistance, and shared their knowledge with teachers. They invited teachers to participate in their play scenarios, sometimes assigning roles to teachers. In many cases, teacher support was about following their children's lead and allowing children to orchestrate their play.

Underlying Program Structure in Support of Child-Initiated Experiences

In order to successfully create an outdoor classroom that fosters children's skill development, first programs need to philosophically and structurally support the concept.

At this site, the underlying program philosophy and structure was dedicated to supporting children's learning in nature and fostering children's initiative. The written philosophy of the program recognized the importance of children connecting with nature and spending significant time outdoors. The program's long history of advocating for time for children to play outdoors influenced everything from daily routines to the NEC design. The flow of children moving between the indoor classrooms and outdoor NEC occurred naturally so that children were able to follow their own plans. There was an order to the day for routines such as snacks, lunches and nap-time, yet teachers exercised flexibility based on children's needs and interests (see daily schedule, Appendix D). This flexible routine and the indoor/outdoor flow allowed children to spend large blocks of uninterrupted time outdoors. Children were able to fully invest in hands-on, experiential learning activities without being asked to transition indoors or move to a new activity. Teachers respected children's competence to make plans and decisions, initiate experiences, and direct their own learning. Teachers trusted children's ability to construct knowledge by engaging in experiences that were meaningful to them.

The child-centered philosophy of this early education program, which honored children's initiative, provided a framework for teachers to use in their work with children. It recognized the importance of the teachers' role in observing, guiding, facilitating, supporting, respecting and advocating for children. The program philosophy and teacher-child ratio supported teacher availability and engagement with children and the need for children to take appropriate risks in order to learn.

Implications

This study clearly illustrates the value of children spending time in a well-designed, nature-filled outdoor space with caring adults who support and extend child-initiated activities. The environment in the Nature Explore Classroom (NEC) was critical in supporting children's success and skill development. The word "intentionally" has been a recurring theme in this paper. Intentionality, in the context of this site, included the configuration of the outdoor classroom space, the specific areas constructed in the NEC (e.g., materials/surfaces used, different levels), the loose, natural materials provided for children, and the teachers' role in observing and interacting with children in the NEC. In setting up the NEC, the Ten Guiding Principles outlined in the Learning with Nature Idea Book (Arbor Day & Dimensions, 2007) provided a useful framework for designing a space that supported children's active, multi-sensory learning with nature. Though there are many different ways to implement the principles articulated in this book, their underlying structure ensures that children have a rich and stimulating environment where they can experience the wonder and beauty of nature with their minds and bodies. One implication of this study is that programs need to be very intentional about the kind of outdoor space(s) they want to create for children; to be thoughtful in the design of the space and in selecting natural materials that will facilitate children's learning through inquisitive exploration.

The Nature Explore Classroom concept was created based on sound educational and environmental principles that have been substantiated in the literature. For example, authors have suggested that it is important to provide an abundance of natural materials for children to discover, inspect, interact with, and manipulate (Copple & Bredekamp,

2007). Interacting with nature in the NEC provides children with opportunities for surprises at every turn. Children get to interact with live plants; smell the fresh fragrance of blossoms, taste sweet strawberries plucked from the garden, feel the tickle of the grass beneath their feet and hear the wind blow through the trees. Ladybugs on a leaf, leaves and twigs dropped from trees and rocks under a bush are types of natural materials that inspire a sense of curiosity and wonder, and encourage a deep connection with nature.

Children also need access to plenty of natural, open-ended materials that provide interesting experiences with loose parts (Child Educational Center, 2006; Epstein, 2007). Having materials children can manipulate and move creates a sense ownership over their environment, which they feel freer to act upon. When they are not constrained by ideas of convention they can fully invest in their plans. The overall outdoor space should be carefully divided into areas that remain relatively stable so that children know where to find materials and can make plans based on an understanding of the outdoor classroom's structure. Equally as important, children should be able to move easily from one area to another as their play dictates. Teachers and administrators should be thoughtful and intentional about setting up their spaces, considering their knowledge of children's needs and interests, creating an intriguing and perhaps magical space for children to explore.

When creating outdoor classrooms, it is important to leave spaces for children to fill (Child Educational Center, 2006). Children need room to spread out; to move their bodies, manipulate materials and explore the environment without constantly worrying about others encroaching on their space. The first thing people should hear when they enter the NEC is the sounds of busy, happy children. While it is important for children to experience some conflict in order to learn how to manage it, the stress of frequently

defending space and materials can inhibit children's ability to take full advantage of an experience, depriving them of important opportunities for skill development.

Teachers need to be flexible in their expectations of children in nature-based outdoor classrooms. This study supports previous literature that suggests it is essential that teachers be willing to let children initiate experiences, take the lead in activities and conversations, and to take reasonable risks with their bodies and materials (Biber 1984). It is through this expanded freedom that children more fully experience the space, materials and environment, adding to their skill development and to the depth of their understanding of the world around them.

The underlying structure of a site or program will impact the success of child-initiated experiences outdoors. Programs with indoor classrooms that offer direct access to their outdoor classrooms and allow children to move freely between the indoors and outdoors are the most ideal. The direct access from indoors to outdoors allows children to spend the time they need to fully invest in their play and not worry about how much time is left before they must go inside. While many programs do not have direct access to their outdoor spaces they can still create a schedule that gives children large blocks of time outdoors. A minimum of 60 minutes is recommended for children to fully invest in their play (Copple & Bredekamp, 2009; Lester & Maudsley, 2006). Once teachers and administrators fully understand the valuable skills children develop in the outdoor classroom, they can work together to find ways to rearrange the daily routine to allow children significant time outside.

The number of teachers available to children in an outdoor classroom can have a huge impact on children's experiences. The teacher-to-children ratio needs to allow

teachers to be physically and mentally present with children, at their level. The state ratio for licensed preschools in California (where this study was conducted) is 12 children for every teacher and is not at an optimal level to provide the kind of interaction and engagement needed to fully support children's skill development (NAEYC, 2005). The low 7:1 ratio at our site's early education program allowed teachers to not only be near children, but to spend time observing them closely, assessing their development, and making thoughtful decisions about ways to engage with children to best facilitate learning. For many programs a 7:1 teacher-child ratio may not be economically feasible; however, creative use of parent volunteers or student teachers may help make lower adult-child ratios possible.

Lastly, the overarching philosophy of the site or program must acknowledge and embrace the value of unstructured play for children, the role of child-initiated activities in learning, and the importance of children spending time outdoors, connecting with nature. This underlying program support is what all of our recommendations are based upon. Each recommendation (individually) may be possible to implement without program support, but in order to have a fully developed outdoor classroom, including daily routine, ratio and support for children's risk taking, there needs to be a comprehensive program philosophy that fully embraces these ideals. Teachers simply cannot be as effective in supporting children's learning in an outdoor classroom without the program embracing these principles.

All children deserve the rich learning that can occur through opportunities to experience the beauty of nature that spending time in an intentionally designed outdoor classroom can provide. This study confirms that children's learning will be deep and

meaningful when outdoor environments: a) have been designed with children in mind; b) have an abundance of natural materials and spacious, thoughtfully divided areas; and c) have staff who have made a commitment to giving children time to engage, explore, and play. In fact, important learning will take place through that play, in ways that could not happen solely in indoor classrooms. Children will have many opportunities to develop important foundational skills that will prepare them for future learning and a life filled with a sense of wonder and joy in discovery.

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Appendix A:
Sample Nature Notes Data Collection Form

Appendix B:
Sample Recorded Nature Note (typed)

Appendix C:
Sample Analysis Form

Appendix D:
Child Educational Center Daily Schedule