ABSTRACT

Title of Document: A STUDY OF TAIWANESE CHILDREN'S CONCEPTIONS OF AND RELATION TO NATURE: CURRICULAR AND POLICY IMPLICATIONS

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The present study investigated children's conceptions of and relations to nature. Understanding the factors that influence them was the goal. The study used the Contextual Model of Learning as the theoretical framework to structure the research questions and data analysis to understand children's nature learning in the personal, sociocultural, and physical contexts that change over time.

Twelve children aged 5 and 6 were prompted to draw a picture of themselves in nature. They were interviewed about the sources of those ideas and living experiences, and if they thought photographs of scenery were nature. These twelve children's parents also participated in a survey to study the family influence. I used interpretational analysis to seek for common patterns and themes. Scoring rubrics, coaxial comparison, constant

comparison, and the theoretical framework were used to triangulate and investigate influential factors of children's ideas of nature.

The study showed that children at this age already had developed a basic conception of what is nature, but also need to learn about the role of human beings in nature and the interrelations of nature in order to develop environmental education ideas. Most children also had a positive feeling toward nature. Children's definitions of nature were developed mainly from what parents and grandparents had told them and their firsthand exposure to nature. Only during the weekend did the children's families have time to visit nature.

It was found that most parents in this study stated that they were inspired by nature and were very willing to take their children to nature settings. The most visited natural places that were reported visited were parks in the city and the mountains surrounding the city. However, very often parents missed teachable opportunities to make the experiences with nature meaningful to children.

Implications of the study apply to curriculum designers, educators, urban planners, and parents. It is recommended that teachers and schools develop their school-based curriculum so that children may learn about nature from their surrounding environments. Urban designers should consider providing easier access to green space in the city.

Finally, it is recommended that parents not miss the opportunity to make family visits to

nature meaningful science education learning opportunities.

A STUDY OF TAIWANESE CHILDREN'S CONCEPTIONS OF AND RELATION TO
NATURE: CURRICULAR AND POLICY IMPLICATIONS

By

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Dedication

To the Creator of Nature

and

My Parents

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Chapter One: Problem Statement

Introduction

The purpose of this study was to gain insight into Taiwanese children's emergent

ideas of nature and the factors that influence those ideas as a way to contribute to

curricula transformation and suggest science education policy implications in Taiwan.

Taiwan, an island located in East Asia, has a rich biodiversity due to its unique landscape,

which covers both tropical and subtropical habitats that range across plains and

mountains with a 4,000-meter difference in altitude. The plains have, however, been

exploited, and they are heavily populated. As a result, most children, especially those in

the cities, do not have much access to nature (Appendix A).

Taipei City, with a 2.5 million population, one tenth of the entire country, is also

the capitol of Taiwan. It is located in northern Taiwan bounded by mountains, which form

a basin with three main rivers passing through. The limited amount of green areas is

mainly in the scattered parks and riverfront recreational areas in the city. Around the city,

there are within-a-half-hour-drive mountains where citizens often hike, dine, or entertain.

In a one-hour drive, residents can reach the coast of the northern tip of the main island of

Taiwan. It remains unknown about how children in the city utilize these places or whether

children's conceptions and relations to nature are related to those natural places around

the city.

The biggest metropolitan area also has the highest GDP (Directorate-General of

Budget, Accounting and Statistics, Executive Yuan, R.O.C., 2009) in the country with

busy working parents that strive for their careers and savings for buying a home. The

working hours are long. At the same time, with higher income, parents who highly value

education also have more financial flexibility to arrange for school- and out-of-school activities for their children. Children are not under any less stress than the adults. From a very early age, children live under the pressure of getting into a better school and getting good grades in order to finally earn a diploma from universities that seem to promise a better career choice and socioeconomic status. Credentialism is deeply embedded in Chinese culture and for a long time has been criticized for distorting the purpose of education and destroying young people's lives in other aspects. Therefore, preparing young people as future citizens with a more realistic and comprehensive education has become a strong voice in the society.

The ongoing educational reform in Taiwan began in the mid-1990s. Some of those important policies that are closely related to this study include: Private presses are now allowed to publish elementary and secondary schools' textbook after they pass the scrutiny of the committee formed by a group of scholars; elementary and junior high school's curriculum are integrated into one comprehensive 1-9 Curriculum Guidelines (Ministry of Education, 2008a) so that children's education is developed around one continuum framework; and, the increased flexibility for schools and teachers to choose their textbooks and adapt their curriculum and teaching methods to suite their students' needs. Environmental education is currently not a mandatory subject in schools, but, following the Environmental Education Curriculum Guidelines, it is now required to be integrated in school curriculum. On the other hand, the opportunity for preschoolers to learn about nature depends greatly on an individual's experiences outside the formal school environment.

