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Young Children's Authentic Play in a Nature Explore Classroom Supports Foundational Learning: A Single Case Study

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Note: An earlier version of this research, highlighting 15 authentic play examples, was published on Dimensions' website in 2009. Our original work was significantly expanded for this publication. Many of the site photos were included in the original version.

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1. Prologue and Introduction

Why is play increasingly disappearing from the landscape of our children's lives? And what legacy will we leave our children, and our children's children, if we do not provide opportunities for them to experience the wonder of nature as they play ~ to create childhood memories that will be emblazoned on their hearts forever?

Prologue

Once upon a time, in the not so distant past, many children left the adult world on a daily basis and entered an outdoor world filled with fantasy and improvisation. They played alone, in pairs, or in groups. Using sticks, branches, logs, sand, dirt, water and other natural materials they built forts, castles, houses, ships, rockets – some were large scale models while others were miniatures. As they ran, jumped, dug, climbed, threw, slid, twirled and whirled, their imaginations took them across the prairie in covered wagons, up the tallest mountains, into outer space and on high sea adventures. They assumed the roles of family members, animals, performers, and the occupations of those in their communities. They fought fires, bad guys, monsters, and aliens. They used few props, and the props they used were products of their own resourcefulness. They organized their own sports games, where they were the players, coaches, and referees. They used negotiation and problem-solving skills to create and adapt the rules. At the end of the day, they returned indoors dirty and tired but feeling happy, confident, competent and full of stories. These children were immersed in authentic play in the outdoors, play that engaged them mentally, physically, socially, and emotionally.

Introduction

Extensive research has documented the powerful role of play in children's development and the importance of getting children outdoors. Yet, in today's culture both play and time in nature have become endangered species. Play expert Stuart Brown (2009) provided compelling evidence that a "play deficit" exists (p. 43), and Richard Louv's (2005) well-known book, Last Child in the Woods, described the growing phenomenon he labeled "nature deficit disorder".

So, why is play increasingly disappearing from the landscape of our children's lives? Dr. Kenneth Ginsburg (2007), in his clinical report to the American Academy of Pediatrics, cited several factors that have contributed to the reduction of unstructured, child-driven play (see Table 1), including the demands of an increasingly pressured and hurried lifestyle, increasing pressure for children to begin building their college resumes at much younger ages, the impact of "No Child Left Behind" that has shifted focus to teaching and testing "academic" skills (e.g., reading and arithmetic), and the impact of technology, which has resulted in children being passively entertained by television, computer and/or video games.

All of these factors have significantly impacted the focus of educational programs for young children. For example, three studies conducted between 1982 and 2002 concluded that the prevalence of social, pretend play for 4.5 year-olds in community-based childcare centers dropped from 41% to only 9% (Hirsh-Pasek et al., 2009). With a greater focus on teaching academics, "early childhood programs today have many more didactic components than they did 20 years ago". In fact,

"I make lots of castles" three-year-old Michael told his teacher, and added, "that's the flag…the leaf pokes through on the stick".

the pressure to didactically teach "academic facts deemed essential for 'success' in today's schools is squeezing out developmentally appropriate education in the early years, the cornerstone of which is rich, playful experiences aimed at developing the whole-child" (p. 6). Hirsh-Pasek et al. suggested that, "despite extensive research…that clarifies the components of excellent, effective early education through playful learning, U.S. preschools and kindergartens are becoming academic 'bootcamps'" (p. 10).

At the same time that play is disappearing for children, so is time spent in nature. Louv (2005) cited key research that examined the "de-naturing of childhood" (p. 31) and suggested that, in fact, "our society is teaching young people to avoid direct exposure to nature" (p. 2). One of the primary reasons for this shift is our increasingly technological society. Though we have experienced the benefits of technology in many ways, Elkind (2007) lamented that one negative consequence of the proliferation of automated "toys" and gadgets is that our "increasingly technological, automated society is taking us farther away from the natural world" (p. 7).

Researchers at the University of Maryland discovered that between 1981 and 2003, in a typical week children lost over nine hours of discretionary time, and computer use doubled. Studies released in 2005 and 2006 by the Kaiser Family Foundation, concluded that children between the ages of 8 and 18 "spent an average of nearly 6.5 hours a day plugged in electronically" (Louv, 2005, p.119). One of the measurable impacts of this for young children is that preschoolers "risk for obesity increases by 6% for every hour of TV (they) watch a day" (Linn, 2008, p.49). Though the "childhood link between outdoor activity and physical health is clear…the population of overweight children between ages two and five increased by almost 36% from 1989 to 1999. Two out of ten of America's children are clinically obese – four times the percentage of childhood obesity reported in the late 1960s" (Louv, 2005, p. 47).

Table #1: Factors Contributing to the Reduction of Unstructured, Child-driven Play

- **an increasingly hurried and pressured lifestyle**
- **increased focus on academic preparation in lieu of a broader view of education**
- **children's schedules are becoming highly packed with adult-supervised or adult-driven activities**
- **a media deluge that suggests "good parents actively build every skill and aptitude their child might need from the earliest ages"**
- **the pressure for children to begin building their college (academic) resume starting at much younger ages (i.e., early competition to secure a desired spot in higher education)**
- **children are encouraged to carry increasingly rigorous academic schedules resulting in less free time**
- **a national trend focusing on the "academic" skills of reading and arithmetic (spearheaded by the No Child Left Behind Act of 2001)**
- **children are more passively entertained through television and/or computer/video games**
- **in many communities, children can not play outdoors safely without close adult supervision**

Source: Dr. Kenneth Ginsburg (2007)
Clinical Report – American Academy of Pediatrics

A study published in 2003 concluded that the "rate at which American children are prescribed antidepressants almost doubled in five years; the steepest increase – 66% – was among preschool children". Louv (2005) indicated that although "countless children who suffer from mental illness and attention disorders do benefit from medication…new evidence suggests that the need for such medications is intensified by children's disconnection from nature" (p. 48). Ultimately, as young children "spend less and less of their lives in natural surroundings, their senses narrow, physiologically and psychologically, and this reduces the richness of the human experience" (p. 3).

Unfortunately, White (2004) suggested, children's physical boundaries outdoors have shrunk due to numerous factors, one of which is a growing culture of fear for children's safety outdoors. He cited a study published by Clements in 2004 that concluded that 82% of mothers who had children from 3 to 12 years of age identified crime and safety concerns as a primary reason they did not let their children play outdoors.

The Case for Play

Dr. Ginsburg's (2007) Clinical Report to the American Academy of Pediatrics noted that "play is so important to optimal child development that it has been recognized by the United Nations High Commission for Human Rights as a right of every child" (p. 182). Referencing numerous research-based publications, Ginsburg identified multiple benefits of play (see Table 2). He stressed that play is "essential" to children's cognitive, physical, social and emotional wellbeing and is important to children's healthy brain development.

Dr. Stuart Brown (2009), recognized as one of the leading experts on play behavior in the U.S., suggested that play "seems to be a driving force helping to sculpt how the brain continues to grow and develop" (p. 42). Brown explained that play promotes "new connections (in the brain) that didn't exist before, new connections between neurons and between disparate brain centers…these are neural connections that don't seem to have an immediate function but when fired up by play are, in fact, essential to the continued brain organization" (p. 41). Not only does Brown's work apply to children, but he also described the importance of play for adults. He cautioned that "when we stop playing, we stop developing, and when that happens, the laws of entropy take over – things fall apart. When we stop playing, we start dying" (p. 73). The implications of this are astounding for young children who are not afforded the opportunity to play.

According to Hirsh-Pasek, Golinkoff, Berk and Singer (2009), play is important to "every single developmental domain" (p. xi). It helps children develop fine and gross motor skills and social skills. It is central to emotional development, providing catharsis for children's fears, opportunities to process negative experiences, and teaches children self-regulation. In addition, play has been identified as one of the best tools in battling childhood obesity.

Linn (2008) described play as a "fundamental component of a healthy childhood" and suggested that it is "inextricably linked to learning and creativity" (p. 19), "essential to the development of creativity, empathy, critical thinking, problem-solving and making meaning" (p. 26). She explained that play is central to the "capacity to take risks, to experiment… to act rather than react…". In fact, "children often use pretend play to reflect on their lives the way many adults use journal writing" (p. 19).

Engaging in social play is so important for young children because it fosters both their IQ and EQ (Emotional Intelligence). It teaches children about problem-solving in a pleasurable way. Play promotes children's intellectual curiosity, develops better attention spans, and helps them develop mastery because during their play, "children are in charge; children are calling the shots, setting up their own problems, (and) controlling their own learning" (Hirsh-Pasek & Golinkoff, 2003, p. 255). According to Hirsh-Pasek and Golinkoff "researchers have discovered that play is related to greater creativity and imagination and…to higher reading levels and IQ scores". In fact, they suggested that based on research examining the benefits of play, "a new equation is in order: PLAY = LEARNING" (p. 208).

Hohmann and Weikart (1995) concluded that pretend play in the preschool years "allows children to make

Table #2: Benefits of Play

- **important to healthy brain development**
- **allows children to use creativity while developing their imagination, dexterity, and physical, cognitive, and emotional strength**
- **allows children to create and explore a world they can master, conquering their fears while practicing adult roles**
- **helps children develop new competencies that lead to enhanced confidence and resiliency to face future challenges**
- **allows children to work in groups, share, negotiate, resolve conflicts, and learn self-advocacy skills**
- **child-driven play allows children to practice decision-making skills, move at their own pace, discover their own areas of interest, and engage fully in their passions**
- **builds active, healthy bodies**
- **is integral to the academic environment –helps children adjust to the school setting and enhances children's learning readiness, learning behaviors, and problem-solving skills**
- **unscheduled play that allows time for peer interactions are important components of social-emotional learning**
- **less verbal children express themselves through play, giving parents (and teachers) a better understanding of their perspectives**

Source: Dr. Kenneth Ginsburg (2007)
Clinical Report – American Academy of Pediatrics

a number of cognitive gains as they try out new ideas and skills. Advances in children' play skills not only serve as indicators of preschoolers' advancing cognitive skills but also are critical in fostering further cognitive development" (p. 131).

Well-known author David Elkind (2007) suggested that during the early childhood years, play IS "the dominant and directing mode of learning" and that "children learn best through self-directed learning experiences" (p. 7). It is these "self-directed play experiences (that) nourish and support (children's) maturing mental abilities" (p. 128) and research supports the notion that when children learn concepts through play both their learning and memory "seem to be fixed more strongly and last longer" (Brown, 2009, p. 102).

Interestingly, for many years, **play** was described as a child's work. Paley (2004) explained:

"First there was the business of deciding who to be and who others must be and what the environment was to look like and when it was time to change the scene. Then there was the even bigger problem of getting others to listen to you and accept your point of view while keeping the integrity of the make-believe, the commitment of the other players, and perhaps the loyalty of a best friend" (p. 2).

Paley referenced the revision of educational priorities nationally, which has impacted early education programs and kindergartens across the country, and asked, ironically, if it is possible, that "work is now the play of children" (p. 2)?

Through their years of research, Hirsh-Pasek and Golinkoff (2003) concluded that "…play is to early childhood what gas is to a car. It is the very fuel of every intellectual activity that our children engage in" (p. 214).

The Case for Helping Children Connect With and Play in Nature

Extensive research has substantiated the physiological, psychological, intellectual, social and altruistic benefits of connecting children with nature (see Table 3). Keeler (2008) described the natural world as "a great friend and teacher to young children" because it "offers infinite opportunities for wonder and learning, with surprises around every corner." He posited that the "power of nature to teach and inspire" should be reason enough to make weaving "nature into the lives of young children" a priority (p. 55).

Wells and Evans (2003) concluded that the benefits to children were greater when they experienced a greater amount of exposure to nature. When children engage in play in outdoor environments, their play seems to be more diverse. They are more likely to engage in creative and imaginative play that fosters the development of language and collaboration skills (Fjortoft & Sageie, 2000; Moore & Wong, 1997; Taylor, Wiley, Kuo & Sullivan, 1998). Children have opportunities to develop social skills as they engage in play with their peers, and Moore (1996) suggested that children who play together in nature have more positive feelings toward one another. Researchers have concluded that play in diverse, natural environments tends to reduce or eliminate anti-social behaviors such as bullying and violence (Coffey, 2001; Malone & Tranter, 2003; Moore & Cosco, 2000).

Authors have described the emotional and ecological benefits of spending time in nature. When children play outdoors, in a rich environment, it instills in them a sense of peace and being at one with the world (Crain, 2001). Spending time in nature is important for children to develop their eco-psychological selves. Phenice and Griffore (2003) suggested that children's sense of self needs to develop in conjunction with and as a part of nature and that regular, positive interactions with nature are instrumental to helping children develop a respect for the environment. When children play in nature, the result is a marked increase in children's interest in and knowledge of nature (Fjortoft, 2001).

Time in nature also diminishes the impact of stress on children, and helps them handle adversity (Wells & Evans, 2003), which is critical to helping children cope in this increasingly hurried and pressured society. Peter Kahn identified "over one-hundred studies that confirm that one of the main benefits of spending time in nature is stress reduction" (as cited in Louv, 2005, p. 49).

Howard Gardner (1991) suggested that the value of learning in nature (what he called "outdoor education") is that the learning is not bound to school settings; rather nature education fosters connected knowing that is not separate from but an integral part of life.

After viewing Nature Image Cards indoors, two girls were delighted to discover the same flower outdoors and giggling, said, "Let's be the flower".

Table #3: Key Benefits of Positive Experiences With the Natural World

- increased concern for the environment (Palmer, 1993)
- increased sense of wonder and imagination (Cobb, 1997; Wilson, 1997)
- improved ability to concentrate (e.g., children with ADD) (Taylor et al., 2001)
- increased powers of observation and creativity (Crain, 2001)
- increased motivation for life-long learning (Wilson, 1997)
- improved awareness, reasoning, and observational skills (Pyle, 2002)
- improved personal skills including confidence, social skills, self-efficacy (Dillon, J., Morris, M., O'Donnell, L., Reid, A., Rickinson, M., & Scott, W., 2005)
- reduced stress/greater ability to deal with adversity (Wells & Evans, 2003)
- increased language and collaborative skills (Moore & Wong, 1997)
- increased development of senses (Louv, 2005)
- increased knowledge and understanding of geographical, ecological or food production processes (Dillon, J., Morris, M., O'Donnell, L., Reid, A., Rickinson, M., & Scott, W., 2005)
- increased analytical, problem-solving, and critical thinking skills, and integration of math, science, language arts, social sciences and other subjects (Bartosh, 2006)

Source: Reproduced from the original article titled The seeds of learning: Young children develop important skills through their gardening activities at one Midwestern Early Education Program, previously published in the Applied Environmental Education and Communication Journal (Miller, 2007)

Dimensions' Research:

The Case for Authentic Play and Intentionally Designed Natural Spaces

This study describes the collaborative efforts of the Dimensions Educational Research Foundation and Arbor Day Foundation to address BOTH play and nature deficits through the creation of Nature Explore Classrooms that encourage children, families, and educators to connect with nature in meaningful ways. Specifically this research documents key learning that occurred for young children when they were engaged in authentic play in a Nature Explore Classroom. It also describes the ongoing commitment teachers and administrators at Dimensions Early Education Programs have made to provide intentionally designed outdoor spaces with a variety of rich, natural materials that children can explore daily with their whole bodies (and multiple senses).

In 2004 – 2005 Dimensions constructed the first Nature Explore Classroom, located at its research laboratory school (Dimensions Early Education Programs) in Lincoln, NE. The design of the space was based on years of research and field-testing on effective outdoor spaces for children. The unique interests and needs of the staff and families in the program and the unique features of the community were also an integral part of the design. Since then, teachers (who are co-researchers in our collaborative work) have closely observed and documented children's activities and interactions in the Nature Explore Classrooms. Teachers' record their observations on a "Nature Notes" child observation form (Appendix A), designed collaboratively by teacher/co-researchers and Dimensions' research director as a documentation tool. These Nature Notes serve multiple purposes. They assist teachers in understanding where children are developmentally so they can best scaffold children's learning. They are placed in children's portfolios and sent home to parents, to make children's learning visible to parents and families. Select examples of Nature Notes are incorporated into Dimensions' national educator workshop series, Nature Notes training, national publications, and Parent Newsletters. Teachers' Nature Notes are also submitted to Dimensions' research teams for analysis (see Figures 1 and 2 for examples of documentation used in this paper).

Using her hands Sara mixed sand and water, making three flavors of "cocoa" ("peppermint, cinnamon, and tomato"), then offered a taste to her teacher.

On a cold December day four-year-old Hannah made a "volcano", and explained, it "shoots hot lava out of the hole".

Figure 1: Sample - Nature Notes/Tichota

DIMENSIONS Child Observation Form – Nature Notes

Teacher/Observer: K. Tichota
Date: 4-14-08

Brief description of activity: Kade traveled the outdoor classroom searching for "bones."
Materials/props used: a bucket and sticks

Children	Age/Grade	Gender
Kade	5	M

Why you believe this is significant: Kade used close observation as he deliberately chose sticks to put in his bucket.

Time of Day/Location: 2 P.M.- Outdoor classroom

Location of Activity
- ☐ Climbing/Crawling area
- ☒ Messy Materials area
- ☐ Building area
- ☐ Nature Art area
- ☒ Garden/Pathways
- ☐ Greenhouse
- ☒ Music/Movement area
- ☐ Open area
- ☐ Gathering area
- ☐ Dirt Digging area
- ☒ Sand area
- ☐ Brick Wall

Resources
- ☐ Akambira
- ☐ Nature Art Table
- ☐ Tree Cookies
- ☐ Tree Blocks
- ☐ Square/Rectangle Blocks
- ☐ Rainstick
- ☐ Scarves
- ☐ Garden Tools
- ☐ Clipboards
- ☐ Magnifying Glasses
- ☐ Nature Image Cards
- ☐ Nature Image Posters
- ☐ Tape Measures
- ☒ Other a bucket

Kade was traveling throughout the outdoor classroom collecting sticks in a bucket. I asked Kade if I could interview him about what he was doing and he said, "Yes."
Mrs I.- "Kade, can you tell me about what's in your bucket?"
Kade- (Pulls a stick from his bucket and holds it up) "Guess what this bone is from? A saber-tooth cat teeth." (Pulls out another stick) "A leg from some type of animal." (Pulls out another stick) "This one looks like a fossil from a type of snake." As he takes out another stick, Kade said, "This looks like some kind of signal thing."
Mrs T- "What is a signal thing?"
Kade- "It's what you stick in the ground. It's a sign for help."
(Kade holds up another stick) "This is a triceratop's horn. That's all I can explain right now. If you have any questions, don't be afraid to ask."
Mrs. T.- "Kade, I think you're a scientist who studies bones, a paleontologist."
(Kade walks away and resumes his search.)

Digging in the sand with a small shovel David announced, "I'm a paleontologist…I'm looking for dinosaur bones".

When his teacher asked, "What do paleontologists do?", David explained, "they are persons" who "study bones".

We did not originally intend to write about play. In fact, we initially outlined an article on the math skills children were developing in the Nature Explore Classroom as they interacted with natural, loose materials. However, in our early examination of teachers' Nature Notes, we were continually drawn to the topic of play as we recognized the important role of unstructured, child-initiated pretend (i.e., authentic) play in children's skill development. To examine the topic in-depth, we identified four broad research questions that provided a structure for analyzing teachers' Nature Notes:

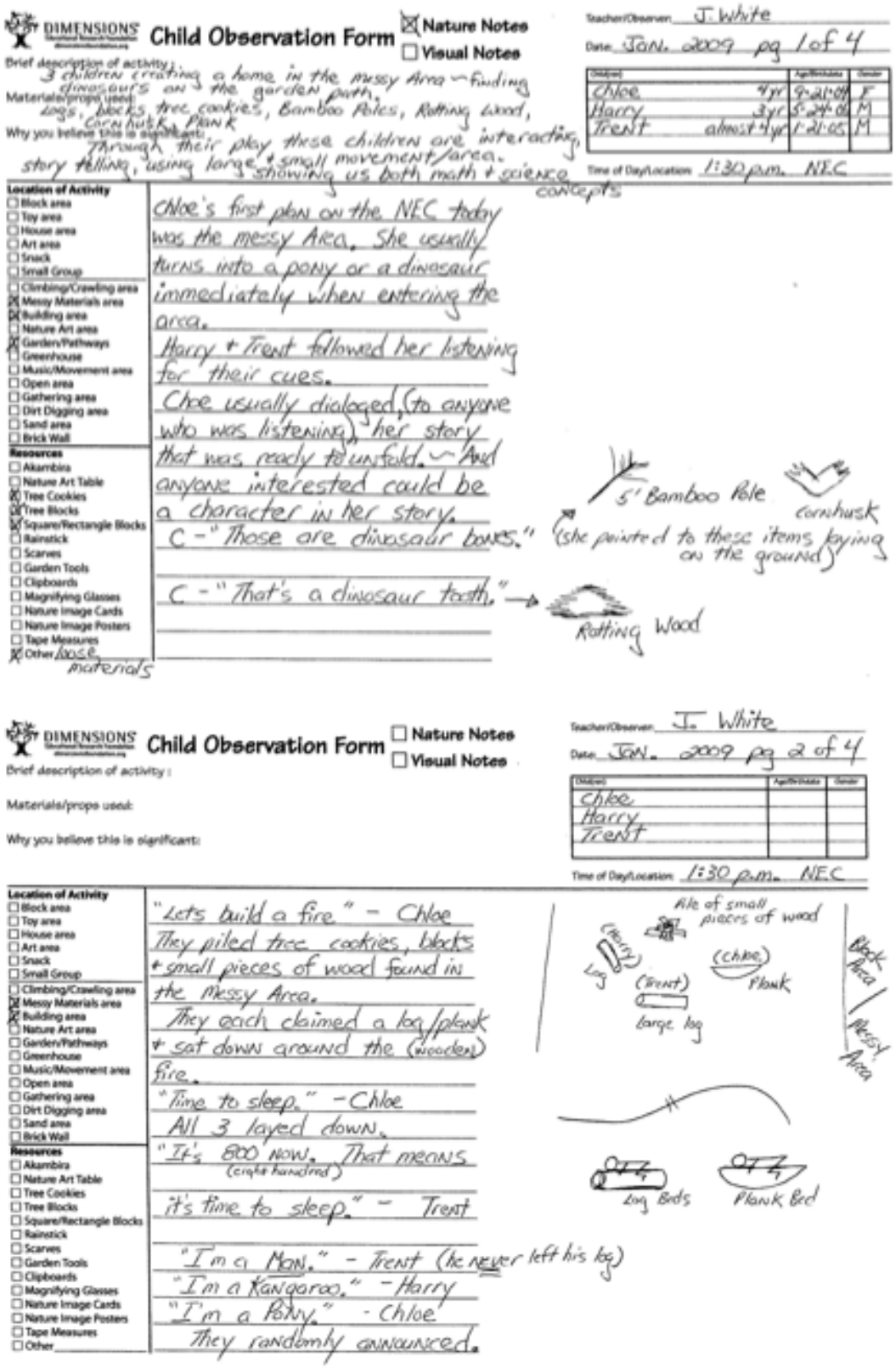
1. What does authentic play "look like" for children in the Nature Explore Classroom?
2. How does authentic play in the Nature Explore Classroom facilitate key learning/skill development for young children?
3. How do natural materials and the intentionally designed spaces in the Nature Explore Classroom facilitate authentic play?
4. How are teachers supporting children's authentic play in the Nature Explore Classroom?