In this study, children aged 5 and 6 were asked to create drawings of themselves in nature and were interviewed about sources of those ideas, school and out-of-school experiences, and living environment. In addition, parents were asked to respond to a survey about their observation of children's ideas of nature. The study's findings concerning children's ideas about nature are intended to contribute to curricula transformation and science education policy in Taiwan. Learning about the sources of the children's ideas also may assist both in understanding what kind of experiences may enhance children's informal science education learning, and in formal science education.

In this study, I included only children who were 5 and 6 years old. Children start to develop ideas about the world at a very young age (Duschl et al., 2007). When entering elementary school, children are not just simplistic and concrete thinkers, but already they have developed substantial knowledge of the world that can be built upon later in school. Duschl et al. (2007) in a book chapter in the book *Taking Science To School: Learning And Teaching Science In Grades K-8* summarized young children's existing understanding and reasoning of the physical world, human psychology, biological world, chemistry, and the earth system and cosmology. Although they might have alternative conceptions about many natural phenomena and their mechanisms, such as plants' physiology, adults also often hold a poor and mistaken understanding of the same topic. The book *Young Children's Conceptions and Thinking of Natural Science* (in Chinese) (Chou, 2003) also mentions children's conceptions of biology, dissolution and evaporation, light and shadows, air and heat, electrical circuit, and the Earth. However, both the chapter and the book lack discussion on how children conceive of nature as a whole. The following studies reveal that using appropriate methods, it is possible to

collect data that can be analyzed as a way to understand young children's ideas about nature.

Phenice and Griffore's (2003) study showed that most children between the ages of 32 and 72 months had developed certain levels of understanding of what is nature. They could answer Yes or No questions as to whether trees, plants, animals, or people are part of nature. Cohen and Horm-Wingerg (1993) used a series of photographs for young children to prompt them to talk about their understandings of the environment. Some studies even suggested that children's understanding of nature was not necessarily age-related (Littledyke, 2004; Shepardson et al., 2007; Loughland et al., 2002). Young children could have expansive conceptions of the environment.

Studies show that most children think of nature as a place where animals and plants live (Phenice & Griffore, 2003; Bonnett & Williams, 1998; Littledyke, 2004; Shepardson et al., 2007). Children also hold different feelings toward nature--some relate it to a place to relax or quiet down, but some relate it to danger or fear. Anthropocentric or biocentric is another lens that is often used to examine children's views of nature (Bonnett & Williams, 1998; Hyun, 2005; Kahn & Lourenço, 2002). Children often value nature from the perspective that nature provides entertainment, learning, physical and emotional experiences, and resources for them or other organisms. They also learn from others the way they think about nature. After starting school, children begin to develop scientific understanding of the natural world beyond their first-hand sensory and interactive experiences (Hyun, 2005; Wilson, 2006). On the other hand, Cobern and his colleagues (1999) found that ninth graders in the United Stated still did not talk much about ideas of nature learned from school after 9 years of schooling. Rather, they linked

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nature with personal life experience that was not related to school science knowledge. For example, students talked about finding peace and pleasure in nature. It remains uncertain if children's living environment affects their ideas of nature. Therefore, to contribute to this area of research, in this study I investigated how an urban living environment affected children's daily experiences and consequently their ideas about nature.

However, even though young children are the primary source of data for this study, it must be keep in mind that very young children may not be fully aware of their own thoughts and not have sufficient communication skills to fully express their ideas. For example, Cohen and Horm-Wingerg (1993) found that it was somewhat difficult for children at age 3 to use language to express opinions in some of the tasks. Yet children aged 4 and 5 could use pictures and language to communicate with adults. Since parents are the adults with whom the young children interact most frequently on a daily basis, I also included their observations of children's ideas as potential sources of these ideas. In addition, I compared the Taiwanese environmental education guidelines, and I identified how the concept of nature was introduced. As a result of my findings, I am able to make empirically informed recommendations to enhance the teaching of and learning about the concept of nature in both the formal and informal educational contexts in Taiwan.