We used the existing literature (Brown, 2009; Garvey, 1977; Hirsh-Pasek & Golinkoff, 2003; Stephens, 2009) to define authentic play and identified the following five key elements of play to use as a lens for our work:

1. Play must be pleasurable and enjoyable. In other words, authentic play has inherent attraction and is pure fun for children! The pleasure children derive from authentic play feeds their desire to play more.
2. Play has no extrinsic goals. It is not task or objective oriented or initiated out of obligation or duty. It is process rather than product oriented. Children engage in play simply for its own sake.
3. Play is spontaneous, flexible, and voluntary. It is child-initiated and absorbs children's attention. It is based on children's experiences. Authentic play may occur alone or with others and it is not directed, dictated, regulated, formatted or structured by parents, supervising adults or teachers.
4. Play involves active engagement on the part of the child/player. It provides freedom from time and when engaged in it, children are fully in the moment.
5. Play contains an element of make-believe. It is non-literal in that it uses symbolic representations for needed objects and is composed of flights of the imagination. When children are engaged in authentic play, they create pretend scenarios, fantasy and make-believe plots. Play has great improvisational potential.

Sonja pretended to be a chrysalis that turned into a butterfly, then a chameleon that snatched bugs with its tongue.

Figure 2: Sample - Nature Notes/White



DIMENSIONS Child Observation Form ☒ Nature Notes ☐ Visual Notes

Teacher/Observer: J. White

Date: JAN. 2009 pg 1 of 4

Child(ren)	Age/Birthdate	Gender
Chloe	4yr	9-21-04 F
Harry	3yr	5-24-06 M
Trent	almost 4yr	1-21-05 M

Brief description of activity: 3 children creating a home in the messy Area ~ finding dinosaurs on the garden path.

Materials/props used: Logs, blocks, tree cookies, Bamboo Poles, Rafting Wood, cornhusk, PLANK

Why you believe this is significant: Through their play these children are interacting, story telling, using large + small movement/area. showing us both math + science concepts

Time of Day/Location: 1:30 p.m. NEC

Location of Activity: ☐ Block area ☐ Toy area ☐ House area ☐ Art area ☐ Snack ☐ Small Group ☐ Climbing/Crawling area ☒ Messy Materials area ☒ Building area ☐ Nature Art area ☒ Garden/Pathways ☐ Greenhouse ☐ Music/Movement area ☐ Open area ☐ Gathering area ☐ Dirt Digging area ☐ Sand area ☐ Brick Wall

Resources: ☐ Akambira ☐ Nature Art Table ☒ Tree Cookies ☒ Tree Blocks ☒ Square/Rectangle Blocks ☐ Rainstick ☐ Scarves ☐ Garden Tools ☐ Clipboards ☐ Magnifying Glasses ☐ Nature Image Cards ☐ Nature Image Posters ☐ Tape Measures ☒ Other base materials

Chloe's first plan on the NEC today was the messy Area. She usually turns into a pony or a dinosaur immediately when entering the area.

Harry + Trent followed her listening for their cues.

Chloe usually dialoged (to anyone who was listening) her story that was ready to unfold. ~ And anyone interested could be a character in her story.

C - "Those are dinosaur bones."

C - "That's a dinosaur tooth."

5' Bamboo Pole

cornhusk

(she pointed to these items laying on the ground)

Rafting Wood

DIMENSIONS Child Observation Form ☐ Nature Notes ☐ Visual Notes

Teacher/Observer: J. White

Date: JAN. 2009 pg 2 of 4

Child(ren)	Age/Birthdate	Gender
Chloe		
Harry		
Trent		

Brief description of activity:

Materials/props used:

Why you believe this is significant:

Time of Day/Location: 1:30 p.m. NEC

Location of Activity: ☐ Block area ☐ Toy area ☐ House area ☐ Art area ☐ Snack ☐ Small Group ☐ Climbing/Crawling area ☒ Messy Materials area ☒ Building area ☐ Nature Art area ☐ Garden/Pathways ☐ Greenhouse ☐ Music/Movement area ☐ Open area ☐ Gathering area ☐ Dirt Digging area ☐ Sand area ☐ Brick Wall

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"Lets build a fire." - Chloe

They piled tree cookies, blocks + small pieces of wood found in the Messy Area.

They each claimed a log/plank + sat down around the (wooden) fire.

"Time to sleep." - Chloe

All 3 layed down.

"It's 800 NOW. That means (eight hundred) it's time to sleep." - Trent

"I'm a MAN." - Trent (he never left his log)

"I'm a Kangaroo." - Harry

"I'm a Pony." - Chloe

They randomly announced.

Pile of small pieces of wood

(Harry) Log

(Chloe) Plank

(Trent) large log

Block Area / Messy Area

Log Beds

Plank Bed

DIMENSIONS Child Observation Form ☐ Nature Notes ☐ Visual Notes

Brief description of activity:

Materials/props used:

Why you believe this is significant:

Teacher/Observer: J. White

Date: pg 3 of 4

Child(ren)	Age/Birthdate	Gender
Chloe		
Harry		
Trent		

Time of Day/Location:

Location of Activity
☐ Block area
☐ Toy area
☐ House area
☐ Art area
☐ Snack
☐ Small Group
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☐ Nature Image Cards
☐ Nature Image Posters
☐ Tape Measures
☐ Other

"Wake Up! Lets go look for dinosaurs." - Chloe
Chloe galloped off down the garden path. Harry followed her.
Two minutes later they returned to the camp fire.

"It's dark time NOW - that's bed." - Trent
They all layed down to sleep once again.

"Lets get up." - Chloe
Chloe + Harry galloped off down the garden path.

DIMENSIONS Child Observation Form ☐ Nature Notes ☐ Visual Notes

Brief description of activity:

Materials/props used:

Why you believe this is significant:

Teacher/Observer: J. White

Date: pg 4 of 4

Child(ren)	Age/Birthdate	Gender
Chloe		
Harry		
Trent		

Time of Day/Location:

Location of Activity
☐ Block area
☐ Toy area
☐ House area
☐ Art area
☐ Snack
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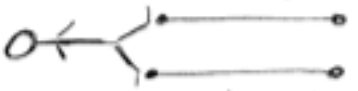
☐ Tape Measures
☐ Other

Suddenly Chloe stopped + layed down in the dirt off the path.
"Harry, come down like this." - Chloe
Chloe reached for 2 Bamboo Poles + placed them at her feet. She layed very still + closed her eyes. Harry placed 2 Bamboo Poles by his feet + closed his eyes too.
They layed still for over a minute.

(Bamboo Poles were approx. same length)



Chloe - "I'm a dinosaur bone."

"We need a (the) man to discover us." - Chloe yelled toward Trent
"He needs to dig and brush." - Chloe
Trent was happy in the Messy Area at the campfire and did not respond.
Ms White come over + pretended to dig + brush.

2. Purpose and Procedures

We used a case study tradition to explore a phenomenon that was of interest to us. Case study research examines a particular case or cases of interest that fit within a bounded system, and the goal is to understand the case (or cases) in-depth (Creswell, 1998; Merriam, 1998). While extensive research has focused on children's learning in traditional academic settings, we wanted to better understand what children were learning though play in an outdoor classroom. This was a single case study, conducted at one site, and bounded by criteria that included:

a. the uniqueness of the setting (i.e., the research site was an intentionally designed certified Nature Explore Classroom where teacher/co-researchers were trained in qualitative research methodology and in recording Nature Notes based on their close observations of children);

b. the purposeful selection of participants by age (i.e., preschool and kindergarten-age children); and

c. a focus on observations that specifically included a "pretend play" element.

This exploration of children's learning through play was part of a larger, ongoing study that began in 2004-2005 with the creation of Dimensions' Nature Explore Classroom. Since then, we have examined the observations more than twenty teacher/co-researchers have submitted, to identify the skills children were developing (in multiple domains) as they interacted with nature and natural materials in the outdoor classroom. In narrowing our focus to play, we reviewed over 400 observations teacher/co-researchers recorded, and used several criteria to purposefully select the data we analyzed for this study:

1. All of the observations were of preschool and kindergarten-age children. We did not include infant-toddler data.

2. All of the documentation was recorded in the Nature Explore Classroom (with the exception of two observations that took place indoors but were direct extensions of activities in the Nature Explore Classroom).

3. We excluded teacher/co-researchers' Visual-Notes that were based on observations of children indoors, manipulating blocks and other three-dimensional materials.

4. Since all of the 400+ Nature Notes we reviewed met the first three criteria, we added a fourth. All of the observations we included in this study had to demonstrate the five elements of authentic play that we had selected to use as a lens for our work. In particular, there needed to be a "pretend" (i.e., make believe) element present in children's play. We excluded many observations because they described children interacting socially with their peers, doing "real work" in the Nature Explore Classroom, and/or making specific discoveries in nature that did not include a pretend-play element.

From our original sampling of 400+ Nature Notes we selected 63 that met all four criteria.

The 63 observations we used were recorded by 13 teacher/co-researchers, from fall 2005 through spring 2012. The teachers were "participant observers" in the setting, because their primary role was to interact with children as teachers. The co-researcher role was secondary. We did not ask teachers to record observations of children engaged in pretend play scenarios. In fact, teachers more often recorded observations of other kinds of activities, focused on children's skill development (e.g., developing body competence, language/literacy skills, math skills, social skills, intrapersonal skills, science skills). We simply asked teachers to record observations of children that they believed were significant and illustrated children's learning, then to identify why they believed they were significant (particularly based

on their knowledge of their children). Appendix B provides a visual overview of the 63 Nature Notes we included in this study.

Teachers recorded almost half of the observations (28/44%) in the Messy Materials area, where children could manipulate loose materials and use the features of the space to engage in rich make-believe scenarios. Teachers recorded almost another quarter of the observations (12/19%) in the sand area, where many added materials facilitated children's imaginative play. Teachers recorded 11 (17%) of the observations as they followed children who moved through multiple areas of the Nature Explore Classroom during their make-believe play scenarios.

Fourteen of the 63 Nature Notes (22%) included narrative description only. Fifteen (24%) included teachers' visual sketches along with narrative description, and 22 (35%) included one or more photographs of children in addition to teachers' narrative description. Eight (13%) of the observations we used included children's sketches or artwork. One observation was an annotated visual note (i.e., a sketch with brief explanation) and two observations included narrative description, plus visual notes, plus children's work. One observation consisted of a teacher's visual sketch and a child's drawing. Appendix C illustrates the types of documentation we used in this study.

Data analysis is an ongoing process at Dimensions. Three teams meet weekly to analyze teachers' Nature Notes. Each team includes two teacher/co-researchers and Dimensions' Research Director. All of the teacher/co-researchers involved in analysis were formally trained in qualitative research methods in a graduate level course, taught by the research director. On average, teams spend 20 minutes analyzing each Nature Note initially, then we re-examine the data multiple times during the "sense-making" process as we develop key themes.

Our approach to data analysis is systematic, and specifically examines:

1. the context and description of the activity/ interaction identified on the entry;
2. children's ages, gender and pertinent demographic information;
3. evidence of key skill development (in nine developmental categories);
4. the materials children are interacting with and the spaces/areas children are using;
5. the teacher's role in scaffolding/supporting children's learning; and
6. the significance of each entry.

Appendix D identifies the analysis categories we used to examine teachers' Nature Notes. The data incorporated into this study illustrate teachers' direct observations of children engaged in pretend play in the Nature Explore Classroom. The following sections introduce Dimensions' outdoor classroom, describe children's play in a natural setting with natural materials, and identify key skills children developed through their play. We used pseudonyms in place of children's names in all of the examples cited in this book, to protect their anonymity.

3. Introduction to the Site

Dimensions Early Education Programs is located in Lincoln, Nebraska in an older, residential neighborhood that is rich in architectural beauty, with established trees and beautiful parks within walking distance. Its infant, toddler, preschool and summer Kindergarten – Grade 5 programs serve as Dimensions' research classrooms (until recently when the school district changed to all-day Kindergarten, Dimensions also served Kindergarten children). Dimensions' programs rent space from First-Plymouth Church, in a spacious, 75-year-old brick building with intricate architectural features. The Early Education Programs, although housed in a church, are not affiliated with a religion and welcome children from all backgrounds and income levels. Dimensions employs 24 teachers (with an average tenure of over ten years) and serves approximately 200 children.

In 2004 – 2005, Dimensions constructed a model outdoor classroom for preschool, Kindergarten and school-aged children (later, a separate outdoor classroom was constructed for infants and toddlers). The Nature Explore Classroom on the preschool/school-aged side is approximately 82' x 78' and includes specifically designated areas. Children meet at the gathering area to make their plans for their time outdoors. A 12' x 20' greenhouse, with child-size tables and benches (constructed by a parent out of rainforest wood to handle the moisture), gives children the opportunity to interact with plants year-round. The spacious L-shaped sand area allows an entire class of children to play in the sand at one time. The large, messy materials area, filled with natural materials to manipulate, such as woodchips and sections of cut tree trunks (i.e., "tree cookies") is bordered by a low (child height), organic-shaped brick wall, which was created by a local sculptor. Children went to the sculptor's studio to learn about the kiln and brick-making process and to put their handprints and footprints in the bricks before they were fired. Later the sculptor filled several of the depressions with melted glass. Next to the messy materials area is a separately designated block building area, with a hard (tree cookie) surface to provide stability for building.

Three children, ages 11 and 12, who were alumni of the preschool program and volunteered in the summer program, designed the rectangular-shaped dirt-digging area, which is located next to the block-building area. They worked with a local sculptor to design the brick border around the space, laying it out with large cardboard blocks in one of the classrooms prior to constructing it, calculating the dimensions and how many bricks they would need. The wide brick border, recessed into the ground, provides children with places to sit as they dig.

A towering climbing-crawling structure with multiple slides, ladders and landings gives children the opportunity to physically experience different levels and exercise their whole bodies.

A large perennial garden (approximately 15' x 36') spans the north end of the Nature Explore Classroom, with limestone paths through it. It contains prairie plants that can withstand dry, hot summers. The plants were intentionally selected to provide a variety of colors, shapes, smells, sizes and textures; to attract insects; and because they had interesting stories associated with them. A key goal was to provide children with rich, multi-sensory learning experiences through their interactions with nature. The seeds and bulbs children plant in the greenhouse are often transferred to the garden where children can watch them grow, care for them, harvest them, and taste the edible plants.

The vegetable garden is approximately 17' x 28' and has been terraced into multiple levels, with pathways so children can access every tier. Children love climbing the stairs and experiencing the level changes and watching the garden grow. Children have grown sweet corn, multiple varieties/colors/shapes/sizes of tomatoes, pumpkins, squash, kale, basil, garlic, carrots, green beans, purple potted pole beans, cabbage, lettuce, a variety of peppers and okra in the

garden. Children have the opportunity to share the produce they grow during an annual Farmers' Market that brings parents and the community to the Nature Explore Classroom.

A large, open grassy area in the middle of the Nature Explore Classroom provides space for children to engage in whole body, gross motor movement activities. A corner of the open space is designated as a music area. It includes an Akambira made from Brazilian hardwood (harvested sustainably) and teachers bring drums and other natural instruments outdoors daily.

The artist's garden (Nature Art Area) was recently renovated to provide a more beautiful, inspirational, and functional space for children to create art outdoors. Children helped design the multi-tiered, mosaic surface where easels stand. They broke glass dishes and ceramic tiles for the flooring, and created their individual designs by arranging glass pieces on trays. Dimensions' Art Specialist and a sculptor incorporated children's designs into the mosaic surface by transferring them from the trays to the adhesive base.

In the northeast corner of the Nature Explore Classroom (completed in November 2009), at the edge of the artist's garden, is a smooth, child-height corner bench, large enough to hold a group of children. In contrast to the bench, positioned directly behind it on the other side of a wrought-iron fence, stands a taller, ruggedly textured wall, with sculpted bricks placed vertically and irregularly, with occasional small openings. These negative spaces were intentionally incorporated to provide children with multiple perspectives as they peek through the wall to the world outside. The smooth brick bench matches the architectural features of the low brick wall that borders the messy materials area and the rugged wall has similar depressions (made by teenagers' hands and feet), with melted blue glass in them. The bench and wall was a gift to the Early Education Programs, commissioned by a family as a memorial in celebration of their 16 year-old daughter/sister's vibrant life (an alumni of the preschool who lost her life in a traffic accident). Her twin sister worked with the sculptor and a teacher to design the memorial. She and several friends helped create the depressions in the bricks used for the textured wall and in the arm rests for the bench. A small strip of mosaic runs through the smooth seat of the bench, visually tying it to the artist garden's mosaic floor.

Children spend time daily in the Nature Explore Classroom, and on a typical day, visitors might see children:

- making a plan about where they choose to play
- initiating games and creating pretend scenarios
- using their imaginations to transform natural materials into food, houses, castles, rocket ships, roads, ice cream stands, tools, and equipment
- pretending to be someone or something else (e.g., birds, animals, insects, plants, community workers, family members)
- engaging in dialogues related to their play "scripts"
- exercising their large muscles as they move freely through the pathways and open areas of the outdoor classroom
- negotiating and collaborating as they work together to accomplish a goal
- solving problems about how to move and manipulate heavy natural materials
- proposing and testing hypotheses about how things work.
- sharing their knowledge and experiences with each other
- rehearsing and practicing newly acquired skills
- learning through trial and error and repetition
- and most importantly, having fun!

The Greenhouse, built large enough to accommodate groups of children, for year-round use.

Inside the Greenhouse, where children work on child-sized tables and benches.

The L-shaped Sand Area, large enough for groups of children to work together on projects

The Gathering Area, where children make their plans when they enter the outdoor classroom.

The Block Building Area with a hard surface made of tree cookies.

The Dirt-Digging Area, created by three 11 and 12 year old alumni of the preschool program, because children "need a place to dig".

The terraced Messy Materials Area with the "cave" and brick walls, created by a local sculptor.

The Climbing/Crawling Area that provides a variety of opportunities for kinesthetic development and pretend play scenarios.

The Open Area provides opportunities for large motor movement.

The Music and Movement Area, where children create music on portable instruments and the built-in akimbira.

The perennial Garden and Pathway, planted with a variety of types and sizes of plants that provide children with rich sensory experiences.

The Nature Art Area, with a mosaic surface and large brick corner bench.

The vegetable garden, where children have the opportunity to experience the lifecycle of gardening.

4. The Findings

An Overview: Children's Skill Development in the Nature Explore Classroom

Our data suggest that engaging in pretend play in an intentionally designed outdoor space, with intentionally selected materials, provided rich opportunities for young children to develop important life skills. We identified social, intrapersonal, kinesthetic, visual-spatial, and math skills children were developing through pretend play in every observation we analyzed. We identified language/literacy skills children were developing as they interacted with teachers and peers in all but one Nature Note. In almost two-thirds of the Nature Notes we analyzed, children were developing science skills, and in over half of the observations documented, children were developing construction and engineering skills.

As we analyzed the data, we focused on children's development of nine skills:

Skill 1 **Creative Representation**

Skill 2 **Social Skills**

Skill 3 **Intrapersonal Skills**

Skill 4 **Kinesthetic Skills**

Skill 5 **Visual-Spatial Skills**

Skill 6 **Math Skills**

Skill 7 **Language/Literacy Skills**

Skill 8 **Science Skills**

Skill 9 **Construction and/or Engineering Skills**

The nature of the space, availability of materials, and having time for unstructured play allowed children to use their imaginations and develop ***creative representation*** skills. They built small and large-scale models, noticed that materials looked like something else, and used materials for a variety of creative purposes. Children imitated birds (e.g., a great owl, an eagle, a peacock) and animals (e.g., a moose) and became objects (e.g., flowers). Through their words and actions they assumed various roles and some children drew maps or pictures to depict their experiences. Appendix E provides a brief summary of what children were doing in their pretend play scenarios in the 63 Nature Notes we used in this study. Appendix F illustrates the ways children were transforming materials through the use of their imaginations.

The majority of the observations our teacher/co-researchers documented (44/70%) were of multiple children interacting in the Nature Explore Classroom. Children developed their ***social skills*** as they worked cooperatively to accomplish shared goals. They shared space, materials, ideas and stories and took turns without conflict. Both boys and girls assumed leadership roles and directed their peers in play. We noted that leadership was not gender specific in the outdoor classroom. Children assigned tasks to peers, asked peers for ideas, and credited their peers for their ideas and contributions. Children displayed a high level of inclusiveness, in their actions and in their language (e.g., "we", "us", "our", "let's"). They invited peers into their play, and welcomed children who wanted to join in. Children most often inserted themselves into their peers' play by offering to help or by simply joining in and making themselves useful. Children shared their knowledge and expertise with peers, about a variety of subjects (e.g., from shadows, to birds, to the temperature's impact on snow melting), and modeled how to use materials or perform tasks. Children called their peers "friends" and described how they "worked together". They offered to share their creations with friends (e.g., "Who wants a bite?"). One young girl rallied her friends together when she announced, "We have to do teamwork" (as she and her peers moved large, recycled Christmas trees across the Nature Explore Classroom). As one young boy helped his friend with a task, he turned to her and said, "I'm having fun with you, Allison!" Not only were these three, four and five year old children developing their social skills – they were clearly having fun with each other as they pretended, played, worked and learned together in the outdoor classroom.

Having unstructured time to play in the Nature Explore Classroom and the availability of a variety of interesting materials provided children with rich opportunities to develop ***intrapersonal skills***. This was evident in all 63 of our teachers' observations (100%). All of the pretend play scenarios we analyzed were child-initiated and illustrated children's emerging ability to direct their play – to demonstrate initiative in making plans initially, to make decisions along the way, and to quickly adapt to new plans as they and/or their peers had other ideas. Almost half of the observations (25/40%) provided examples of ways children made their needs, desires and preferences known, to peers and to teachers. Almost a quarter of the observations (15/24%) illustrated children's use of specific problem solving and critical thinking skills. As children made choices and directed their play in the Nature Explore Classroom (i.e., were in charge of their play), they had many opportunities to develop confidence in their emerging skills. This seemed especially true as children explored the space and experimented with materials and their bodies. They had time to practice and refine their skills, sometimes repeating their play scenarios over multiple days (e.g., "This is our third day…" creating the Titanic). Children's pride and sense of personal satisfaction with their ideas and accomplishments was evident in many of our Nature Notes (37/59%), generally demonstrated by children's requests for teachers and peers to look at their work. We also noted children's ability to stay focused for long periods of time and the persistence they displayed during their imaginary play scenarios in the outdoor classroom.

Fifty-eight (92%) of our Nature Notes illustrated that children were developing ***kinesthetic skills*** (i.e., body competence) as they engaged in "purposeful"

movement during their pretend play in the outdoor classroom. Children learn best when they are able to move, and they used their whole bodies, large and small muscles, as they navigated the space and manipulated materials. They had many opportunities to develop gross motor skills (evident in 52/83% of teachers' observations). Children traveled the pathways in the Nature Explore Classroom, walked and ran from area to area, negotiated obstacles, lifted and carried large and small materials, balanced on objects, climbed on stationary structures (e.g., the brick wall/cave, climbing/crawling structure, and stairs), manipulated tools (e.g., shovels), used their bodies to imitate birds and animals, and built props for their play.

Thirty-eight (60%) of our Nature Notes identified fine motor skills children were developing, in particular manual dexterity, as they used their fingers and hands. They drew pictures and maps, and manipulated a variety of loose materials with their fingers. In addition to our analysis of body movement, we noted that in over half of the observations teachers recorded (35/56%), children had tactile experiences with natural materials as part of their imaginary play scenarios (e.g., handling leaves, mulch, rocks, sand, soil, berries, acorns, pine needles, various shapes and sizes of woods). These rich sensory experiences provided a kinesthetic way for young children to explore the properties of those materials and learn about their environment. Appendix G illustrates the kinds of loco-motor and non-locomotor body movements children were engaged in during their play in the Nature Explore Classroom.

Laura regularly pretended to be an animal outdoors. "Look at me, I'm a monkey" she called to her teacher as she dangled upside down on the bars.

All 63 (100%) of the Nature Notes we analyzed illustrated key ***visual-spatial skills*** children were developing as they played in the outdoor classroom. Using visual-spatial skills was critical to successfully navigating the space (e.g., moving in, around and through objects and structures), and to carrying large materials without running into peers, teachers or other objects (e.g., gathering and building with large blocks of wood, manipulating 6' long poles). The nature of the materials available on the outdoor classroom and features of the space provided many opportunities for children to learn about spatial concepts, such as outside/inside, up/down, around, under, over, and through (this was evident in 37/59% of our Nature Notes). Children had the opportunity to develop their distance vision and learn the difference between positive and negative space. Almost two-thirds of teachers' observations (38/60%) demonstrated children's use of close observation skills – they noticed details, patterns, textures, colors and the specific physical properties of materials. Their close observation was evident in their selection of materials and when they stopped their activities to look at something in the outdoor classroom that caught their attention. Over a third of teachers' observations of children using fine motor skills to construct props for their pretend play scenarios (22/35%) also illustrated their use of eye-hand coordination, an important visual-spatial skill that is critical for young children's development of manual

dexterity. Almost half of our Nature Notes (31/49%) described how children made visual analogies as they noticed that materials "looked like" something else (e.g., a 12" piece of driftwood looked like a dinosaur bone, a 2 ½' piece of rotting stump looked like a surf board, a corn cob looked like a breakfast sausage, a hollowed out tree stump looked like an oven).
All of our observations (63/100%) suggested that children were developing early ***math skills*** as they played with peers and physically handled materials in the outdoor classroom. The two math skills we most often identified in our data were classification and size relationships/measurement (both were evident in 38/60% of our Nature Notes). In their make believe stories and construction, children classified times of the day, types of materials, animals, birds, insects, trees, and people. They classified objects based on color, size, type, and specific attributes.

Children physically learned about size and measurement, including the height and weight of objects, the distance between two points, and the length of materials (particularly as they were lifting, carrying and placing or arranging materials). They compared sizes visually and used math vocabulary (see Appendix H), including gross terms such as "big" and "little" (e.g., contrasting a "big ocean" and "little pond"). They learned about angles as they created play props out of various sizes of natural materials (e.g., creating a small scale bug house, a trap, a fire, and a large scale teepee style structure that they could get their bodies inside). As children explored materials through their pretend play, they learned about whole-part relationships, including trees and parts of trees, plants and parts of plants, the earth and parts of the earth (we noted this in 30/48% of our Nature Notes). Children physically combined several "parts" to create a whole (e.g., an unnamed vehicle, a space ship, a tree farm); and created houses and castles that included various rooms and accessories.

Children learned about quantity and number as they counted people and materials (e.g., the number of friends, 6' long poles, dinosaur horns, acorn lids, tree cookies, scoops of sand, snow cone flavors, and letters in the word "Robin"). Children held garage sales and sold food, using natural materials as money (e.g., a green leaf represented currency). One child told his teacher that a piece of pepperoni pizza would cost $300. When a second teacher asked what a piece of pepperoni and hamburger pizza would cost (two ingredients), he thought about it and answered, "$306. Another child suggested charging "one invisible dollar" for a ride on a spaceship.

Children had many opportunities to learn about scale relationships, particularly as they constructed miniature or small-scale objects in the messy materials or sand areas, and as they constructed 100% scale structures that their bodies would fit inside or on (e.g., a house, a fort, a castle, a boat, a vehicle). Children physically experienced volume as they built objects they could get inside, or worked to fill and/or dump containers with sand, soil, and loose materials. They estimated how far away certain objects were, the length of a pole needed to reach a branch in a tree, how large a dinosaur's footprint was, and the amount of materials needed to continue their play scenarios. Because of the nature of the materials available in the outdoor classroom, children physically experienced many geometric shapes (e.g., ovals, circles, spheres, rectangles, triangles, squares, cones) and worked with both whole tree cookies and broken pieces of tree cookies (a lesson in fractions). In the context of their pretend play with peers and teachers, children had many opportunities to practice math vocabulary identify patterns (especially in nature), and to practice their sequencing skills in both their construction and story telling scenarios (e.g., pretending to be birds flying "high", "higher" and "way high"; "first" I did this, "then" I did this, and "then" I did this…).

Teachers recorded children's use of ***language/literacy skills*** in all but one observation (62/98.4%). In the single observation where language was not recorded, two boys were moving from log to stump to brick wall, pretending to be driving vehicles. The teacher noted that while they used little verbal communication this was a repeated play scenario that these boys often engaged in and they used non-verbal cues, with little need for verbal communication.

During children's imaginary play scenarios they engaged in rich, reciprocal conversation – with peers and teachers. They listened to one another and responded appropriately. They asked and answered questions (evident in almost half of the Nature Notes – 28/44%). Almost three-quarters of the Nature

Notes described children's experimentation with vocabulary, using words such as: "smasher", "the blade", "gunk", "fire lighter", "mountain salt", "signal thing", "sabre tooth cat teeth", "banana house", and "choo-choo". They used descriptive vocabulary to name and/or label their play in almost all (58/92%) of their pretend scenarios (e.g., performing a flute "concert", building "the Titanic", having a "fireman's race", creating a "music maker" by swirling sand in a metal bowl, finding a "poisonous rock" with "poking sticky-up things", adding "yucky poisonous stuff" to "poison pie", rescuing "sea turtles and crabs", cooking pizza in a "cooker", looking for "buried treasure", "decorating" the Nature Explore Classroom with "happy streamers", creating a "volcano" and explaining that "hot lava shoots out the hole", "going on a safari – follow Map A", pretending to be a "great owl", a "flower", an "eagle", a "peacock", a "moose").

Almost one-third of our Nature Notes described children's storytelling (19/30%), and narrating their actions. For example, one child placed a large plank across two stumps, added three smaller blocks of wood on the stump at one end, and called it "the blade". He described how to use it as he demonstrated: "You gotta step on this (smaller block) and this, and then you go on the blade…You just gotta balance and balance, and the blade lets you off when you want off." Another young boy described the process of creating a surfboard, explaining how he put it through the "grinder" and "shredder".

Besides the use of verbal language skills, eleven of the observations (17%) included children's written work – primarily maps and sketches they had drawn. Clipboards and pencils (regular and colored) are always available in the greenhouse and often children retrieve those to document their work. For example, two of the play scenarios documented included searching for "treasure" and "gold", and children had constructed "treasure maps". Two of the Nature Notes described pretend play scenarios with birds. Multiple children had drawn and labeled specific birds, another child drew a robin and experimented with fitting the letters "R-o-b-i-n" on the page (adding the number "5" because the word robin has five letters). Another child recalled a field trip to the prairie, and created a drawing of the prairie, and spatially experimented with fitting the word "prairie" on the paper. One child

Three boys made "sand pie" (using sand, water, wood-chips, a feather), and debated about how much water was "enough". "Who wants a bite", they offered?

Andrew and Harry tried to lift their "sand pie" onto a log to help slide it into the "oven" (a large, hollow tree stump).

made a sketch of the "dinosaur" bone she had found, and another child sketched the earth, using colors to differentiate between the different types of land (e.g., green for grass, brown for desert) and water (blue). He verbally described his work to his teacher, using words like: "desert", "oasis", "ocean", and "pond."

Forty-one (65%) of the observations we analyzed illustrated ***science skills*** children were developing through their pretend play as they interacted with nature and natural materials in the Nature Explore Classroom. They had direct experience observing natural, scientific phenomena outdoors. For example, children observed the effects of temperature on snow melting, watched vegetation change with the seasons, and observed birds' behavior. Through hands-on experiences they learned about plants, soil, insects and decomposing wood. They learned about absorption and watched sand change consistency as they added water to it (gauging when they had added "enough" water). As children exercised their close observation skills, they speculated or hypothesized; about what might happen, about what had happened, and/or about cause-and-effect relationships. For example, a four-year old girl found a 12" piece of driftwood and in conversation with her teacher called it a "dinosaur bone". She speculated about how it got there and how old it might be, and about what kind of dinosaur it was – "a T-Rex". As she thought more about it (without teacher prompting), she amended that to a "baby T-Rex" because she noticed that the weight of the driftwood felt so "light".

Through children's interactions with teachers and peers, they learned new science vocabulary (e.g., crater, paleontologist), and had opportunities to experiment, especially with natural materials. For example, a three-year old boy experimented with sound, using a thin 8" long stick. He tapped on the rungs of the ladder under the climbing/crawling structure. He moved to the underneath side of the structure, and then around it as he tapped, and finally announced to his teacher: "Every sound sounds different." In the sixty-three observations we analyzed, teachers recorded many examples of children sharing science knowledge (with peers and teachers), including knowledge about:

- telling time (using the sun and shadows)
- dinosaurs (types, attributes, age, and size)
- the earth, including land masses and the ocean
- lava, prairie habitat, fossils, insects, the sea and sea creatures, and
- what paleontologists do.

Over half of teachers' observations (34/53.9%) described children's use of basic ***construction and/or engineering skills*** in their pretend play. Teachers' Visual and Nature Notes illustrated the diverse and creative ways children worked with a variety of natural materials (e.g., small and large blocks of wood, tree cookies, large slabs of wood, 6'long poles) and used tools in their play (e.g., hand trowels, shovels). Children used their imaginations to build structures and props that supported their make-believe story lines (e.g., a house, a fort, a castle, a space ship, a campfire, a trap, the Titanic). They constructed small scale and large (100%) scale enclosures that they could fit on or inside (e.g., a teepee style "house" using 6' long poles propped up against a tree). They piled, propped, stacked, and balanced materials (e.g., they learned how to brace large, recycled Christmas trees by propping them up and gathering large blocks of wood to place around the trunks to brace them – an excellent example of problem solving). Children used tools to level surfaces, dig holes, make piles, dig a trench, and move materials. They stacked, assembled and disassembled materials and worked to get joints to meet (e.g., constructing a large-scale hexagonal shaped "clock" on the ground with 6' long poles, creating a small-scale "bug house" in the sand by angling sticks toward a center point, without gaps so bugs could seamlessly crawl up one side and down the other side). In some cases children considered the parts they would need for functionality (e.g., a lever as a control for a vehicle, a tool to clean "gunk" out of the engine of the Titanic, toys and dishes for a house, a "flusher" for the toilet). Children combined multiple materials to create their designs. Their construction involved planning, selecting materials, constructing their structures, evaluating their work, and in some cases, problem-solving.

A Sampling of Teachers' Documentation That Illustrates Key Skill Development

The following 16 examples illustrate the kinds of skills young children were developing during their pretend play scenarios in Dimensions' Nature Explore Classroom. We took these examples directly from teachers' written documentation. They represent a variety of lengths and are in no particular order. We cited the specific teachers who recorded the observations and the dates they occurred. The narrative for each example has two components – first the description of the pretend play scenario, as recorded on teachers' Nature Notes forms, and second, a short summary of the key skills we believe children were developing through their play.

Example #1

Creating a Snow Cone Factory in the Greenhouse

Five children designed and implemented a snow cone making process. They took snow into the greenhouse and colored it using colored pencils. They identified a problem and chose a solution. The children told the teacher about the project toward the end. The children spoke about the contributions they made to the whole process. This shows their understanding of part-to-whole, sequence of events, and practical knowledge about the world. The most important aspect of this story is that these children applied practical knowledge in a creative way. They used high level thinking skills to create their own learning experience. This is a fine demonstration of initiative and self-reliance by young children.

The Idea and Process:

Charles – Actually, I think it was Kelli's idea. I passed the test. I'm the colorer of the snow. You just poke 'em in or color them in, then you have snow cones.

Melissa – One triple cone coming up. It's raspberry, blueberry, and grape (three acorn lids were still connected).

Charles – One blueberry sundae!

Will – I got more snow. I'll get the color in.

Melissa – We were looking around outside for something to use for cones. At first I tried sticks.

Kelli – But then we saw the acorn lids. They have kind of an open place. My idea is we should put the snow cones in a box for the snow cone sellers.

Charles – (poking a yellow colored pencil into the snow) This is lemon. We need a banana. It's not that hard to make.

The Problem and Solution Ideas:

Charles – The snow cones are melting! (The children are working inside the greenhouse.)

Will – It's colder outside!

Laura – So we're going to take this outside (she quickly collected the snow covered slab of wood and colored pencils).

Charles – I've got an idea! We could do it by the window. (He shared his knowledge that it is often cooler next to a window.)

(Murdoch, Holly; Nature Notes: January, 2007)

This play scenario represents a rich social experience where children worked together cooperatively, gathered materials for the group, and built on one another's ideas. Throughout their play children were inclusive – in their actions and in their language (i.e., "We were looking around outside…", "We saw the acorn lids…", "We should put the snow…", "We need

a banana…", "We're going to take this outside…", "We could do it by the window…"). Children listened to each other and every child had the opportunity to contribute to their play. Children had the opportunity to practice a number of math skills, including classification by color (yellow=lemon/banana), by flavors of snow cones (raspberry, blueberry, grape), and by types of materials (specifically collecting acorn lids). As children packed snow in the indentions in acorn lids, they experienced volume on a small scale as they filled the spaces. Several children used math vocabulary in their dialogue with one another (i.e., "One triple cone coming up…", "One raspberry sundae…", "I got more snow…", "It's colder outside…"), and experienced the concept of number in collecting multiple acorn lids and packing them. One child noticed three acorn lids connected and used the trio of lids to represent "one triple cone". Children used rich, descriptive language throughout their dialogue with one another.

This Nature Note illustrates two good examples of problem solving. First, children tried to decide on a material to use for snow cones. They experimented with sticks and when that did not work they looked for an alternative. They noticed small acorn lids on the ground that had an open space that would hold packed snow, using close observation skills and figure-ground perspective – both visual/spatial skills. Second, children realized the snow was melting inside the greenhouse where they were working and discussed a strategy for addressing this (which provided hands-on science learning as they literally experienced cause-and-effect relationships when the warmth of the sheltered space caused solid packed snow to melt to liquid). One child shared that it was colder outside than in the greenhouse, and his peer immediately suggested they move their snow cone operation outside. Another child thoughtfully proposed an alternative solution – working by the window, which would allow children to continue working inside, yet provide a cooler place for the snow. Children also used their whole bodies during this play scenario (e.g., gathering materials), and in particular fine motor skills as they packed snow into tiny acorn lids.

After crafting a "surfboard" from a partially rotted log, using imaginary tools and narrating the process, Mark demonstrated how to ride it (example #15).

Two four-year-olds pretended to cut up "food" (leaves from daisy plants) with "knives" (pieces of wooden mulch).

Example #2

Creating a Band and Dancing (as Peacock and Moose)

Four six-year-old boys chose to create "a band" in the music and movement area. Two of the boys, Jake and Charlie, played and shared instruments made from natural materials: a log drum, seed rattles and guiros. The other two boys, Quentin and Jason, performed a dance. These boys used branches they found in the messy materials area to create their own costumes. They worked together to prop the branches behind their heads, anchoring them between their clothing and their coats. Jason's branch helped him become "a peacock" and Quentin's branch transformed him into "a moose." There was little conversation as the boys totally focused on their music making and dancing **(Murdoch, Holly; Nature Notes: January, 2007).**

These boys negotiated who would be the musicians and who would be the dancers. Using their creativity and problem solving skills, Quentin and Jason helped each other anchor the tree branches that represented peacock feathers and moose antlers into their clothing (a construction skill). The boys recalled visual images of a peacock and a moose, identified materials that symbolized peacock feathers and moose antlers and transformed these natural materials into parts of animals. Jake and Charlie used their musical instruments to create sound, rhythms and patterns, and Quentin and Jason exhibited coordination, balance and spatial awareness as they used their large muscles to move their bodies to the beat of the music.

Example #3

Decorating the Outdoor Classroom With Happy Streamers

Four-year-old Sarah, holding a wooden block with her arm out-stretched, danced around the Nature Explore Classroom. Her teacher asked what she was doing. Sarah replied, "I have dancing happy streamers on! This is the on button (she touched her chest), and this is the off button (she held up the wooden block)." Sarah continued, "You're supposed to twirl with them (the imaginary streamers) and cut the tops off the plants."

Sarah twirled around in circles changing levels with her body. The wooden block slightly grazed over the tops of the native grasses. She was careful to only touch the tops of the plants and not hurt them. She danced and ran with her arms outstretched and repeated this pattern twice. When her teacher asked her about the streamers, Sarah said, "I'm decorating." Sarah said her plan was to "decorate the whole outdoor classroom." When her teacher asked her where her streamers came from, Sarah told her, "They are in my brain when I do different things. My brain tells me what to do."