Research Questions

In this study I explored Taiwanese children's conceptions and relations to nature and the sources of those ideas and experiences. First, I wanted to determine children's definition of nature and their feelings toward and interests in nature. I wanted to investigate whether children's interests in nature were inherent or were contingent on their upbringing. Second, I wanted to know the sources of the children's ideas. Third, I

wanted to learn if the children's living environment and lifestyle influenced their ideas about nature. Fourth, I wanted to understand the parents' points of view about these topics. As a result, the fourth question answers the first four questions from the parents' points of view and might tell more about what children do at home and school that might affect children's ideas. *Ideas* can mean knowledge, understanding, feeling, or anything that makes children think of the word *nature*. Finally, I wanted to investigate what factors influenced children's ideas and experiences in nature. The research questions follow:

1. *What are children's conceptions of nature?*

   a. *How they define nature*

   b. *Their interests in nature*

   c. *How they feel about nature*

2. *What are the sources of these ideas about nature?*

3. *How do children's surrounding environment and lifestyle influence these ideas?*

4. *How do parents think about children and nature?*

5. *What influences children's conceptions and experiences in nature?*

Theoretical Framework

The Contextual Model of Learning (CML) (Lemke, 2001; Falk & Dierking, 2000; Schauble, Leinhardt, & Martin, 1997) was used to frame and analyze this study. The CML model looks at learning from four contexts: personal context; sociocultural context; physical context; and a time dimension that emphasizes learning is a contextual, on-going process occurring in the interaction of several dimensions (Figure 1). The model is mainly for museum learning such as art and natural history museums, zoos, and botanical gardens. Falk & Dierking (2000) called it free-choice learning, where learners can freely

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navigate and select what to learn, how to learn, and when to learn. The out-of-school learning is more often called informal education.
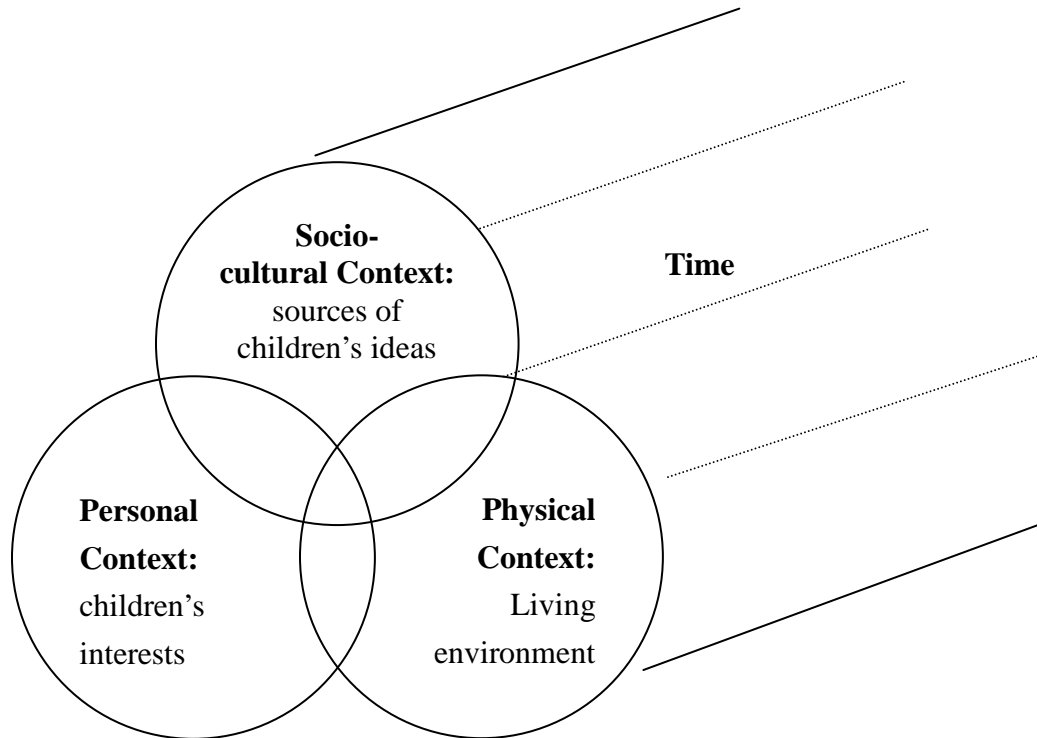
Figure 1. Contextual Model of Learning