As Sarah continued to decorate the outdoor classroom with streamers she said, "I put some steamers around the plants. These streamers are saying 'don't go around the plants or trees'. It will probably make them die if you touch them too much or shake them too much. I'm decorating seeds in the garden. I put a white streamer all through the pathway and I heard crickets while I was doing it." Sarah invited her teacher to come and "hear the crickets."

They walked the path and stopped at the sound of the crickets. Sarah's teacher asked her to show her how a cricket moved. Sarah said, "I move my wings like a cricket. They rub their wings together so they can call other crickets to play in the grass and eat the grass." Sarah stuck out her chest with elbows bent and tried to rub her elbows together behind her as if they were her wings making sounds. Sarah abruptly looked up and saw a butterfly. "There is a monarch," she said. "That's why monarchs are made in the world, because there's flowers" **(Ragland, Natalie; Nature Notes: September, 2008).**

Sarah experienced imaginative play in nature with her teacher, a caring, interested adult. Sarah narrated a story with rich descriptive language that allowed her to tap into her vast imagination and physically act out her descriptions ("dancing happy streamers," "on button," "off button," "twirl with them," "streamers are in my brain," "decorating seeds in the garden"). Sarah used personification when she said the streamers "are saying don't go around the plants…" The Nature Explore Classroom provided the setting for this story filled with imagination, language, and movement.

Sarah's decorating of the outdoor classroom had many kinesthetic components to it. Sarah engaged in purposeful movement as she traveled through the pathways of the Nature Explore Classroom. As she danced, she extended her arm while holding a block and negotiated her body around objects in space as she moved through the areas.

Through her conversation, Sarah used the skill of classification to identify plants, trees, insects (math and science). Using her whole body and purposeful movement, Sarah shared her knowledge about crickets and how they create sound using their wings. The outdoor classroom venue gave this child the opportunity to show her knowledge and practice skills in multiple ways.

Example #4

Performing a Concert

Alex carried a stick he discovered in the messy materials area. The stick was about an inch in diameter, ten inches long, narrower at one end, and had indentions that looked like holes. Alex made an announcement to his teacher and to other children in the vicinity, "The concert's going to start. Come hear the concert." His teacher and some children gathered around him. With his audience seated on the low brick wall, Alex introduced his work, "This first song is going to be Darth Vader's song." Alex put his stick flute up to his mouth, covered the indentions with his fingers, and accurately hummed the tune. When he finished, his audience applauded. Alex next played "Luke Skywalker's Song" for his enthusiastic audience and several other selections until he announced the concert was over **(Heinzman, Cindy; Nature Notes: June, 2009).**

In this play scenario, Alex communicated his knowledge about music. The visual image of a stick triggered the information Alex had stored in his memory about concerts. Alex transformed the stick into a flute (creative representation). Using his voice, he projected the sound of a flute. He used his fine motor skills as he played his imaginary flute. He associated concerts with an audience, so he displayed initiative and confidently invited his teacher and other children to attend his performance. Alex matched the pitch of the songs he was humming so they were recognizable to the audience. This play experience provided Alex with an opportunity to be in charge and show his expertise. He was affirmed by the applause from his teacher and the other children.

Example #5

Playing Ladybugs and Aphids

When five-year-old Josie entered the Nature Explore Classroom, she had an idea. Indoors at story time, she had just finished listening to the book, Are You A Ladybug?. Josie created the structure and rules for a game based on the book. She gathered a small group of friends around her and explained the rules of the game that she titled "ladybugs and aphids." She said to her friends, "I'll be the ladybug and you're the aphids. I'll try to catch you." Josie later added, "If I catch you, I'll eat you." The children laughed and squealed as they ran through the Nature Explore Classroom and participated in Josie's game during their entire outdoor time using visual spatial skills to navigate through space and around objects **(Tichota, Kathy; Nature Notes: May, 2008).**

Josie's game of ladybugs and aphids was directly linked to a literacy experience. It illustrated how learning about nature in the indoor classroom inspired an outdoor experience based on a child's recall. Josie transferred the knowledge she had learned from the book and used her imagination and creativity to apply that knowledge.

Of her own initiative, Josie created a plan for her outdoor experience. Normally a shy and quiet little girl, Josie became the leader as she defined the rules and boundaries of her game to her peers. She practiced social skills by recruiting children to join in her play and used vocabulary that successfully explained the rules of her game to them. Josie's game provided an opportunity for whole body, gross motor movement as the children navigated their bodies through space and around objects in the Nature Explore Classroom. This scenario also demonstrates a direct application of Josie's acquired science knowledge about ladybugs and aphids to a meaningful social experience.

Example #6

Building a Bug House

Four-year-old Brent called his teacher to the sandbox so he could show her what he had made. He explained, "I just worked and worked. I scooped the sand in a pile and flattened it like this." Brent demonstrated the motion with his hands. Brent had balanced two small sticks together in an inverted V shape to make a two-way ramp-like structure that went into his pile of sand. He named his creation "a bug house" and explained to his teacher how it was used: "The bugs climb up and slide down," he added. "Lots of bugs come, big black bugs, little black bugs. They should come and see their new house." **(Heinzman, Cindy; Nature Notes: September, 2006).**

As Brent worked alone in the sandbox, he used his creativity (and fine motor skills) to build an angled structure out of sticks that he labeled a "bug house". He demonstrated a sense of satisfaction or pride with his creation, evident in his request that his teacher view his structure and in his description of his hard work (an intrapersonal skill). He tested the physical properties of sand, experimented with scooping sand into a pile, and used his hand as a tool to pack and flatten it (science skills). Brent discovered through his play that the two sticks could be balanced at an angle (math), and anchored in the sand to create a ramp for bugs to go up and down (engineering skill). Brent used the antonyms " big" and "little" to describe the size of the bugs that would use his bug house, the adjective "black" to classify the type of bugs, and the word "lots" to identify the quantity of bugs (math vocabulary). Brent also verbally described the process he used to construct his "bug house" to his teacher (literacy skills).

Example #7

Baking in the Sand Area

Four three-year-olds, Emma, Isabella, Grant, and Charles used real baking pans and rolling pins in the sand area to do some baking. Isabella suggested, "Let's make a birthday cake. I need a pan. Do we have a pan? Let's make a birthday cake inside it." Isabella looked around and found two pans stuck together and pulled them apart. She and Emily filled the pan with sand.

Grant, who was playing in the sand near Isabella, announced, "I'm making bread." He used a rolling pin, rolling it back and forth in the sand. Grant asked, "Anyone want a taste of bread?" Isabella replied, "No, thank you. We are almost done. It will be longer and longer, Grant." Then she announced, "It's done."

Emma said, "Let's put it in the oven." Together Emma and Isabella carried their cake over to a large, hollow stump that was sitting in the sand area. Charles had filled the stump with sand and was putting a stick in the sand that was in the stump **(Britton, Tami; Nature Notes: October, 2008).**

Sand, sticks, a stump and additional props (i.e., pans, rolling pin) provided four children with multiple opportunities for spontaneous, flexible play filled with make-believe. These children linked their dramatic play to their background knowledge of food, utensils, and baking. The children transformed the sand into ingredients for cakes and bread (creative representation). The large, hollow tree stump in the sand area became an oven to bake their cake. The children engaged in cooperative play – Emma helped Isabella fill the pan with sand. They used inclusive language (i.e., "Let's make," "do we have," "anyone want") and practiced verbal language skills in a meaningful way as they engaged in an interactive dialogue. Their-give-and-take conversation included questions and statements, and they listened and responded to each other. Isabella practiced manners when she politely declined Grant's offer of some bread.

Using full-sized kitchen utensils, like the ones they've observed adults using, provided these children with a hands-on opportunity to experience some mathematical concepts. Isabella needed "a pan" (one) for her cake so when she observed two pans stuck

together, she pulled them apart. As the children filled the cake pan and the large hollow stump with sand, they experienced quantity, weight, and volume. Isabella referenced the passage of time describing the progression of the baking process ("almost done," "longer and longer," and "done"). The children had whole body experiences as they pulled apart the cake pans, pushed the rolling pin back and forth, carried the pans to the oven, and filled the pans and stump with sand.

Example #8

Making Cupcakes

On a cold, windy day in January two five-year-old girls, Patty and Ginger, chose to go outdoors when the rest of their group stayed in the gym. They immediately went to the sand area and began to play. Their teacher was cold and suggested going inside, but the girls declined. The girls asked their teacher to pretend to be "the mom," and Ginger commented, "Isn't this fun being alone (outside). No one can bother us." Patty exclaimed, "No boys!" She used a hand shovel to scoop up a little pile of soil lying at the edge of the sand area. She said, "Here's our chocolate," and added it to some sand in a copper "Jello" mold. Ginger replied, "I'll get some more sugar." She shoveled sand into a container. She groaned loudly as she carried a brick toward Patty and said, "This brick is heavy. I've got the smasher". As she sat the brick down, she added, "I'll get the rolling pin."

Once again the teacher who was cold suggested going inside, and Ginger responded, "Remember, we're going to have a party. We need some more sugar." The chocolate mixture spilled and Ginger scooped it up with her mittened hands. "Mom, mom, mom," she said and reminded her teacher that she was the mom.

For the third time, the teacher suggested going inside, but the girls continued working, transferring their mixture into muffin tins and leveling off "cupcakes," making them almost flat on top. Patty instructed, "Don't dump it out." and asked "How long is it going to take?"

Pretending it was an oven Ginger put the filled muffin tin into the sand area storage cupboard. She counted, "1, 2, 3, 4, 5. It's done!" She removed the muffin tin from the oven, sat it down and said, "We need a spoon."

"A fork!" said Patty.
"A spoon!" said Ginger.
"Fork!" said Patty.
"Ok, a fork," replied Ginger.

The girls sat down and pretended to take bites of the cupcakes using their hand shovels.

Patty stood up and took away the muffin tin. As she put the muffin tin back into the oven, she said, "You're supposed to do this. My mom always cooks it for a long time."

Since they had been outside in the winter weather for twenty minutes, the teacher announced, "We have to go inside or into the greenhouse." The girls chose the greenhouse, and they left the sand area **(Murdoch, Holly; Nature Notes: January, 2009).**

Ginger and Patty chose to play outdoors in the sand on a cold, January day. Being outdoors "alone" and without boys gave them great pleasure, and they verbally communicated their mutual feelings as they engaged in collaborative play. They worked together in a spirit of friendship and cooperation to make their "cupcakes." Their teacher supported this child-initiated activity by allowing the girls to make the choice to stay outdoors and by playing the role of the "mom," which Ginger had assigned to her. The girls conversed with each other and with their teacher, declined three suggestions from their teacher to go indoors and reminded her of her role.

The girls made visual analogies using dark soil to represent chocolate and sand to represent sugar. Ginger used her large muscles and purposeful, whole body movement as she lifted and carried the "heavy" brick to the sand area. Ginger named the heavy brick a "smasher" at the same time assigning it a function (using an adjective and a verb in her description – a link to literacy).

In their conversation the girls asked questions and at one point even had a disagreement ("it's a fork"… "it's a spoon"…) giving them an opportunity to practice their verbal language skills in negotiation and compromise.

Using their imagination, the girls transformed a storage cabinet into an "oven" and the cold, outdoor sand area became their kitchen (creative representation).

Ginger and Patty experienced volume, quantity, and the concepts of full and level as they filled the muffin tins with sand. They used numbers to represent the passage of time, estimating that their "cupcakes" were "done" on the count of five.

Through their authentic play, these girls had the opportunity to engage in a holistic, multi-sensory outdoor experience that allowed them to practice several skills (e.g., initiative, kinesthetic/purposeful movement, literacy, mathematics, visual-spatial, and creative representation).

Example #9

Fixing the Titanic

Three five-year-olds, Al, Lydia and Thomas, hauled tree cookies inside a small brick enclosure known as the cave. Their teacher had noticed them doing this before and asked, "Can you tell me about what you're doing?" Al replied, "This is our third day." Thomas added, "Last time this Titanic didn't break. This time it's the Titanic, the one that already hit the iceberg." "We're fixing it," Al explained. Lydia said, "I know the story of the Titanic. It hit an iceberg, and then it started sinking 'cuz there was a hole in the boat."

A large piece of heavy wood had been placed on top of a tree stump and the teacher asked, "How did this get up here?' Thomas answered, "We carried it. We got it up there."

The children began using pieces of tree bark that were shaped like a scraper to dig in the crack of the tree stump. Al explained, "This is a pretty old boat. It's got a big crack. We're digging gunk and iceberg pieces out of the engine." As Thomas put woodchips back in the crack of the tree stump, he said to Al and Lydia, "Pretend this isn't gunk." **(Tichota, Kathy; Nature Notes" May, 2007).**

This child-initiated dramatic play experience allowed these three children to use their creativity and problem-solving skills. In the spirit of camaraderie, two boys and a girl used their storytelling skills and descriptive language (literacy) to share their knowledge about the Titanic. They used organic materials (i.e., tree cookies, bark, a stump, a heavy wooden plank) and a brick cave to transform their ideas into the parts of a ship. This was a significant kinesthetic experience for these children. Using their whole bodies, they cooperatively maneuvered many heavy objects into place. They experienced volume as they filled the cave with tree cookies. Al used an ordinal number and recalled a past experience when he stated, "This is our third day." Thomas connected the past with the present when he contrasted "last time" with "this time" and Al described the "boat" as "pretty old" (reference to a time concept). Lydia described a cause-and-effect relationship (a science construct) when she explained that the Titanic "started to sink 'cuz there was a hole in the boat".

The children solved an imaginary problem they identified (i.e., removing the "gunk" from the "engine") by creating a scraper-type tool from bark. The suggestion Thomas made to his friends, "pretend this isn't gunk," illustrates shared imagination between children, which is indicative of authentic play.

Example #10

Becoming Flowers

Over several days, during their indoor small group time, children had been closely examining photographs of flowers (i.e., Nature Image Cards) and pretending to be parts of flowers. Using their whole bodies, they imagined being seeds, roots, leaves, and flowers. One day as a group of children entered the Nature Explore Classroom, two three-year-old girls, Ellen and Cassidy, started giggling. Ellen noticed the same flower they had examined on the photograph growing in the Nature Explore Classroom. She exclaimed, "Look, a flower! Let's be the flower!"

Cassidy framed her face with her hands and exclaimed, "Look, I'm the face, see!" Ellen announced, "I'm planted right here," as she stiffened her body and physically planted her feet on the ground. Cassidy promptly planted herself. "Wow, the wind is blowing," she laughed as her body swayed in the imaginary wind. Ellen joined in, pretending to be the flower swaying in the wind. Both girls giggled with glee. **(White, Joyce; Nature Notes: Fall, 2005).**

When they entered the Nature Explore Classroom, the sight of a flower they had examined earlier in a photograph inspired Ellen and Cassidy (matching-a math skill). They made this discovery using close observation skills. These three-year-old girls chose to extend a small group activity outdoors, by pretending to be a flower, making a visual analogy between their bodies and the parts of a flower. Their teacher described these girls as "visual learners" who "concretely internalized their learning about flowers through movement." Using their imaginations, they transformed themselves into that flower (transference), through a whole-body, kinesthetic experience. They experienced the concepts of cause-and-effect through the imaginary wind (science) as they observed the whole flower and became parts of the flower (whole-to-part – a mathematics concept). The girls observed both a two-dimensional representation of the flower on the photograph and a three- dimensional, live flower on the Nature Explore Classroom. These two very young girls spontaneously engaged in collaborative play, expressing their ideas and knowledge to each other (practicing social and literacy skills).

Example #11

Roasting Hot Dogs and Marshmallows on a Camp Out

Four children, three boys and a girl, were manipulating long bamboo poles in the messy materials area as they played "camp out." They worked collaboratively with their teacher's support to learn how to safely carry six- foot poles upright. They leaned the tall poles against the trunk of a large pine tree so they fanned out in a circle around the tree trunk. The five-year-old girl called their structure "a clubhouse," and the five-year-old boy named it "a fort." One of the boys, who was three-years-old, happily wove himself in and out of the poles while another boy stayed "inside" the cone-shaped structure. Two of the children sat on the low brick wall nearby, holding long sticks and told their teacher they were roasting hot dogs and marshmallows in "fire" **(Kiewra, Chris; Nature Notes: November 2008).**

This example illustrates a whole-body kinesthetic experience for four young children who carried large objects and safely negotiated those objects and their bodies through space. They engaged in a collaborative, social experience that spanned age (three to five-year-old children with an adult) and gender (three boys and a girl).

They physically experienced several mathematical concepts as they worked (i.e., the length, weight and diameter of the poles as they carried them) and created a 100% scale structure that they could fit inside. They experienced the concepts of horizontal (the sticks lying on the ground) and vertical (carrying the same sticks upright) then placed them at an angle against the tree. The children experienced the circumference of a circle as they propped poles around the tree trunk, which represented the center of the circle, and fanned the poles out from the trunk. They estimated how far apart to place each bamboo pole as they created their structure.

The children used construction and engineering skills to balance long poles and prop them around the tree trunk to create the framework of an enclosure. One boy visualized the stick framework as a complete enclosure. He described his position as "inside" and experienced the volume of his body filling part of the space inside the structure.

Two of the children labeled their creation (literacy) and the open-endedness of the natural materials allowed the structure to be anything the children imagined. All of the children were involved in the same activity but because of their imaginations it meant different things to each child. Two children recalled previous knowledge and imagined they were roasting hot dogs and marshmallows in "fire," transforming sticks into skewers (creative representation). The three-year-old saw this as an opportunity to engage in a complex, kinesthetic experience as he weaved his body in and out among the poles without knocking them over. In order to do this, he had to visually estimate the size of the openings between the poles in relation to the size of his body.

Example #12

Constructing and Furnishing a House

In a similar example, two boys, four and five-years-old, spent ten minutes leaning six-foot bamboo poles against a large tree to construct what they labeled "a house." When they invited their teacher to see their "house," a three-year-old girl accompanied the teacher. As one of the boys observed the structure, he said, "I need to fix this wall" and began adjusting the poles. The other boy described the construction process to the teacher, "I did the middle, (he) did the edges."

The girl exclaimed to the boys, "Let's get some toys!" and ran to collect broken, round tree pieces for toys (creative representation). She delivered a few, then made a second trip and delivered what she described as "more toys." Next she collected pinecones and said, "These are the dishes." After she set them down, she and one of the boys left to play in another area. The boy who remained in the messy materials area after the other children had left continued to work on the "house." He tried to prop additional poles against the tree and discovered the sticks he had selected were too short. He stepped back, observed the height of the tree trunk, pointed, and counted under his breath. Then he estimated outloud, "fourteen feet long," and then selected a pole that was long enough **(Reitz, Kristi; Nature Notes: November, 2008).**

Through children's imagination and creative representation, long poles propped against a tree were transformed into a "house" and natural items (tree pieces and pinecones) became "toys" and "dishes."

These two boys used whole body, gross motor skills and engineering skills to lift, carry, balance, and prop six-foot poles against a tree. The poles served as the outside walls of their enclosure. These boys' play seemed to be more about the process of creating a structure than playing in it. The boy who remained was more interested in "fixing" the structure than using it.

This scenario includes many of the same math concepts we identified in the previous example. One of the boys identified a mathematical position – the "middle" (i.e., concept of midpoint) and contrasted it with the outside (i.e., "edges"). The three-year-old girl referenced quantity in gross terms as she initially delivered "some toys" then brought "more toys." She used the skill of classification to select tree pieces first, then pinecones. The boy, who remained with the structure after the other two children left, visually estimated and counted to determine what he believed was the length of the pole he needed to prop against the tree trunk with the others.

This example also illustrated several social skills these children had the opportunity to practice. The boys worked collaboratively to create their structure, and they issued an invitation asking their teacher to see their work. They shared the space with a younger girl who joined them later and accepted her contributions. This three-year-old girl, who joined the boys later, displayed both confidence and initiative (intrapersonal skills) in suggesting to the boys that they get "some toys," then followed through on collecting pretend "toys" and "dishes."

This cooperative play scenario also provided multiple opportunities for these children to practice literacy skills. For example, they named their structure ("a house") and contents ("toys", "dishes") and used language to describe the collaborative process of building (who did what). In spite of joining the boys after they had built their "house," the young girl used inclusive language ("let's") to invite the boys to collect toys.

Example #13 (see Figure 2: Sample-Nature Notes)

Discovering Dinosaurs and Dinosaur Bones

On a cold day in January, four-year-old Chloe planned to play in the messy materials area. Two three-year-old boys, Harry and Trent, followed her and listened to Chloe's unfolding story. She pointed to two items lying on the ground, a six-foot long bamboo pole and a cornhusk. Chloe announced, "Those are dinosaur bones." Pointing to a piece of rotting wood, Chloe added, "And that's a dinosaur tooth." She then suggested, "Let's build a fire." The three children gathered tree cookies, blocks, and small pieces of wood and placed them in a pile. They each claimed a log or wooden plank and sat down around their imaginary "fire."

Chloe announced, "Time to sleep." Each child lay down on either a large log or a long plank. Trent said, "It's 800 now. That means it's time for us to sleep. I'm a man." In response, Henry identified himself as "a kangaroo" and Chloe became "a pony."

Chloe exclaimed, "Wake up! Let's go look for dinosaurs." She galloped down the garden path and Henry followed her. A few minutes later, they returned to the "fire."

Trent, who had not moved from his log said, "It's dark time now – that's bed." They all lay down to sleep again. Soon Chloe suggested, "Let's get up." She and Henry galloped down the garden path again. Suddenly Chloe stopped and lay down in some dirt beside the path and said, "Henry, come down like this." Chloe reached for two bamboo poles and placed them parallel to each other at her heels, appearing to extend the length of both legs. She said, "I'm a dinosaur bone." She lay very still and closed her eyes. Henry followed Chloe, placed two bamboo poles at his heels and closed his eyes. They lay still for over a minute. Chloe yelled to Trent (who had earlier announced he was "a man" and who had remained on his log the whole time), "We need a man to discover us. He needs to dig and brush." Trent, however, continued to sit by the "fire" and did not respond. The teacher, who was listening to the children's dialogue, came over and pretended to dig and brush **(White, Joyce; Nature Notes: January, 2009).**

As was typical of this child, Chloe expressed individual initiative in creating a story about dinosaurs that she could enact in the Nature Explore Classroom. Chloe made visual analogies as she selected natural materials to use as props. She transformed long, narrow bamboo poles and a triangular-shaped cornhusk into "dinosaur bones." A piece of rotting wood became "a dinosaur tooth," a pile of natural materials was turned into a "fire," and logs and planks became beds. Through pretend play, the children also transformed themselves into "a man," "a kangaroo," and "a pony." All of these are examples of creative representation.

Chloe demonstrated her prior knowledge about a scientific profession, paleontology, in her references to "dinosaur bones," and the need for someone "to discover us" and to "dig and brush."

The children physically experienced one-to-one correspondence as each child selected a log or plank to lay on and also when two of the children extended each of their legs with bamboo poles (two legs = two poles). They also experienced the concepts of parallel and horizontal as they placed the bamboo poles parallel to each other on the ground. They referenced multiple time concepts (i.e., "it's 800"… "it's time to sleep,") and paused as they waited for someone to "discover" them.

Chloe was clearly the leader and expert in this play scenario as the younger boys followed her lead. She continually included them in her play and used her inclusive language to engage them ("Let's build a fire," "Let's go look for dinosaurs," and "Let's get up.") Chloe made an extra effort to include Trent in their play when she yelled to him "we need a man." Their dialogue suggested that these children were involved in conversation that included listening and responding to each other on cue (literacy skills).

These children's teacher described how they used half of the spacious Nature Explore Classroom for this whole body experience. The block area became the sleeping area with the fire in the center of the space, the messy materials area became the location where they gathered wood for a "fire." The garden path became part of their journey in the hunt for dinosaur bones and they designated a small area off the garden path to dig for dinosaur bones (which they became with their bodies).

This activity became a rich sensory and kinesthetic experience as these children lifted and carried natural materials and galloped through space and around objects (kinesthetic skills). They experienced multiple levels and multiple textures including lying on wood and on the ground.

Example #14 (see Figure 1: Sample-Nature Notes)

Bucket of Bones

Five-year-old dinosaur lover Kade traveled through the Nature Explore Classroom carrying a bucket. He looked carefully at sticks on the ground and occasionally picked one up and put it in his bucket. His teacher had been watching him and as he passed by, she asked if she could interview him about what he was doing. With Kade's permission, his teacher asked, "Can you tell me about what's in your bucket?"

Kade pulled a stick from his bucket, held it up and asked, "Guess what this bone is from?" Not waiting for a reply, Kade said, "A saber-tooth cat teeth." He pulled out another stick and identified it as, "A leg from some type of animal." He took out another stick, "This one looks like a fossil from a type of snake." As he took out another stick, Kade said, "This looks like some kind of signal thing."

His teacher asked, "What is a signal thing?" Kade replied, "It's what you stick in the ground. It's a sign for help." Kade continued as he held up a Y-shaped stick and said, "This is a triceratops's horn. That's all I can explain right now. If you have any questions, don't be afraid to ask." His teacher said, "Kade, I think you're a scientist who studies bones, a paleontologist." Kade walked away and resumed his search **(Tichota, Kathy; Nature Notes: April, 2008).**

Kade's teacher knew that he collected dinosaur toys and models, and his family had read many non-fiction books about dinosaurs to him, so he brought lots of prior knowledge to this play experience. He also used recall and visual-spatial skills. Kade retrieved from memory the stored visual images of his mind's picture of ancient animal bones, and as he walked through the Nature Explore Classroom, he closely observed the shape of sticks. He made visual analogies between the sticks and dinosaur bones, teeth, and fossils and selected sticks that he believed "looked like" the visual images he recalled. He retrieved visual images from his mind that linked to his prior scientific knowledge about dinosaurs and this play experience gave him the opportunity to share his expertise. Kade also had the opportunity to internalize multiple math concepts. He classified sticks and selected only sticks to put in his bucket, estimated the size of sticks that would fit in his bucket, and observed the volume in his bucket change as he added and removed sticks from it. He also physically experienced the length and diameter of the sticks he added to his collection.

Through his imagination, Kade transformed sticks into prehistoric dinosaur bones (creative representation) and linked his present discoveries to a historic past (a time concept).

This scenario provided an opportunity for this five-year-old boy to practice literacy skills through his social interaction with his teacher. He engaged in a meaningful conversation with her and seemed to understand the interview process. He practiced language and communication skills as he labeled each stick as he pulled it out of his bucket ("saber tooth cat teeth," "a leg," "a fossil," a "triceratops's horn"). One of Kade's sticks triggered the image of a "signal thing." Although he did not have the precise word for the object, he was able to describe it by its function. He used similes in describing specific sticks that looked like "a fossil" and a "signal thing." Kade's teacher also provided a scientific vocabulary word for him when she described the role of a "paleontologist."

The Nature Explore Classroom provided Kade with the space he needed to use his whole body to freely explore the pathways and collect natural materials.

This self-initiated, personally meaningful play experience and interview allowed Kade to share his knowledge and be the expert. He exhibited competency and confidence when he ended the interview ("that's all I can explain right now") and told his teacher that if she had "any questions, don't be afraid to ask." In this authentic play scenario, Kade was highly motivated because he was doing what he loved.

Example #15

Crafting a Surfboard

One January day, four-year-old Mark picked up a two-and-half -foot-long, partially rotted tree log in the messy materials area. As his teacher observed him, he carried the log and laid it down balancing on top of a large, rectangular tree block. He announced to his

teacher that he was " making a surf board" and added, "But first I gotta saw it." He picked up a six-inch diameter tree cookie and made sawing motions on one side of the log. The log tipped off of the rectangular block, so Mark picked it up, balanced it back on the log and said, "I put it back on my square." Then he added, "I have this kind of shredder." He picked up a tree cookie that was once round but had broken into a triangular shape. Mark briefly ran the "shredder" along the surface of the log. He picked up a small wooden cube and gently hit the log with it. "It snaps it," he said.

Mark lifted the rotted log and carried it to the brick wall where there were three small, circular openings. He bent over and pushed the log partially through the first hole, then pulled it out. He walked to the second hole and repeated the motion, and walked to the third hole and repeated the motion again. Mark explained, "I'm grinding it."

Putting the log back on the ground, Mark said, "Now I'm gonna surf on it." But instead he turned the log over, picked up a small stick and put it into a hole in the log, twisting it after he got it in. "I need a hammer," Mark said, and picked up the triangular-shaped piece of wood and used it to pound in the stick.

"Now I'm ready to surf on it," Mark announced as he stepped on the log. However, he reconsidered, "First I gotta take the nail out. How am I gonna get the nail out?" Mark turned the log upside down, pounded the log with the "hammer", picked up a small stick, put it into a hole, and pulled it out again. Suddenly, Mark changed his focus and walked away to watch some other children who were playing with tree pieces **(Reitz, Kristi; Nature Notes: January, 2009).**

This example describes the process of creating "a surfboard." Mark announced that his plan was to make a surfboard but the focus of his play was on the tools he needed for its construction. As Mark observed the natural, open-ended materials in the outdoor classroom and the openings in the low brick wall, he visualized the tools he needed for the job: "a saw," a " shredder," a " grinder," a "hammer," and a "nail." Mark was in charge of his workshop, and he had the power to transform the natural materials he collected to serve his purpose. He intentionally chose materials that represented the tools he needed (i.e., making visual analogies). Mark practiced symbolic thinking: his make-believe play allowed him to manipulate the natural materials and pretend they were tools.

Mark interacted socially with his teacher as he explained the process and tools he needed to construct his surfboard. He problem-solved outloud, asking himself how to remove the "nail" from the log and discovered the solution himself.

This was also a rich kinesthetic experience for Mark. The log became a 100% scale, functional object that he could physically stand on and use as a "surfboard." He used gross motor skills to balance the log on a rectangular -shaped block. Mark used his whole body as he lifted and carried the log, used his arm in a sawing motion, and pushed and pulled the log through three holes to "grind" it. He used his arm in a pounding motion as he pounded a small stick into the log.

This example also illustrates the use of several math skills. Mark's dialogue and actions suggest that he was sequencing his activities ("first I gotta saw it," "Now I'm ready to surf on it," "First I gotta take the nail out"). He was physically manipulating materials that represented a variety of geometric shapes including a long half-rounded log, a circular tree cookie, a triangular-shaped piece of a tree cookie, and a wooden cube. He was verbalizing shape when he returned the log to his "square" after it fell off the rectangular block it was balanced on. There was even a sequence and a repeated pattern to his grinding motion in the three holes in the brick wall.

In this example we see one young boy's planning, decision-making and problem-solving activities (intrapersonal skills) and the communication of his ideas and needs to his teacher (literacy). In the process of creating his "surfboard" he demonstrated both social and literacy skills. Mark used a variety of nouns in naming the specific tools he needed to create the surfboard and used verbs to describe the action of the tools ("saw," "snaps," "grinding"). Mark narrated the entire activity as he physically experienced it.

Example #16

Decorating a Princess House

Early in January, four-year-old Sally and three-year-old Eve were playing together at the brick cave in the Nature Explore Classroom when their teacher walked by. Sally handed the teacher a large, broken tree cookie that resembled a semi-circle and said, "You earned the rainbow." Sally picked up a scalloped-shaped tree cookie and said, "We earned the flower." Their teacher asked, "How did I earn the rainbow?" Sally thought about the question and replied, "By doing very kind things."

Eve balanced the "flower" tree cookie on the edge of the cave's roof and said, "We're putting the flower here to decorate our princess house." Sally suggested, "Now let's sit down in our castle," and sat on the ground beside the cave.

Eve noticed a boy watching from a distance and asked, "Boys can come in, right?" "Yeah," Sally answered. Eve stipulated, "Nobody can touch anything unless they have sparkles." Sally picked up a small stick from the ground and announced, "Here's our flag." Eve said, "Our castle needs to be beautiful." Sally responded "I'm cleaning," as she bent down and moved pine needles around on the ground. Sally picked up the scallop-shaped tree cookie and asked, "What will we do with our flower plate?"

Eve picked up several small tree pieces and said, "This is our pizza." Sally suggested, "We can put it on our flower," and Eve laid the pieces on the "flower plate." Sally placed another broken tree cookie on the brick wall near the cave and said, "This is our toilet." She sat down on it for a few seconds until Eve said, "Now I gotta go potty." Eve sat on the "toilet", got up and announced, "I'll wash my hands." Sally picked up a small stick and placed it near the "toilet." "Here is our flusher," she added.

The girls put a larger thick piece of a tree on the brick wall and Sally said, "That's where we sit to watch TV." After sitting for a few seconds, she added, "I'll get the remote." She found a small wooden block and sat back down.

Next, Eve offered to "get the pizza," and Sally warned her, "It's hot." Eve countered, "No, it's warm," and said "here you go," as she handed the "flower plate" with the "pizza" on it to Sally. Their play scenario ended abruptly when Eve ran to the climbing structure and Sally announced, "I'll go too," and followed **(Reitz, Kristi; Nature Notes: January, 2009).**

Sally and Eve's dramatic play was filled with rich language as they created a story line, transforming natural materials into the props they needed for their story. This example illustrates two young girls engaged in cooperative play that allowed them to practice and develop their social skills. Their language was inclusive and their willingness to share was evident by their repeated use of the words "we" and "our". The girls created the social structure for their play, agreeing that boys were allowed to visit their "castle". When Eve observed a boy watching from a distance, she anticipated that he might want to be included and checked with Sally about allowing him to join their play. The girls also created a rule that only those "with sparkles" would be allowed to touch anything. The girls listened and responded to each other respectfully as they talked with one another. They recognized kindness as a desirable attribute demonstrated by the award they presented their teacher for "doing very kind things."

Sally and Eve used language to name and label natural items ("flag," "flower plate," "pizza," "TV," "remote control," "toilet," "flusher") as parts of their "princess house/castle."

They practiced construction and engineering skills by planning and designing the space for the house (castle) they created, and they understood the concept of inside and outside. The aesthetic, decorative component was important to them as indicated by their desire to make the space "beautiful" and "clean." Their creation and many of the items in it were 100% scale, allowing them to use their whole bodies as they stood, sat, bent, balanced and lifted. They experienced the different textures of the tree cookies, sticks, pine needles, and blocks they used in their play.

Creative representation was a significant component of Eve and Sally's play. This transference of natural materials to familiar objects occurred multiple times, often making associations based on shape (i.e., making visual analogies). For example, the semi-circle tree cookie represented a rainbow and the scalloped tree cookie became a "flower" and then a "flower plate." A small stick was transformed into a toilet "flusher" and a tree cookie became the toilet seat. A stick represented a flagpole, and a small wooden block became the TV "remote."

This play scenario allowed two young girls to verbally communicate their knowledge of the world and to play off each other's dialogue. These children shared their knowledge about items found in their homes (i.e. dishes, pizza, toilets, televisions) and they also paid attention to functional details including retrieving a "remote" for the "TV" and a "flusher" for the "toilet."

Five children created a "house" with fabric and clips and furnished it with "food", including a "birthday cake" (made with tree cookies, pine needles, and mulch).

Three girls played with loose materials, scissors and a bucket and announced to their teacher, "We're making soup with pine cones and pine needles".

Sean used a bundt pan in the sand area to make “a cake”. He called the stick he placed in the center “the candle”.

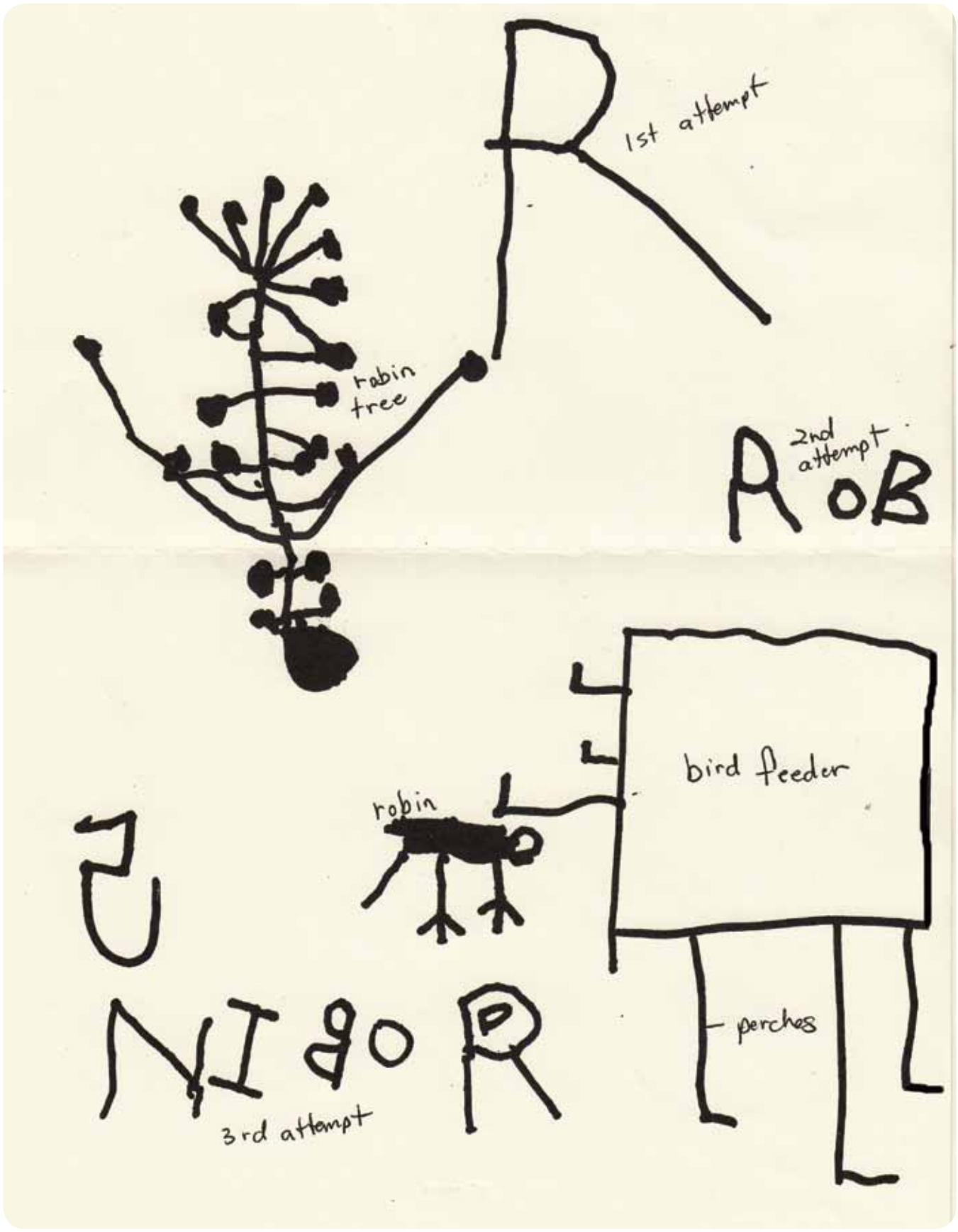
Landon and George created a “house” with 6’ long poles. Emma furnished their house with “toys” (broken tree pieces) and “dishes” (pine cones).

Photo (left):

Hannah repeatedly pretended to be a "great owl" running through the Nature Explore Classroom saying "Whoo, Whoo". This was the first time her tacher noticed that Hannah extended her wingspan using scarves. “I’m the great owl” she announced. “Owls flap their wings as they fly in the sky".

Child's sketch (right):

Curt pretended a stuffed robin was real as he closely observed it in a tree. He sketched the tree, robin and bird feeder and practiced writing the word “robin”, along with the number 5 because robin has “five letters”.


1st attempt
robin tree
2nd attempt
bird feeder
robin
perches
3rd attempt

5. Discussion

As we examined the 63 pretend play scenarios teachers recorded, two key themes emerged. First, our data suggested that children's pretend (authentic) play in the Nature Explore Classroom provided rich opportunities for integrated learning to occur. In other words, children were developing skills in multiple domains simultaneously, which fostered the development of the "whole child". Second, the Nature Explore Classroom provided a rich and unique context for meaningful learning, largely due to the intentional design of the space; the open-ended nature of the materials available for children to explore; and the opportunity for children to engage in unstructured, child-initiated play. Table 4 illustrates these key themes and their related sub-themes visually.

"Look what I found… a poisonous rock" Connor exclaimed. He said he knew it was poisonous because it had "poking, sticky-up things".

Table #4: Key Themes - Learning Through Play in the Nature Explore Classroom

Key Themes	Sub-themes
Integrated Learning that develops the whole-child (key skill development occurred simultaneously)	**Key skills** children were developing in the Nature Explore Classroom included:
	• Language/literacy skills • Social/interpersonal skills • Intrapersonal skills • Visual-Spatial skills • Kinesthetic skills/body competence • Math skills • Science skills • Construction/engineering skills • Creative representation/symbolic thinking
The Nature Explore Classroom: **A rich and unique context for learning**	• An **intentionally designed space** to foster meaningful learning • Rich and versatile **open-ended, natural materials** that engage all of the senses • **Unstructured child-initiated activities** that encourage intrinsic motivation, full engagement, and active learning

The first key theme that emerged in our analysis of teachers' Nature Notes suggests that when children were engaged in authentic play in the Nature Explore Classroom, they were developing important skills – skills that were foundational for early learning and will be important in helping children successfully navigate in the world. This research in the Nature Explore Classroom is an extension of our earlier work that was specifically focused on how children developed visual-spatial skills and how teachers could best support that development. In our analysis of teachers' observations of children's visual-spatial work (i.e., Visual Notes recorded indoors) with blocks and other three-dimensional materials, we discovered the importance of children's work (and play) in relation to learning. Our early findings suggested that through their visual-spatial work, children were:

1. communicating their knowledge about the world;
2. conveying, processing, and learning to manage their emotions; and
3. developing a variety of construction and engineering skills (identified on the construction typology created directly from our data).

The application of this earlier work to our present research is evident, however, the data in this study were from teachers' observations of children in the Nature Explore Classroom, recorded as "Nature Notes". As we began to analyze teachers' documentation, we broadly examined skills children were developing (beyond construction and engineering skills) to include social, intrapersonal, language/literacy, science, math, kinesthetic, visual-spatial, and creative representation skills.