Informal education in science consists of programs and projects which take place outside the classroom and which can occur in many different settings; for instance, in environmental centers, zoos, aquariums, national parks, arboreta, and museums (Dierking *et. al.*, 2003). It also includes the media and community-based organizations and projects. Some specialists in the field define it by emphasizing the agents; namely, the individuals who choose and control the objectives and means of learning (Heimlich, 1993; Paris, 1997). According to Heimlich's definitions, in formal education institutions choose both the means and objectives of learning; in informal education institutions choose the objectives of learning, and the learners control the means of learning. An example of informal education would be interpretation activities in which either texts or docent talks

are offered, and learners could choose whether to read the signages or listen to the talks. By contrast, in *non-formal education*, institutions choose the means of learning and the learners control the objectives. The availability of choices distinguishes informal education from traditional, formal education.

Personal Context

The personal context of learning emphasizes how people identify themselves as learners and how they construct their own meaning from contextual experiences. It focuses on the roles of identity, prior knowledge, choice and control, interest, motivation, and expectations (agenda) (Rennie et al., 2003; Falk & Dierking, 2000; Schauble et al., 1997). These factors construct the relationship between who the learners think they are (identity) and what the context offers. Falk and Dierking (2000) discussed learning from four aspects of personal context. First, learning emerges from motivational and emotional cues. People are motivated to learn when the learning is emotionally rewarding and satisfying. It is a human being's basic survival need and instinct. Cognition and affection are both important and sometimes inseparable for learning. Second, learning occurs with interests. Two kinds of interests, personal and situated interests, were defined by Hidi (1990). Personal interest is more of a deep and long-lasting interest that develops overtime. For instance, someone might say "I have a passion for mountain climbing." Situated interest is usually evoked more suddenly by something in the environment. The effect may not last long. For instance, a friend talks about her trip to the Galapagos Islands and you see a television program talks about the animals and geology of the islands, and all of the sudden you get interested in this history and ecology of the islands.

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What interest visitors bring to the settings may also affect their planning agenda and learning outcomes. We might suspect that visitors attend for social or recreational purposes; others may visit to learn something new or of interest to them. However, people with the strongest educational goals may not necessarily learn more than those pursuing goals with educational and social intentions (Falk, Moussouri, & Coulson, 1998). Falk & Adelman (2003) grouped visitors by their prior knowledge and interest in order to further understand visitors' learning about conservation in an aquarium. Both prior knowledge and interest are categorized into three levels; extensive, moderate, and minimal. It shows that no matter what level of prior knowledge visitors enter with, only those with moderate to extensive interest showed significant knowledge gains. People with minimal to moderate interest showed significant increase in concern about conservation after the visit, whereas those with extensive knowledge didn't.

Third, the focus is on the impact of the learning construct on prior knowledge. Since learning is a nonstop reassimilation and constructing process, adding new things, assembling, and reconstructing existing knowledge take place. This perspective of prior knowledge manifests the cumulative nature of learning. Not only is prior knowledge taken into account, but also visitors' prior experiences with similar situations, such as previous visits to museums or prior participation in summer camps (Kruse & Card, 2004). Based on existing perceptions, visitors reconstruct their knowledge and values in order to accommodate a new way of thinking and feeling (Brody & Tomkiewicz, 2002).

Last, learning not only requires emotional motivation, prior knowledge, interests, appropriate contextual cues from the outside world, but it also pulls out information from

past events. Context is ever changing, however, and is always related to the person. Hence, learning needs to be understood in context.

Sociocultural Context

The second context of the model emphasizes that learning is mediated culturally and socially. That aspect of learning is closely related to the sociocultural learning theory. The sociocultural theory is based on two underlying assumptions: first, that learning occurs within social interactions; and, second, that the learning process is mediated by cultural norms and tools (Siegle & Alibali, 2005). Social interactions happen when children work with siblings, peers, parents, teachers, or even extended communities. They learn from conversation, gestural cues, facial expressions, and by observing others. Development does not only happen during solitary learning, but instead children-in-groups or children-in-context are taken as the unit of analysis of learning in sociocultural theory (Miller, 2002). Very often, social interactions help children to achieve their potential competence better than children learning alone. This Zone of Proximal Development (ZPD) was first defined by Vygotsky (1978), the pioneer of the development of sociocultural theory. He thought that in order to understand children's development, the assessment of learning should be a changing process over time rather than a one-time observation, since development can progress at any moment. Neither the interaction nor the knowledge gain should be taken as static. Hence, sociocultural theory emphasizes understanding a phenomenon's development, and tries to explain learning by looking into its dynamic processes (Schauble *et. al.*, 1997).

The study of Crowley *et. al.*'s (2001) examined how 4 to 8-year-old children interact differently with parents and peers, looking particularly at one exhibit's design to

demonstrate scientific thinking. They analyzed groups' conversations and behaviors to see whether parents play a critical role in children's scientific thinking during activities. Compared to children with peers, children with their parents spent more time manipulating the exhibit in order to try different variables and discover new evidence. Parents are recorded providing instructions, connecting prior knowledge, encoding evidence, and suggesting manipulation and comparison of variables to children. Furthermore, some parents directly provided children causal or analogical explanations if the children didn't see the relationship between the variables and phenomenon. In this particular case, only 11% of the explanations responded to children's questions. Most of the time, it was the parents who decided to explain the exhibit. Parents appear to have the role of regulating the learning experiences of young children in museums. With much awareness of the exhibits' intentions, the parents tended to lead children through the exhibits. Sometimes this goal may be so strong that parents keep themselves as outsiders, only offering one-way direction instead of mutual interaction with children (Shine & Acosta, 2000).

In Jarvis & Pell's (2005) study, they observed and analyzed how socially adults, teachers, museum staff, or parents, facilitated students in museums. They identified five types of adult roles in the visit: manager, controller of student behavior, and facilitator of role-play activities, but didn't intend to categorize any individual adult into one particular category. Adults with varied experiences, interests, ability, and missions play very different roles in students' experiences in the visit.

Learning not only occurs within interaction of adults and children. Different levels of expertise among groups of adults may also lead to meaning-constructing.

People may learn from one another on different issues in a group of peers. For instance, in Brody and Tomkiewicz's (2002) interviews of groups of visitors in a national park, the process of negotiating a shared meaning through the discussion was demonstrated. Knowledge is constructed through the mediations and interactions. Furthermore, people with expertise related to the context may contribute deeper understanding or provide more accurate information to the dialogue. We should keep in mind that even though social interaction often constructs shared meaning, it does not automatically promise an accurate understanding.

Cultural norms and tools include technological and psychological tools, such as language, number systems, time systems, symbols, and material artifacts. The cultural and historical shared belief, values, customs, and experiences within a group shape the customary ways of a human's behavior. Our religious, economic, and political worlds all shape our experiences in different ways. Although human beings may not genetically carry these cultures, we have the predisposition to acquire these cultural products. Each family, school, and class culture directly influence young children's experiences about nature, while the parents, school administrators and teachers are all parts of the larger society.

Cultural norms may reflect the language we use connecting to a particular concept. A word may have different implications in different cultures. For example, in Barraza's (2001) study about children's environmental attitudes developed at home, the word *environmentalist* triggered very different underlying assumptions in different countries. The analysis of open-ended questionnaires revealed that participating English parents tended to understand the word as an action or imply some radical meaning when the

Mexican parents understood the word as an attitude. The natural environment may also create the cultural context that manipulates the symbolic meaning of certain animals (Barraza, 2001). Together those sociocultural activities reinforce the norms and practices shared by society, and in the meantime, the learners internalize what they have learned from the interactions.

Physical Context

The physical context is mainly composed of interactions between learners and the learning environments. Learning environments provide activities for meaning construction and social interaction. The unique situation created by the environment is expected to promote a learner's motivation, which includes constructing meaning for the learners, providing choices, creating challenges, and developing positive consequences (Paris, 1997). The large-scale space and climate are examples of the physical context. Take museum learning as another example, how children navigate and orient in the museum space that contain different labels, exhibit sequences, layout, and content (Falk, 1993). Conversely, some physical elements, such as noise or inappropriate lighting, might hinder learning experiences. Crowding may cause people to move away from an exhibit or to be distracted from the content (Goulding, 2000). Visitors' agendas are more likely to be achieved in the less crowded conditions, for example, visits during the weekdays rather than weekends (Sandifer, 1997).

Falk and Dierking (2000) argued that it is inborn in human beings to make meaning from their environment. We continually "monitor the environment, always measuring the new against the expected, is an evolutionary strategy designed to help humans make sense of what is happening in their world, to make meaning of the world (p.