Earlier in this study we discussed each of these skills individually. As we examined all 63 observations we concluded that one of the most significant findings of this research is that when children were engaged in authentic play in the Nature Explore Classroom, they were developing skills in a variety of domains simultaneously. This is what is referred to as whole-child learning.

Appendix I visually illustrates the skills children were developing across all observations (identifying which Nature Notes those skills appeared in). In more than half of the observations teachers recorded (37/59%), we identified seven different skills children were developing simultaneously. In almost a third of the Nature Notes (20/32%) we identified eight skills children were developing simultaneously, suggesting that when children were engaged in pretend play, their learning was more holistic rather than compartmentalized. When children were playing in the outdoor classroom, they were learning in multiple domains – from teachers, peers, the environment and materials, and they were actively engaged with their minds, bodies and senses. The outdoor classroom continually offered surprises to spark children's interest because there was always something living and changing.

The second key theme that emerged in our data relates to the kind of rich learning environment the Nature Explore Classroom provided for children, and some of its unique features as an outdoor learning space. Dimensions' Nature Explore Classroom was intentionally designed based on ten guiding principles, supported by years of field-testing and research. The principles address both the design of the space and the materials provided for children. The Nature Explore Classroom concept was created to address the growing problem of children's disconnection from nature – to provide spaces that nurture children's sense of wonder, encourage rich learning, and to provide children with opportunities to spend time in nature daily (opportunities that are increasingly disappearing). One primary goal in creating Nature Explore Classrooms was to provide intentionally designed outdoor spaces that help children "master new challenges, develop increasingly complex skills, and closely observe and appreciate the natural world" (Learning With Nature Idea Book, 2007, p. 4).

The design of Dimensions' Nature Explore Classroom, with separate, defined areas, encourages children to choose from a variety of activities (i.e., from fantasy play to real work) and to engage in play concurrently with other children with very little conflict (We noted the absence of conflict in the 63 Nature Notes we analyzed, even when there was potential for conflict to occur.). One advantage of having separate designated areas is that children are able to move freely and manipulate objects (e.g., carry long, six-foot bamboo poles and work to prop them against a tree, drag recycled Christmas trees across the Nature Explore Classroom), without interrupting children who are engaged in other activities (e.g., "baking" in the sand area, or drumming and dancing in the music and movement area).

The designated areas in the Nature Explore Classroom also provide consistency for children, so they understand the design of the space and are empowered to make choices as they identify their plans for their time outdoors. Children know where to go to retrieve specific materials (e.g., where to find sticks, tree cookies, sand, measuring cups and baking pans that they can use as props in their pretend play or in the structures they want to build; where to find the heavy, hollowed-out tree stump that might serve as an oven; where to find specific plants and soil; where to find baskets, clipboards, pencils, and paper) and where to go to engage in a particular activity that interests them (e.g., where to look for crickets, or where to go to create music and engage in dance). The logic of the patterns in the Nature Explore Classroom design helps children make sense of their world, work, and play most effectively.

The design of Dimensions' Nature Explore Classroom (with designated areas) combined with the availability of a variety of natural materials work in tandem to provide children with a greater opportunity for creative play, rich learning, and knowledge-sharing. For example, two girls' play was enriched in the sand area because of the availability of a large hollow stump that, through their imaginations, they turned into an oven. Four children who chose to play in the messy materials area had a rich, whole-body experience because there was ample space to maneuver large-scale materials (i.e., 6' long bamboo poles). Two boys who chose to dance to their friends' music in the music and movement area, displayed their creativity, initiative, knowledge and physical abilities by retrieving tree branches and anchoring them in their clothing (to transform themselves into a moose and a peacock). In every case, the availability of these natural materials worked in tandem with the design of the space to create a rich learning environment.

Even the architectural and structural features of the Nature Explore Classroom were designed intentionally so children could use them in multiple ways. For example, two boys used the low, organic-shaped brick wall that serves as the perimeter for the messy materials area (a very purposefully designed feature on the Nature Explore Classroom), in very different ways. Alex invited his teacher and peers to attend his "concert" and they used the brick wall for seating. Mark saw the three holes in the wall (i.e., the negative spaces) and physically used those as a tool in his workshop (i.e., as he pushed his "surfboard" in and out of the "grinder"). Two girls used the wooden storage unit as an oven to bake cupcakes when they had access to it during their play. A group of children used the brick "cave" as part of the Titanic, and added natural materials inside and along side it to represent additional pieces of the boat.

Our findings suggest that the combination of intentionally designed spaces and natural materials plus make-believe play allowed children to demonstrate their knowledge about the world in unique ways. In focus group interviews with teacher/co-researchers, teachers indicated that one of the benefits of close observation and documentation of children's skill development outdoors is that it provides the most authentic form of assessment of children's knowledge, abilities, personalities, and temperaments. The outdoor classroom is a place where children can be authentically themselves. They are often freer and more relaxed outdoors (compared to indoors) and often teachers see more of children's interests outdoors. Teachers believe their documentation provides a tangible way to make children's learning visible – to them and to parents and families.

Our data clearly illustrate that one of the primary ways children shared their knowledge and abilities was through their use of creative representation skills. This included using their imaginations, making

visual analogies, and often manipulating materials. For example, seeing a tapered stick with indentions triggered Alex's recollection of a musical instrument (i.e., a flute) and gave him the opportunity to share his knowledge about concerts. He gathered his teachers and peers together so he could perform a "concert" and recalled specific songs he could perform, using his vocal cords to hum recognizable songs. Another boy, Mark, used a variety of natural materials and the brick wall in the messy materials area to verbally and physically illustrate his understanding of tools and the building process (rather than viewing the architectural feature simply as a boundary dividing the areas). He demonstrated his strong visual-spatial skills by selecting the negative spaces in the wall to use as a tool. Sarah invited her teacher to share in an experience on the garden pathways, to listen to the crickets, and used her body to illustrate for her teacher how a cricket uses its wings. The cave enclosure at the edge of the messy materials area, with the addition of natural materials, became a rich backdrop for dialogue and fantasy, and showcased children's knowledge about the Titanic, as they worked together to repair the ship. Children's use of imagination is unparalleled outdoors, compared to indoors, because the environment and materials provide literally endless possibilities for creativity, experimentation, and discovery.

The intentionality of Dimensions' Nature Explore Classroom provides spaces large enough for groups of children to engage in play concurrently, in small or large groups or alone. It is spacious enough and well-designed so that children have room to safely manipulate large-scale objects that they would not have access to inside because of space limitations, and to create large-scale structures they can fit their bodies inside. Using materials such as 6' long bamboo poles (interesting natural materials that can be used for many purposes) would typically not be available indoors. The intentionality of the space allows children to visually observe, touch, smell and manipulate natural materials with their hands (i.e., handling small-scale items such as small pieces of tree cookies, pieces of bark, pine needles, small sticks) and use their whole bodies (i.e., working with large-scale objects such as logs, planks, long bamboo poles, large wooden blocks, stumps and large tree cookies). There are no walls and ceilings in the Nature Explore Classroom, and children are free to move, laugh, sing, raise their voices, and to squeal with delight (as Josie and her friends did as they ran though the entire space playing Josie's game, "Ladybugs and Aphids").

Staff have given careful consideration to the types of plants and grasses that have been planted on the Nature Explore Classroom (to attract certain types of insects, for example), and children have the opportunity to co-exist with living things that they can see, hear and touch (e.g., the crickets Sarah heard; the Monarch butterfly that caught her attention). The presence of living creatures in a natural space (e.g., plants and insects), teaches children about the importance of respecting and caring for the environment (as articulated by Sarah who was very careful to only lightly touch the tops of the plants as she danced around the garden paths and verbalized that "the plants will die if you touch or shake them too much").

Our data also suggest that a rich outdoor learning environment allows children to connect their learning activities indoors (e.g., the books they are reading) with their play outdoors. For example, Josie's class had been reading a book about ladybugs and aphids indoors. She applied that knowledge outdoors, in the creation of a game, for which she created the rules, recruited her friends to play, and provided instructions. She also communicated her knowledge about ladybugs and aphids to her friends (i.e., "I'll be the ladybug and you're the aphids…If I catch you, I'll eat you").

One of the key Nature Explore design principles describes the value of incorporating a variety of natural materials into an outdoor space (e.g., trees, stones, bricks) so children have the opportunity to learn about colors, shapes, textures and patterns in nature. The examples cited in this research illustrate the richness of the natural materials available for children to interact with in the Nature Explore Classroom, and their creative and interesting uses for those materials. For example, in these 16 scenarios, children interacted with:

- sand
- soil
- pinecones
- a cornhusk
- pine needles

- a brick
- natural and man-made musical instruments
- native grasses/plants/a flower
- pathways through the gardens
- and trees (in a variety of forms, including live and large scale, various sizes of stumps, logs, planks, tree cookies, woodchips, sticks, long poles, wooden blocks, and even rotting wood).

Most of the above are simple, inexpensive materials, yet their open-endedness allows infinite possibilities for use when they are transformed by the magic of children's imaginations. Our research presents compelling evidence that providing children with open-ended natural materials fosters imagination, creativity and symbolic (abstract) thinking. When they are working with open-ended materials children get to decide what those materials will become, explore interesting ways to manipulate the materials, and how their use of those materials may change during a dramatic play scenario. Children get to search for just the right material or object to represent something in their minds, and through that use and the functions they assign to those materials, children display their brilliance.

Our data illustrate the kind of symbolic thinking children were engaged in during their pretend play scenarios in the Nature Explore Classroom. They used primarily natural, open-ended materials to creatively represent objects in their play, and through their imaginations those materials could be anything. We discovered how sophisticated children's thinking was as they intentionally selected natural materials to serve as their props and we noted how different their play would have been if they had not had these materials; or, for example, if we had provided them with pre-formed props so they did not have to engage in this kind of intellectual and imaginative thinking. In the outdoor classroom, children had the power to transform simple objects into complex objects for a variety of uses.

Why is this kind of symbolic thinking (i.e., creative representation) so important? Hirsh-Pasek and Golinkoff (2003) believe that it is crucial because children need to develop the ability to think beyond the objects that are concretely in front of them if they are going to learn to combine new ideas in creative ways. "Treating objects as though they were something else is the beginning of that important ability. And being able to use objects symbolically, to stand for something other than what they really are, is related to children's language progress" (p. 209). The authors suggested that when children transform materials into other things (i.e., a piece of tree cookie became "a saw"; pinecones became "dishes") this is "progress" because children are "no longer tied to the features of the props." Using their imagination, children can treat those objects as though they are something else and this is "exactly what takes place in generating ideas, in thinking a problem through." Ultimately, "pretend play is practice for children in freeing themselves from what is right in front of their eyes" (p. 219). Talbot and Frost (1989) suggested that "when an object or environment is open to many interpretations and uses" children "hold the power to tell it what it is to be or do" rather than giving children one "preconceived 'correct' way" to view something or act (cited in Hohmann & Weikart, 1995, p. 111).

Our findings suggest there are numerous other reasons open-ended, natural materials are so valuable. For example:

- Natural, open-ended materials weather and change, which opens up a range of possibilities for their use. The ever-changing nature of the materials provides possibilities for ever-changing thinking.
- The organic shapes of natural materials fuel children's creativity and critical thinking, and the non-standard shapes encourage children to make visual analogies (i.e., X "looks like" Y). For example, in children's minds, a semi-circle shaped piece of a tree cookie looked like a "rainbow"; a broken piece of tree cookie placed on a low, brick wall looked like a toilet seat; and a cornhusk looked like a dinosaur tooth.
- At the same time children are resourcefully creating their own props for their stories, they are also using their language skills to label those props and/or describe their function, often experimenting with language. For example, a stick became a "signal thing". Though Kade did not have exactly the word to identify the item, he clearly communicated its function.
- Toys and props typically found indoors (with the

exception of materials such as blocks and three-dimensional manipulatives) tend to have a specific function, yet open-ended materials are versatile. Our data illustrate that one simple material, such as a stick or a tree cookie, can represent many different objects. The identical material can represent something different for children, even when they are engaged in the same activity (e.g., tree branches tucked into clothing transforms one boy into a moose and another into a peacock).

- When indoor materials are broken, they are generally discarded. When open-ended, natural materials become broken, the change in their form (i.e., new size, new shape) presents more possibilities for children to view and use them in interesting and imaginative ways. Even materials that are decomposing provide a lesson on nature.
- Open-ended natural materials are simple, and generally inexpensive. There are usually enough loose-materials available to meet the needs of several children, plus children can be involved in collecting, classifying, and sorting them (which also strengthens children's observation skills and math skills)
- Open-ended natural materials provide important opportunities for active learning through sensory (i.e., tactile) and physical engagement. Depending on the size and shape of the materials, children have opportunities to use their fine and gross motor skills to manipulate these objects for different uses (e.g., building with them, baking, cooking, repairing and decorating with them, and at the same time experiencing them with their senses). Open-ended materials allowed children to use their hands and bodies as tools. Every example in this study of children engaged in authentic play in the Nature Explore Classroom illustrates that children become fully immersed in learning through their senses. When young children are fully engaged outdoors they cannot be passive!

Dimensions' Nature Explore Classroom was thoughtfully designed to provide children with opportunities for rich sensory, whole-body experiences through their interactions with nature. All of these characteristics of open-ended, natural materials contribute to the richness of children's learning. As Louv (2005) suggested, nature "remains the richest source of loose parts". Louv cited Cambridge architect Simon Nicholson's "loose parts" theory, which has been "adopted by many landscape architects and child's play experts". Nicholson proposed that, "the degree of creativity and inventiveness in any environment is directly proportional to the number of variables in it" (p. 87). Louv described nature as "imperfectly perfect, filled with loose parts and possibilities" (p. 97). This is one of the unique contributions of Nature Explore Classrooms compared to indoor classrooms; the richness in natural materials and the contributions of those materials to children's learning is unparalleled. The "built environment" cannot compete with the kind of learning environment nature provides. It simply does not "offer the array of loose parts, or the physical space to wander" (Louv, 2005, p. 96).

In many cases, nature's open-ended natural materials are, literally, right outside our doors (or accessible nearby), yet today's culture places great emphasis on buying just the right toys and gadgets, particularly the next best electronic toys that are touted to teach young children academic skills. Children's play has changed dramatically since the advent of battery-operated, do-everything, technology driven toys that are created by adults and marketed to children as consumers. One concern with this, as Louv (2005) stated, is that "the life of the senses (has become), literally, electrified" (p. 57). John Rosemond (2001) cautioned that:

> Today, instead of sending children outdoors to play, we let them sit in front of TV sets for thousands of hours during their formative years, staring at a constantly blinking, tasteless, odor-free, hands-off counterfeit of the real world. Meanwhile, their imaginations atrophy from disuse, along with their initiative, their curiosity, their resourcefulness, and their creativity (p. 164).

Joan Almon, director of the Alliance for Childhood, suggested that a good toy is really only 10% toy and 90% child (cited in Linn, 2008). One implication of this is that parents and educators need to give children the opportunity to play – time to enjoy free, unstructured play, think and dream. Yet, according to the Alliance for Childhood, young children are spending over four and a half hours a day watching TV, playing video games and sitting in front of computer screens, when "every day of childhood

should be a day for play"!

> What's the smartest thing a young child can do with a computer or TV? Play with the box it came in! Computers tend to insist on being just computers, programmed by adults. But an empty box becomes a cave, a canoe, a cabin, a candy shop – whatever and whenever the child's magic wand of imagination decrees.
> *(Alliance for Childhood Newsletter)*

In our Nature Explore Classroom a small, wooden block becomes an off and on button for imaginary happy streamers. A piece of rotting wood becomes a prehistoric dinosaur tooth and a piece of bark becomes a very important tool to repair the Titanic. Tree branches become moose antlers and peacock feathers. Through their hands-on manipulation of these rich, natural materials, children have the opportunity to share their knowledge at the same time they continue to construct it. Our data leave no doubt that open-ended materials engage young children's minds – they spark children's imaginations and intellectual curiosity, they stimulate children's senses, and they ignite children's love for learning because the learning is personally meaningful to them.

Our findings suggest that children's learning was also meaningful to them because it was child-driven rather than adult-driven. All of the examples in this paper illustrate child-initiated activities – authentic play that was about children's agendas. As a result, children were fully engaged (minds and bodies) in play that contained a great deal of intrinsic motivation. This is significant because research has repeatedly demonstrated that "learning occurs best when children are motivated by personal goals and interests" (Hohmann & Weikart, 1995, p. 55). Increasingly in today's culture children do not have the time or opportunities to pursue their own interests.

Through their authentic, child-initiated play in the Nature Explore Classroom, children had the opportunity to make choices, and explore content that interested them. They got to choose what they wanted to do or create, what materials they wanted to incorporate into their play, how they wanted to use those materials, what areas they wanted to use, who else they wanted to involve in their play, how involved they wanted to be and what role(s) they would assume (and in some cases, what roles they wanted others to assume). Children had the freedom to decide when they wanted to change their play, and even when they wanted to end their play. It would be difficult to allow this level of self-initiative in indoor classrooms. One of the keys to children's rich learning experiences in the Nature Explore Classroom was that they were in charge of their play. Having opportunities to demonstrate initiative will contribute to children's growing sense of self-esteem and skills competency.

Hohmann and Weikart (1995) described why encouraging children's initiative is so important:

> Making and expressing choices, plans, and decisions is fundamental to a child's developing sense of competence and equality. As daily planners and decision-makers, children acquire increased confidence in interacting with peers and adults. They come to see themselves as respected partners in shaping many of the ongoing events in their world (p. 381).

Gellens (2007) suggests that:

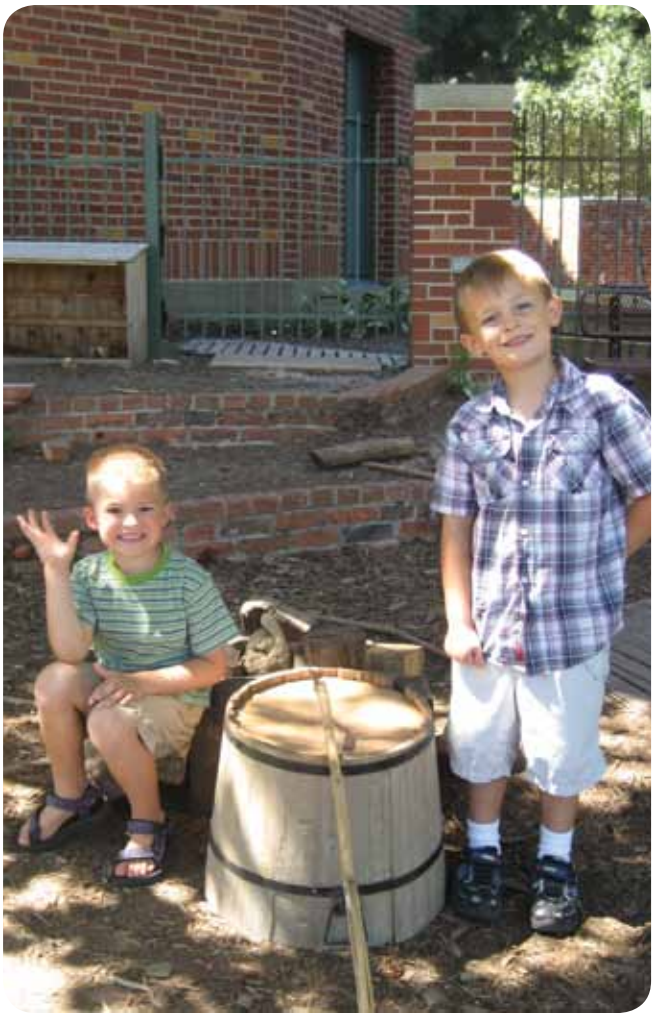
> Giving children the opportunity to develop critical thinking skills is the best legacy we can leave them…adults don't always have to teach, but can simply allow children to learn. Too often parents and teachers feel they must direct the learning. (Children's) minds will be involved when adults create active learning environments and ask questions about their play (p. 41).

Though the focus of this study was on children, and the play scenarios they initiated, we would be remiss not to mention the significance of the teacher's role. While in most cases teachers intentionally stayed out of children's way, they placed themselves in close proximity to children, where they could observe them, be available to share in the joy of children's discoveries, and to scaffold learning at teachable moments. Even when quietly observing children, teachers were fully engaged.

In the Nature Notes we analyzed, children often initiated conversation with teachers. They proudly shared their accomplishments and discoveries with teachers (e.g., "Look", "Look what I found.", "Come over here.", "Look at me."). Children invited teachers

into their play, and sometimes assigned roles to teachers. Teachers were available when children needed physical assistance, especially to move heavy objects. Sometimes children looked to teachers for approval and asked permission (e.g., to go into the greenhouse). Teachers monitored children for safety and helped them learn how to navigate space and negotiate materials safely (e.g., 6' long poles). When appropriate, teachers asked children questions (especially open-ended questions) to help them think more deeply about what they were doing. Sometimes those questions were general and other times they were content related, about specific experiences children were having. Teachers allowed children to take appropriate risks (e.g., balancing on objects of different heights, carrying heavy objects, manipulating long and large materials) because they knew risk taking in a safe environment was important to children's development. Teachers also allowed children to use materials in non-conventional ways, which was key to helping children engage fully with their imaginations.

Teachers also made a commitment to take children outdoors, even in inclement weather. At times they extended children's time outdoors, to provide a richer play experience and because they recognized that important learning was happening. They gave children freedom in their play, especially to make choices and direct their play. Teachers honored children's knowledge and allowed them to become the experts. At times teachers provided vocabulary words to scaffold children's understanding of a concept. Teachers also modeled literacy and validated the importance of children's play by documenting what children were doing and saying. The process of documentation became not only an avenue for authentic assessment but also a teaching tool.



Curt and Charlie's "big, huge spaceship". "Pull the stick and it goes faster, more than a hundred…pull it forward and it makes it slower".

6. Recommendations

Based on the findings of this study, we offer several recommendations:

- Make a commitment to take children outdoors on a regular basis, carving out time in hectic schedules for uninterrupted, unplugged, unstructured play. Give children the gift of time to become involved in complex play, and to change that play as their imaginations dictate.
- Create intentionally designed spaces outdoors (at schools, at home, in neighborhoods) and intentionally select materials that will engage children in physical movement and multi-sensory learning, in order to enhance their learning.
- Allow children to direct their play. Closely observe what they are doing, what they are interested in, their ability to focus for sustained periods of time, how they use their imaginations with different types of materials, and how they add to their existing knowledge-base through authentic play experiences.
- Advocate for play. Collaborate to develop "one clear voice" about the value of authentic, unstructured play for children, and identify ways to share that message with key individuals who have the power to make decisions about how children spend their time.
- Materials are key. Look beyond traditional marketing of the latest toys and consider the possibilities that natural materials and loose parts provide for children's imagination and learning. When children are playing outdoors, allow them to create their own props with natural materials, rather than providing them with pre-constructed toys.
- When schools are planning to remodel outdoor spaces, parents and administrators might urge committees to consider the value of incorporating natural spaces and to compare the cost of cement, rubberized surfaces and high quality play equipment to the basic, simple, natural features of outdoor classrooms, which can be constructed to fit any specification.
- Schools might consider asking parents and/or their communities to help supply or replenish natural materials. These materials might include pieces of wood, logs or tree stumps, various sizes of sticks, rocks, plants, or seasonal materials such as pumpkins, gourds, and recycled Christmas trees. Parents and teachers might involve children in collecting materials, taking them on collection walks to find loose parts such as leaves, pinecones, pods and acorns (giving children the opportunity to practice close observation and classification skills).
- College and university faculty might incorporate curriculum in their teacher training programs to help students understand the value of outdoor play for children and how their teaching role with children will be different outdoors. Coursework might help students think more intentionally about the kinds of outdoor spaces and materials that foster learning. The curriculum should be set up in way that gets pre-teachers outdoors, and helps them become more comfortable spending time there, teaching outdoors, and taking children outdoors. It should also include methodology to help students learn to not only use their close observation skills with children outdoors, but to document that learning using some kind of protocol that helps them identify the important skill development that is taking place as children are fully engaged outdoors. The curriculum should help new teachers make the link between this type of documentation and authentic assessment.
- As parents visit infant/toddler/preschool programs to make decisions about enrolling their children, they should ask questions about the programs' philosophy on play and on making sure children have outdoor time during the day. They should consider whether programs have made a commitment to creating rich, outdoor spaces that provide time for play and facilitate learning in nature.
- Parents, adult family members and older siblings have the opportunity to go outdoors with children and model authentic, unstructured, unplugged play. Carve out time to do this, whether spontaneously or planned. Take advantage of weather elements, seasons, and the richness of the environment.

Children worked together to move recycled Christmas trees then stand them up against the fence. Samantha reminded her friends, "We have to do teamwork!"

Samantha counted, "One, two, three, four Christmas trees. We're trying to get all the trees up for all the people". Lucy braced a tree by placing large rectangular tree blocks near the base of the trunk, then announced, "I think it's going to stay".

7. Epilogue

Dimensions' Nature Explore Classroom was intentionally designed to provide a rich environment, where caring adults help nurture children's intellectual curiosity and active-learning. The important life skills that young children were learning when they were engaged in child-initiated authentic play in the Nature Explore Classroom is evident. These skills cannot effectively be learned from worksheets, textbooks, screens, memorization, and drills. They must be learned experientially and through the senses in ways that are meaningful for children. The natural learning environment that gives children opportunities to be in charge, make choices, and play make-believe presents a stark contrast to many of today's learning environments that place a heavy emphasis on "skill and drill" and testing to validate learning. Because of initiatives such as "No Child Left Behind" educators have been forced to view children through the lens of test scores. Increasingly, many early childhood programs across the country have shifted their focus exclusively to children's academic development, with little emphasis on developmentally appropriate practice for the whole child. This research adds to the growing body of evidence that substantiates that for young children, play IS learning, and that intentionally designed outdoor spaces provide powerful contexts for learning. The irony is not lost on us that while the goal of this research is to substantiate the importance of "authentic, unstructured play" by identifying the rich skill development that happens when children engage in this kind of play, the real value of play is simply that it is what children are supposed to do.

"Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world and all there ever will be to know and understand, stimulating progress."

~ Albert Einstein

Braden's "pepperoni pizza shop", where a hamburger pizza costs "$300." and a hamburger, pepperoni pizza costs "$306".

After observing birds, two boys became a "chickadee" and "cardinal", then created a storyline around their play. At the teacher's invitation, they sketched themselves.

"Children need to discover their own answers to the questions why, when, how come, in a relaxed and non-competitive environment (that) promotes creative play. The understanding of these questions does not come through words alone. Preschoolers have important lessons to learn about themselves that have virtually nothing to do with education as adults understand it. Children are dependent on real experiences they can feel, touch, taste, smell, hear and see…This sensory type of learning remains the dominant way children build solid understandings about themselves and the world in which they live. One of the most important ways children clarify their understanding of the real world is by playing make believe or pretend play. Children bring what they know about the real world, as limited as that may be, and build upon that knowledge…Dramatic play lays the framework for children's abstract thought and for future creativity and storytelling….Play is fun and necessary for a joyful early childhood."

~ Gail Shepard

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8. Appendices

DIMENSIONS Educational Research Foundation
dimensionsfoundation.org

Documentation Form

☐ **Nature Notes**
☐ **Visual Notes**
☐ **Other Developmental Notes**

Teacher/Observer: _____

Date: _____/_____/_____ Time of Day: _____

Brief description of activity :

Why you believe this is significant:

☐ Teacher Initiated Activity
☐ Child Initiated Activity

How Long Observed: _____

Weather Conditions:

_____

Child(ren)	Age/Birthdate	Gender

Location of Activity

- ☐ Block area
- ☐ Toy area
- ☐ House area
- ☐ Art area
- ☐ Materials Exploration
- ☐ Science area
- ☐ Snack
- ☐ Climbing/Crawling area
- ☐ Messy Materials area
- ☐ Block/Building area
- ☐ Nature Art area
- ☐ Garden/Pathways
- ☐ Greenhouse
- ☐ Music/Movement area
- ☐ Open area
- ☐ Gathering area
- ☐ Dirt Digging area
- ☐ Sand area
- ☐ Brick Wall

Resources/Materials

- ☐ Akambira
- ☐ Nature Art Table
- ☐ Tree Cookies
- ☐ Tree Blocks
- ☐ Square/Rectangle Blocks
- ☐ Rainstick
- ☐ Scarves
- ☐ Garden Tools
- ☐ Clipboards
- ☐ Magnifying Glasses
- ☐ Tape Measures
- ☐ Water
- ☐ Shovel
- ☐ Rake
- ☐ Hand Trowel
- ☐ Nature Image Cards
- ☐ Writing Materials
- ☐ Unit Blocks
- ☐ Large Hollow Blocks
- ☐ Fabric/Clips
- ☐ Paint/Watercolors
- ☐ Reusables
- ☐ Other _____
- ☐ Other _____

DF PRE **Rev August 2011**

Appendix A: Nature Notes Form - Back

Key skills children are developing through using Dimensions' resources

Visual-Spatial ☐ observing closely ☐ noticing patterns, details, textures, colors, shapes, sizes ☐ discriminating between objects/types/sizes ☐ developing figure-ground perspective ☐ seeing from multiple perspectives ☐ reading and following maps and recognizing landmarks ☐ understanding concepts such as inside, outside, over, under, around, through ☐ making visual analogies (X looks like Y) ☐ learning about dimensionality ☐ creating maps (spatial orientation) ☐ seeing, storing, retrieving visual images ☐ identifying similarities and differences	**Other/Comments**
Language/Literacy ☐ recognizing and using symbols ☐ telling stories ☐ reading ☐ conversing with other children and adults ☐ recognizing that print has meaning/is verbal language translated to written form ☐ practicing letters, forming words, formatting them on the page ☐ naming ☐ spelling ☐ creating pledges, poems, songs	**Other/Comments**
Science ☐ understanding seasons/lifecycles ☐ learning about plant life, pond life, insects, birds, animals, habitats ☐ learning about hibernation, migration, metamorphosis ☐ formulating research questions/hypotheses ☐ conducting experiments ☐ learning about cause-and-effect relationships	**Other/Comments**
Mathematics ☐ counting ☐ matching ☐ learning geometric shapes ☐ understanding whole-part relationships ☐ understanding scale relationships ☐ understanding diameter ☐ experiencing area and volume ☐ classifying ☐ seriating ☐ understanding time concepts ☐ sequencing ☐ estimating distance ☐ recognizing symmetry ☐ understanding perimeter	**Other/Comments**
Kinesthetic/Body Awareness ☐ using body as a tool and learning to use tools ☐ developing fine and gross motor skills (small and large muscle movement) ☐ developing muscle memory/concepts cemented with repeat experiences ☐ turning body into shapes (helps internalize learning) ☐ creating dances (creative and emotional expression) ☐ experiencing textures and shapes of natural materials (sensory/touch) ☐ developing balance and knowledge of stability ☐ navigating through space (awareness of body in space and proximity of body to objects)	**Other/Comments**
Social/Interpersonal ☐ learning cooperation and teamwork ☐ resolving conflicts ☐ communicating desires, needs, ideas to others ☐ learning to share, negotiate ☐ interacting/collaborating with adults ☐ sharing knowledge and expertise with others (children, teachers, parents)	**Other/Comments**
Intrapersonal ☐ developing critical thinking, questioning skills, abstract thinking ☐ developing respect/reverence for the environment ☐ developing a sense of ownership and responsibility to become good stewards of the environment ☐ developing self confidence, pride, self-efficacy ☐ taking initiative ☐ expressing emotion ☐ solving problems ☐ expressing creativity ☐ taking appropriate risks ☐ conquering fears ☐ making decisions	**Other/Comments**
Construction/Engineering ☐ stacking ☐ making balance ☐ bridging ☐ ramping ☐ making tunnels ☐ making lines (straight, curved, zig-zag, etc.) ☐ making walls ☐ cornering ☐ emptying and filling ☐ supporting ☐ making an opening ☐ making symmetrical ☐ propping ☐ stepping ☐ making enclosures ☐ covering	**Other/Comments**
Creative Representation ☐ making representational models (3D) ☐ making representational drawings, sketches, paintings (2D) ☐ pretending/role playing ☐ using natural objects to represent other things (transference)	**Other/Comments**
Music ☐ keeping a beat ☐ creating music ☐ moving to music ☐ singing songs ☐ matching a pitch	**Other/Comments**

Appendix B: Overview of Data/Authentic Play

NN#	Teacher	Date	Initiated by	Area(s)	Materials(s)	Types of Data
1	Renee P	9/17/08	Child	Multiple	Paper Pencil Pinecone	Narrative Child's map
2	Kristi R	11/13/08	Child	Messy Materials	6' long poles Broken tree cookies Pinecones	Narrative Photo(s)
3	Joyce W	3/21/07	Child	Messy Materials	6' long poles Large stone Red brick	Visual note/ annotated Child's drawing
4	Holly M	1/4/07	Child	Greenhouse	Snow Colored pencils Acorn lids Paper	Narrative Photo(s)
5	Holly M	1/23/09	Child	Sand	Hand shovel Soil Metal ring mold Muffin tin Brick Rolling pin	Narrative
6	Kathy T	5/2/07	Child	Messy Materials/ Brick cave	Tree cookies Bark Stump Heavy wood plank	Narrative Visual note
7	Suzan H	11/24/09	Child	Multiple	Corn kernels Fabric clips	Narrative
8	Holly M	2/5/08	Child	Indoors/ extension of outdoor activity	None/based on close observation out window	Narrative Child's drawing
9	Holly M	2/22/08	Child	Indoors/Science table /Extension of outdoor observations	Live Hibiscus tree Stuffed robin Magnifying glass Paper/Markers	Narrative Child's drawing
10	Laurie F	3/5/08	Child	Messy Materials and Open area	6' long poles Corn cob	Narrative Visual note
11	Chris K	10/3/08	Child	Messy Materials	Green leaf	Narrative
12	Holly M	10/1/08	Child	Nature Art Table	Mulch pieces Daisy leaves Cake pan	Narrative Photos
13	Chris K	3/30/07	Child	Messy Materials/ Brick wall	6' long pole Tree cookies Wood chips	Narrative Visual note
14	Chris K	11/7/07	Child	Sand Digging	Shovels Bucket Hollow stump Sand Rocks Wood chips Metal bowl	Narrative Visual note
15	Kristi R	11/15/07	Child	Messy Materials	Stumps/2 large Long plank Small wood blocks	Narrative Visual note
16	Kathy T	12/8/10	Child	Block Building	Tree blocks Small tree cookie	Narrative Photos

Appendix B: Continued

17	Kathy T	3/14/11	Child	Sand	Small shovels Large metal bowl Berries	Narrative
18	Kathy T	9/29/10	Child	Messy Materials	6' Long poles Tree stumps Tree cookies	Narrative
19	Joyce W	10/22/10	Child	Messy Materials	Piece of wood Nature Notes form Pencil	Narrative Child's sketch
20	Kris V	4/18/11	Child	Sand	Acorn caps Corn cob	Narrative Child's sketch
21	Kathy T	8/30/10	Child	Sand	Sand Water Buckets Wood chips Rock Feather Sticks Large metal bowl	Narrative Photos
22	Suzan H	9/30/10	Child	Messy Materials	Stump Hay bales Log Wood chips Clipboards Paper Pencils	Narrative Visual note Child's sketch
23	Suzan H	10/14/10	Child	Digging Nature Art	Paper Colored pencils Easel Clips	Narrative Children's sketches
24	Cindy H	8/10 (23th/ 25th/ 27th)	Child	Messy Materials	Large chunks wood Tree cookies Sticks Branches Bucket Water	Narrative Photos
25	Kathy T	12/3/10	Child	Sand	Rock Bowl Sand	Narrative Photos
26	Kristi R	10/5/10	Child	Climbing	2 Sticks	Narrative
27	Kathy T	4/6/11	Child	Sand	Print in cement Bone shaped rock	Narrative
28	Kathy T	12/3/10	Child	Multiple	Branch Leaf Acorns Dry rooted plant Feather Wood chips Brick Chalk	Narrative
29	Amanda K	8/29/11	Child	Messy Materials	Large rectangular blocks Sticks Tree cookies	Narrative
30	Kristi R	10/4/11	Child	Messy Materials	12" long piece of driftwood	Narrative Visual note

Appendix B: Continued

NN#	Teacher	Date	Initiated by	Area(s)	Materials(s)	Types of Data
31	Holly M	1/07	Child	Music	Branches Log drum Seed rattles 2 Guiros	Narrative Photos
32	Natalie R	9/3/08	Child	Multiple/ Pathways	Wooden block Plants Flowers	Narrative Photos
33	Cindy H	6/10/09	Child	Music	10" tapered stick	Narrative
34	Cindy H	6/9/06	Child	Messy Materials	Sand Twigs	Narrative Visual note
35	Kristi R	1/6/09	Child	Messy Materials	Broken tree cookies Small Sticks Small blocks Pine needles	Narrative
36	Tami B	10/9/08	Child	Sand	Pans Rolling pin Mini pumpkins Stick Hollow stump	Narrative
37	Joyce W	Fall '05	Child	Garden	None	Narrative
38	Chris K	11/24/08	Child	Messy Materials	6' Long poles Tree Brick wall	Narrative Visual note
39	Kathy T	4/14/08	Child	Multiple	Bucket Sticks	Narrative
40	Kristi R	1/20/09	Child	Messy Materials	Log Tree block Tree cookies Wooden cube	Narrative Photo
41	Kathy T	12/8/08	Child	Sand	Shovel Sand	Narrative Photo
42	Chris K	2/20/09	Child	Messy Materials	Tree stump Piece hard clay Pine needles	Narrative Photo
43	Kris V	10/29/08	Child	Sand	Sand Stick Leaf	Narrative Photo
44	Joyce W	10/16/08	Child	Messy Materials	Brick wall Three tree stumps Log	Narrative Visual note
45	Kris V	6/9/06	Child	Messy Materials	Wood chips Pine cones	Narrative Visual note
46	Joyce W	10/12/07	Child	Multiple	Paper Green marker	Narrative Child's drawing
47	Tami B	10/1/07	Child	Messy Materials	Large tree stump Small block of wood Large wood blocks Parts of tree cookies	Visual note, annotated
48	Natalie R	8/27/08	Child	Climbing	None (body)	Narrative
49	Holly M	4/22/08	Child	Messy Materials	Broken tree cookies Bark Large tree blocks	Narrative Visual note
50	Suzan H	9/17/08	Child	Messy Materials	Fabric, scarves, tree cookies, log, wood chips	Narrative Photo

Appendix B: Continued

NN#	Teacher	Date	Initiated by	Area(s)	Materials(s)	Types of Data
51	Kathy T	2/2009	Child	Multiple	2 scarves	Narrative Photos
52	Kathy T	3/2009	Child	Multiple	2 scarves	Narrative
53	Kris V	10/29/08	Child	Messy Materials	Pine cones Leaves Pine needles Scissors Bucket	Narrative Photos
54	Kris V	10/29/08	Child	Sand	Sand Bundt pan Stick	Narrative Photos
55	Kris V	10/10/08	Child	Messy Materials	6' long poles Corn kernels Corn cobs	Narrative Visual note
56	Kris V	11/24/08	Child	Messy Materials	Rotting stump	Narrative Child's sketch
57	Kristi R	10/9/08	Child	Messy Materials	6' long poles Bricks Large tree cookie	Narrative Visual note
58	Kathy T	4/7/07	Child	Sand	Sand Bucket Water Shovel	Narrative Photos
59	Holly M	5/16/12	Child	Messy Materials	Pieces of wood Bushes Piece of driftwood Fabric clips Brick wall	Narrative Visual note
60	Holly M	5/16/12	Child	Messy Materials	Large piece of wood Tree blocks Corn cob Rectangular blocks Paper Maps children drew	Narrative Visual note Child's maps
61	Suzan H	3/22/12	Child	Sand	Sand Small shovel	Narrative Photos
62	Suzan H	1/10/12	Child	Along Fence	Donated Christmas trees (recycled) Large wood blocks Leaves Straw Wood pieces/various sizes	Narrative Photos
63	Holly M	4/12/12	Child	Artist Garden	Cardboard wheel Curvy stick	Narrative Visual note

Appendix C: Types of Documentation Analyzed (N=63)

Types of Data	Frequency/Percentage *
Narrative description only	14/22%
Narrative description plus teacher's visual sketches	15/24%
Narrative description plus photograph(s)	22/35%
Narrative description plus children's sketches or artwork	8/13%
Visual sketch only (plus annotations by teacher)	1/2%
Visual sketch (from teacher) plus child's drawing	1/2%
Narrative description plus visual sketch, plus children's work	2/3%

* Rounded up or down to the nearest tenth

Appendix D: Analysis Form Used for Authentic Play Article

Pretend Play Element:

Area(s): _____

Material(s): _____

☐ Child initiated ☐ Teacher initiated

Creative Representation

☐ Teacher: _____

☐ Pretend/Role Playing
☐ Making representational models
☐ Making representational drawings/sketches
☐ Using natural objects/materials to represent something else _____
= _____

Intrapersonal Skills

☐ Individual initiative
☐ Making choices/decisions
☐ Developing/displaying confidence, self-efficacy, pride in accomplishment
☐ Making preferences/needs/desires known
☐ Taking risk(s)
☐ Problem-solving, Critical Thinking, Abstract Thinking

Other: _____

Social/Interpersonal Skills

☐ Engaging with another child
☐ Engaging with teacher
☐ Working cooperatively with peers
☐ Sharing/taking turns
☐ Displaying inclusiveness
☐ Sharing knowledge/expertise with others
☐ Resolving conflicts

Other: _____

Science Skills

☐ Observing natural/scientific phenomenon
☐ Experimenting
☐ Speculating or hypothesizing or formulating research questions
☐ Learning about seasons/lifecycles
☐ Learning about cause and effect
☐ Learning about plants, insects, birds, animals, earth's elements

Other: _____

Appendix D: Continued

Math Skills

- ☐ Volume
- ☐ Number/Quantity/Counting
- ☐ Classification by attribute
- ☐ Whole-Part relationships
- ☐ Estimating
- ☐ Time Concepts
- ☐ Size relationships
- ☐ Geometric shapes
- ☐ Scale relationships (small vs large)
- ☐ Sequencing or Seriation
- ☐ 3D to 2D
- ☐ Repeated pattern
- ☐ Experiencing: Distance, length, height, width, area, diameter, angle

Other: _____

Language/Literacy Skills

- ☐ Reciprocal conversation
- ☐ Asking or answering questions
- ☐ Storytelling
- ☐ Recognizing/using symbols
- ☐ Reading … Recognizing print has meaning
- ☐ Naming/labeling
- ☐ Creating pledges, poems, songs
- ☐ Using vocabulary

Other: _____

Kinesthetic Skills

☐ Gross Motor ☐ Fine Motor ☐ Locomotor ☐ Non-Locomotor

- ☐ Engaged in purposeful movement
- ☐ Using/manipulating tools or using body as a tool
- ☐ Developing muscle memory from repeated activity
- ☐ Developing balance and knowledge of stability
- ☐ Navigating through space (body … or with objects)
- ☐ Tactile/physical experience with natural materials/textures, shape (sensory/touch)

Other: _____

Appendix D: Continued

Visual-Spatial Skills

- ☐ Close observation
- ☐ Eye-hand coordination
- ☐ Noticing patterns, details, textures, colors, shapes, sizes
- ☐ Figure/ground perspective
- ☐ Seeing from Multiple Perspectives
- ☐ Making visual analogies (X looks like Y)
- ☐ Creating maps (spatial orientation)
- ☐ Reading and following maps, identifying landmarks
- ☐ Understanding spatial concepts such as over, under, up, down, through, around, inside, outside

Construction/Engineering Skills

- ☐ Digging
- ☐ Clearing/preparing "site"/space
- ☐ Making lines
- ☐ Ramping / propping
- ☐ Bridging
- ☐ Stacking
- ☐ Emptying/Filling
- ☐ Sturdy base
- ☐ Bracing/stabilizing
- ☐ Making enclosures

Other: _____

Music or Performing Arts Skills

- ☐ Creating song / singing song / performing
- ☐ Playing instrument
- ☐ Creating Dance / performing
- ☐ Creating art product

Other: _____

Appendix E: Brief Description of Children's Authentic Play

Nature Note #	Description of Authentic Play
1	Going on a treasure hunt, using a map child had drawn of the Nature Explore Classroom to find the treasure
2	Constructing and furnishing a "house" with "dishes" and "toys"
3	Building a castle (100% scale that children could go inside)
4	Operating a snow cone factory in the greenhouse
5	Making cupcakes
6	Building the Titanic (a repeated activity by a group of children)
7	Using super powers in the outdoor classroom to help with tasks
8	Pretending to be birds (specific types), flying and resting in trees
9	Pretending a stuffed bird is real bird in a hibiscus tree/observing closely with magnifying glass
10	Creating large scale clock on ground with 6' long poles and sticks, pretending it is different parts of the day, serving food
11	Pretending to have a garage sale and that a green leaf is money
12	Cutting up pretend food (leaves) with mulch pieces that served as pretend knives
13	Cooking "pizza" on the brick wall
14	Cooking in the sandbox
15	Balancing on "the blade" (elevated plank placed between two stumps)
16	Making pizza in a "pepperoni pizza shop"
17	Making "poison pie"
18	Building a "trap"
19	Sharing discovery of a "dinosaur bone"
20	Burying and digging for "treasure"
21	Making "pie"
22	Creating a "Fireman Race"/obstacle course with awards
23	Pretending dirt digging area was construction site and desert
24	Building a space ship (repeated activity over three days)
25	Discovering and sharing a "poisonous rock"
26	Pretending to lock up bad people (turns into sound exploration)
27	Initiating conversation with teacher about print in cement – a "dinosaur footprint"; later shows teacher a rock that is a "dinosaur bone"
28	Searching for "gold"
29	Building a "fire"/searching for "fire wood"/ child becomes "fire-lighter"
30	Discovering "dinosaur bone" and speculating about its age, type of dinosaur and how it got there
31	Pretending to be animals while dancing, pretending branches tucked in coats are moose antlers and peacock feathers

Appendix E: Continued

Nature Note #	Description of Authentic Play
32	Pretending to decorate the Nature Explore Classroom with "happy streamers" (that come out of a small, rectangular block)
33	Pretending a tapered stick with holes is a flute and performing a concert for peers and teacher
34	Creating a "bug house" and imagining how bugs climb up and down it
35	Decorating a "princess house" and "castle" and giving "awards"
36	Making a birthday cake
37	Pretending to be flowers, moving in the wind
38	Building a "club house"/"fort" and roasting marshmallows and hotdogs in "fire"
39	Traveling through Nature Explore Classroom with bucket, collecting "bones"
40	Making a "surfboard" (narrating the construction process and pretending loose materials are tools)
41	Making a volcano
42	Building a campfire
43	Building a castle
44	Driving vehicles
45	Driving a "choo choo train"
46	Pretending to be at the prairie/hiding in tall grasses and mapping path through prairie
47	Creating 100% scale vehicle (unnamed)
48	Pretending to be a butterfly and chameleon
49	Creating pretend play scenario using loose materials to represent people and cats
50	Building a house with fabric and clips and imagining the rooms
51	Pretending to be a "great owl", using scarves to extend wings
52	Pretending to be an "eagle", using scarves to extend wings
53	Making soup with pine cones and pine needles
54	Making a cake
55	Creating a campfire experience
56	Pretending rotting stump is a surfboard, then transforming it into a ladder
57	Fixing a ship and playing in the sea, rescuing sea turtles
58	Making "peppermint", "cinnamon" and "tomato" hot "cocoa"
59	Packing for and taking a motorcycle trip to a music contest, pretending bushes are back-up dancers
60	Driving a vehicle/assuming roles/charging "one invisible dollar" to ride
61	Pretending to be a paleontologist, looking for bones
62	Manipulating donated recycled trees to create a Christmas tree farm, then creating maps of the road they went on
63	Piloting an unnamed vehicle, using a stick as a lever to go "higher"

Appendix F: Creative Representation - Transforming Materials Through Imagination

Nature Note #	Material(s) Children Used	What Materials Represented
1	Pinecone	Directional arrow (on treasure hunt)
2	Pinecone Broken tree cookies	Dishes Toys for house
3	Stick	Light (for castle)
4	Acorn lids packed with snow	Snow cones and sundaes
5	Storage cupboard Soil Sand Brick Hand Shovel	Oven Chocolate Sugar "Smasher" to prepare ingredients Eating utensil
6	Tree Stump Bark	Engine (Titanic) Tool to dig "gunk" out of the engine and iceberg pieces
7	Angled ramp up concrete stairs Climbing Structure	Elevator Ship
10	6' long poles and smaller sticks Corn cob	Large hexagonal clock with hands Sausage (to eat at "breakfast time")
11	Green leaf	Money (to purchase items at pretend garage sale)
12	Pieces of mulch Daisy leaves	Knives to cut food Food
13	Brick Wall 6' long pole Wood chips Tree cookie with wood chips on top	"Cooker" for pizza Spatula Food (placed on cooker) Pizza
14	Metal bowl filled with sand Hollow tree stump	A music maker Oven
15	Long wooden plank	"The blade" (bridging two stumps, to balance on)
16	Wooden blocks (different sizes)	Pizza/toppings
17	Large stump Sand Bowl of Sand/blue berries from shrub	Oven "Mountain salt" and "yucky poisonous stuff" Poison pie
18	6' long poles in pile Tree stump 2 small tree cookies	A Trap Rocketship Gas for rocketship
19	Piece of wood	A dinosaur bone
20	Acorn lids Corn cob	Buried treasure Marker for buried treasure
21	Sand/water in metal bowl Tree stump	Pie Oven
22	Wood chips	Trophies (for "fireman race")
24	Chunks of wood Large rectangular wooden block Stick	Money Engine Lever that controls speed
25	Rock Bowl of sand	Poisonous rock Poisonous pie
26	3" long stick	A lock (to "lock up bad people")
27	Rock	Dinosaur bone
28	Acorn Branch Dry rooted plant Brick surface rubbed with chalk	Gold Piece of a chopstick Parachute Where magic powers are
29	Rectangular blocks, small sticks and tree cookies	Fire
30	Piece of driftwood (12" long)	Dinosaur bone
31	Tree branches	Peacock feathers and moose antlers
32	Wooden block	Apparatus that releases "happy streamers"
33	10" tapered stick with holes	Flute
34	Twigs standing/angled in sand	Bug house
35	Broken tree cookies Small stick Small wooden block Tree pieces Tree cookies (different shapes) Brick cave	Toilet Flusher TV remote Pizza Rainbow and flower awards Princess house/castle

Appendix F: Continued

Nature Note #	Material(s) Children Used	What Materials Represented
36	Pans filled with sand and pumpkin Hollowed out tree stump Sticks	Birthday cake Oven Knife to cut cake and candle
38	Stick	Skewers to roast marshmallows/hotdogs in fire
39	Sticks	"Sabre tooth cat teeth" Leg of an animal "Fossil" of a snake Triceratops horn "Signal thing"
40	Triangular pieces of tree cookie Holes in the brick wall 2 ½' long partially rotted log 6" diameter tree cookie	Hammer and a "shredder" "Grinder" Surfboard Saw
41	Piled sand	Volcano
42	Pine needles piled on clay	Fire
43	Pile of sand Stick with dried leaf attached	Castle Flag
44	Brick wall, tree stumps and log	Vehicles
45	Wood chips Pine cones Hole in brick wall	Tickets Gas Wheel
47	Parts of tree cookies Large blocks of wood Small block of wood	Steering wheel and compass Engine and seat to sit back and "relax" Key
49	Piece of bark Pieces of mulch Stacks of broken tree cookies Large wooden block Small broken tree coookies	Fish Cat water and cat food People and cats Robot Car
50	Fabric draped over tree Small tree cookies Wood chips and pine needles sprinkled on stack of tree cookies	House with multiple rooms Food Birthday cake
51	Two red scarves	Wings (to become "great owl")
52	Two green scarves	Wings (to become "eagle")
53	Pine cones and pine needles Galvanized bucket	Soup Pot
54	Sand formed by bundt pan Stick	Cake Candle
55	3 long sticks placed in triangle Corn kernels Corn cobs	Campfire Fire Hot dogs
56	Rotting stump	Surfboard
57	Brick enclosure Large tree cookie with a hole	Ship Engine
58	Water/sand mixture in bucket	3 flavors of "cocoa"
59	Brick wall Pieces of wood Rounded piece of driftwood Fabric clips 3 bushes	Motorcycle Baby seat Baby Flowers Back up dancers (dance contest)
60	Stumps and large pieces of wood Small rectangular blocks Rolled paper Tree blocks Corn cob	100% scale vehicle Popsicles Megaphone Pizza Object to wash vehicle
61	Sand area	"Dig" area – looking for dinosaur bones
62	Recycled Christmas trees	A Christmas tree farm
63	Cardboard wheel with long stick	Vehicle with lever to go higher

Appendix G: Body Movement Identified in Children's Play in the NEC

Non-locomotor Movement	Locomotor Movement
Reaching	Walking
Grasping	Running
Dropping items (releasing)	Climbing
Cradling objects in arms	Hanging upside down
Placing objects	Sliding
Tapping	Twirling (multiple levels)
Scraping surface	Skipping
Patting with hand	Turning on toes
Patting with tool	Carrying Objects
Pounding objects	Digging (whole body/with shovel)
Rubbing (chalk over brick)	Straddling (low, brick wall; log)
Digging from seated position	Dragging objects (through space)
Sketching/drawing	Starting and stopping
Manipulating scissors	Dancing to music
Scooping with hands	Dancing to shakers
Scooping with tools	
Sticking out tongue (imitating insect)	
Curling tongue	
Extending arms perpendicular to body	
Bracing body with legs	
Striking (instruments)	
Sitting	
Sitting cross legged	
Lifting objects	
Pulling objects toward body	
Pointing with finger	
Pointing with objects/stick	
Drawing imaginary line in air	
Crouching/Squatting – on feet	
Crouching/Squatting – on knees	
Poking objects with stick	
Spinning objects	
Clipping (fabric clips)	
Flapping arms	
Standing	
Bending	
Nodding	
Motioning with hand	
Leaning	
Brushing objects off	
Balancing with arms	
Balancing with body	

Appendix H: Math Vocabulary Children Used in Their Pretend Play (N=33)

Nature Note Number	Math Vocabulary Used
1	"the middle"
2	"I did the middle." "more toys"
3	"up one me, bottom Aaron, middle Stephen"
4	"one triple coming up" "one blueberry sundae" "got more snow" "it's colder outside" (compared to greenhouse)
5	"Mom cooks cupcakes for a long time." "1, 2, 3, 4, 5, it's done." "I'll get some more sugar."
7	"get some more"
8	"a lot of people" "flew up very high" "my two's – my brothers" "the little tree" "I'm number two" "The squirrel is coming closer to the tree."
9	"This is where the big ones (Robins) go."
10	"can tell time by the shadows" "It's play time now." "We just made lunch time." "Let's make breakfast time." "It's going to be time to go when the shadow is on gate time."
14	"I think we need more of that stuff." "We need hundreds."
15	"I'll make it again tomorrow when I come here."
19	"It's 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 19 old."
21	"We need some more." "We don't need any more water." "That's enough water." "The sand pie is done – I want it to be done."
22	"When it's night time the race is closed." "Come back when it's day time." "Now it's night time." "Now you get to race." "Go, go go as fast as you can."
23	"Remember, the earth can hold all of us because it's huge." "big ocean and little pond" "It's about bigger than a human."
24	"build a big, huge spaceship" "goes faster" "more than a hundred" (speed)
27	"this big" "big nails"

Appendix H: Math Vocabulary (continued)

Nature Note Number	Math Vocabulary Used
28	"It's two acorns."
29	"circle" "more wood" "put sticks inside"
30	"May be a baby T-Rex because it's light" (weight) "I found a dinosaur bone. It's thousands and thousands and millions and millions of years."
32	"See, I decorated the whole outdoor classroom." "I put a white streamer all through the pathway" "I put it down low-high."
34	"Lots of bugs. Big black bugs, little black bugs."
36	"We are almost done." "It will be longer and longer." "It's done."
41	"they're (volcanos) big" "hot lava"
45	"choo choo has one wheel" "I have three passengers."
46	"We can hide in the tall grass."
49	"It's big – they're gonna share it."
57	"I'll keep jumping until it's time to go."
58	"take a little sand and water and mix it all together"
59	"Every time I sing I win" "Now we're ready to go" "Can't start without the baby." "It's time to wake up." (crows like rooster)
60	"it costs one invisible dollar"
62	"One, two, three, four Christmas trees." "have to fix some more trees, and that one" "We're trying to get all the trees up for all the people." "need more helpers"
63	"It's time to go up."

Appendix I:

Frequency/Percentage of Nature Notes with: *

9 skills: 2/3%

8 skills: 20/32%

7 skills: 37/59%

6 skills: 3/5%

5 skills: 1/2%

* Rounded up or down to the nearest tenth

Appendix I: Skills Children Were Developing Simultaneously

NN #	Intra-personal	Social	Science	Math	Language Literacy	Kinesthetic	Visual Spatial	Construction/ Engineering	Total Skills
1	X	X		X	X	X	X	X	7
2	X	X		X	X	X	X	X	7
3	X	X		X	X	X	X	X	7
4	X	X	X	X	X	X	X	X	8
5	X	X	X	X	X	X	X	X	8
6	X	X	X	X	X	X	X	X	8
7	X	X	X	X	X	X	X		7
8	X	X	X	X	X	X	X		8
9	X	X	X	X	X	X	X		7
10	X	X	X	X	X	X	X	X	8
11	X	X	X	X	X	X	X		7
12	X	X	X	X	X	X	X		7
13	X	X	X	X	X	X	X		7
14	X	X	X	X	X	X	X	X	9
15	X	X	X	X	X	X	X	X	8
16	X	X		X	X	X	X	X	7
17	X	X	X	X	X	X	X	X	8
18	X	X	X	X	X	X	X	X	8
19	X	X	X	X	X	X	X		7
20	X	X		X	X	X	X	X	7
21	X	X	X	X	X	X	X	X	8
22	X	X		X	X	X	X		6
23	X	X	X	X	X	X	X		7
24	X	X	X	X	X	X	X	X	8
25	X	X		X	X	X	X	X	7
26	X	X	X	X	X	X	X		7
27	X	X	X	X	X	X	X		7
28	X	X	X	X	X	X	X		9
29	X	X		X	X	X	X		7
30	X	X	X	X	X	X	X		7
31	X	X	X	X	X	X	X		8
32	X	X	X	X	X	X	X		8
33	X	X	X	X	X	X	X		8
34	X	X	X	X	X	X	X	X	8
35	X	X		X	X	X	X	X	7
36	X	X		X	X	X	X	X	7
37	X	X	X	X	X	X	X		7
38	X	X		X	X	X	X	X	7
39	X	X	X	X	X	X	X		7
40	X	X		X	X	X	X	X	7
41	X	X	X	X	X	X	X	X	8
42	X	X	X	X	X	X	X	X	8
43	X	X	X	X	X	X	X	X	8
44	X	X		X		X	X		5
45	X	X		X	X	X	X		6
46	X	X	X	X	X	X	X		7
47	X	X		X	X	X	X	X	7
48	X	X	X	X	X	X	X		7
49	X	X		X	X	X	X	X	7
50	X	X		X	X	X	X	X	8
51	X	X	X	X	X	X	X		7
52	X	X	X	X	X	X	X		7
53	X	X		X	X	X	X		6
54	X	X	X	X	X	X	X		7
55	X	X		X	X	X	X	X	7
56	X	X	X	X	X	X	X		7
57	X	X	X	X	X	X	X		7
58	X	X	X	X	X	X	X		7
59	X	X		X	X	X	X		7
60	X	X		X	X	X	X	X	7
61	X	X	X	X	X	X	X	X	8
62	X	X	X	X	X	X	X	X	8
63	X	X		X	X	X	X	X	7
Total	63/ 100%	63/ 100%	41/ 65%	63/ 100%	62/ 98.4%	63/ 100%	63/ 100%	34/ 53.9%	

About Dimensions Foundation Research

Our Methodological Approach

by Dana Miller, Ph.D.

Since February 1998, Dimensions Educational Research Foundation has used a qualitative research approach to help us understand more about children's skill development, the teacher role in scaffolding children's learning, the role of intentionally designed indoor and outdoor spaces and the value of natural, open-ended materials in helping children and families connect more meaningfully with nature.

Qualitative research is based on several distinct methodological traditions that were first documented in the 1800s. Qualitative research includes in-depth inquiry that is particularly suited to exploring complex human issues and social dynamics that cannot be as fully or meaningfully captured and reported by statistics. The goal of qualitative research is to develop a deep understanding of participants, processes and places. Researchers formulate broad, open-ended research questions (how, what) and construct research protocols to collect data.

The data qualitative researchers collect are in the form of words and pictures. Those data are collected in natural settings by researchers who become the "human instruments" for data collection. There are three primary ways to collect qualitative data: by conducting interviews, making observations, and reviewing documents, artifacts, and visual materials. Dimensions' research has always been based on close observation of children.

Qualitative researchers are intentional about the way they select their research sample(s). They use a "purposeful" sampling technique to select "information-rich" participants and research sites that will yield the most information about the topic of interest. Since qualitative samples are typically smaller than quantitative samples, purposeful sampling ensures that the data collected will be useful.

Qualitative data are analyzed systematically and inductively, so that the findings are grounded in the data. Researchers "take apart" the data to examine the pieces and then put the data back together to form a holistic picture. Re-occurring patterns or "themes" are explored within the data, and researchers make sense of those themes.

Qualitative findings are typically reported in a literary, descriptive narrative style. The goal of qualitative writing is to "tell a story" or "paint a picture" of the data for target audiences. This is often accomplished through the use of rich, narrative detail and direct quotes from participants.

Our Research Sites

Dimensions Early Education Programs, located in Lincoln, NE, serve as the research classrooms for Dimensions Educational Research Foundation. Our research model uses teachers who have been trained in qualitative research methodology as co-researchers. Teachers are trained to document their observations of children, recording visual notes and narrative data that include both descriptive and reflective comments. We developed a documentation tool (i.e., Nature Notes) that teachers use to record their observations of children. Teachers' documentation is not only used for research but also goes home to parents in children's portfolios and serves as a form of authentic assessment that makes children's learning visible. Analysis teams meet weekly to examine teachers' observations and to develop papers and articles for dissemination.

In addition to collecting data on children, Dimensions also collects data from teachers who participate regularly in focus group interviews. These interviews explore the ways teachers are supporting children's learning, how being co-researchers has changed them personally and professionally, and how our research is changing the spaces, materials, resources and experiences we provide for children.

Since 2009, Dimensions has collaborated with the Forest Lake Family Center in Forest Lake, MN and the Child Educational Center in La Canada, CA to expand our research to other geographic regions. Dimensions' staff trained teachers and administrators at both sites in qualitative research methods, recording Visual and Nature Notes, as well as data analysis procedures. The culmination of this collaborative work was presented in the summers of 2010 and 2011 at national research symposiums sponsored by Nature Explore.

Dimensions' research is integrated into Nature Explore workshops and informational DVDs, represented in books published by Nature Explore, (including the *Learning With Nature Idea Book* and *Growing with Nature)*, published in journals and magazines, and presented at conferences across the country. A more detailed description of our research and select research papers may be accessed at **dimensionsfoundation.org.**