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113).” For the particular emphasis on museum learning, it is “the need for visitors to orient themselves in space, to explore that which is novel, to prepare themselves mentally for what is to come, and to make overall sense of the museum environment (p. 113).” They also argued that the museum experience is situated in the larger education system. Visitors leave museums with certain experiences and knowledge that might or might not be confirmed and enriched later.

Visitors tend to be motivated by and interested in the exhibits in which they can choose and pursue their own learning agendas. In Falk's (1993) study of the coral reef exhibit in the National Museum of Natural History, he was able to arrange the display in two different ways: one linear and structured; the other, unstructured—allowing visitors to select routes freely in the exhibit hall with identical content. Interview data revealed that visitors in the unstructured mode comprehended information better than those in the structured exhibit. Some features of exhibit environments are designed to orient visitors conceptually along a particular theme. The way an exhibit is structured and the arrangement of signs are designed to guide visitors through an intellectual framework. Some visitors might notice the design, and some might follow the design without being aware of the design. For instance, when the timeline of an exhibit is presented backwards (i.e., in reverse chronological order) the purpose might be to first introduce visitors to relatively familiar information. However, that could collide with people's usual way of thinking about time moving forward and, similarly, induce conversation and meaningful learning among visitors (Leindhardt & Knutson, 2004).

The dimension of physical context also considers awareness of the setting. If, for example, children are more familiar with the physical environment of the exhibit and the

floor plan of each theme, they can better navigate in the three-dimensional setting and manage their learning (Falk, 2004). To investigate the affect of familiarity with exhibit's physical context on students' ability to learn scientific concepts, Anderson and Lucas (1997) randomly assigned pupils to experimental and control groups. The experimental groups received a 40-minute orientation three days before their visit in order to become familiar with the setting. Students who had previously visited the setting and had participated in the orientation scored significantly higher in the cognitive learning test than others. The results indicated that both the previous experience and the orientation contributed to the students' learning. Eliminating the confounding factor that previous experience may have influenced the content knowledge, it was shown that familiarity with the physical settings could reduce students' *perceived novelty*. "Perceived novelty" is defined as the state of mind experienced by the learners when they are exposed to new contexts or sensory experiences. Perceived novelty is said to promote curiosity in children to explore and get involved with the learning environment. However, high perceived novelty could lessen students' cognitive learning.

Time

Learning, as suggested by the CLM theoretical perspective, should be viewed from three constantly changing and interacting contexts while moving through time. However, it is usually difficult to follow up on learning in informal educational settings. Visitors might show immediate learning in a one-time observation, but educators want to know how the experiences can affect people in a long-term scope, and can be applied in new situations. In fact, in Falk & Dierking's Contextual Model of Learning (2000), the time dimension was added to their first Interactive Experience Model in 1992. "Perhaps

the best way to think of it is to view the personal context as moving through time; as it travels, it is constantly shaped and reshaped as it experiences events within the physical context, all of which are mediated by and through the sociocultural context (Falk & Dierking, 2000, p.11)." Rennie & Johnston (2004) mentioned using "memory" as a way to measure the idea of time dimension, but their rationale was not clear. One study used a "delayed post-test" to measure retention after conservation camp programs (Kruse & Card, 2004). They mailed the self-rating test to the participants one month after the one-week summer camp. The general trend of findings showed that scores of knowledge and attitude increased from pre-tests to post-tests and decreased from post-tests to delayed post-tests. There are several concerns raised from this study about how to follow up visitors from informal educational settings. Attribution, time constraint, and budget concerns are not simply the challenges of longitudinal design (Rennie, *et. al.*, 2003).

In 1991, Stevenson conducted a study on long-term impact of museum experiences. Six months after the visit, participants were interviewed on both spontaneous recall and prompted recall. In part of the interview, participants spontaneously talked about which exhibit they remembered the best, and later answered the same questions with pictures of the exhibits as prompted recall. In 2005 Jarvis and Pell (2005) measured, qualitatively and quantitatively, students' attitudes toward science before and after a visit to the UK National Space Center. On the level of an individual lens of learning, the study found that after four months, most students were still excited about the interactive role-play tasks they encountered in the museum. Revealingly, almost none of the students mentioned any text of the interpretative signages. In their interviews, the researchers wanted the children to recall and comment on their visiting experiences.

Then they showed pictures of different exhibits and activities that the children had experienced and asked them to comment further. They found that the children had much more to say than in the spontaneous recall.

A recent study of the role science museums play in family life seems to have made a huge leap. The case study looked at four families while at home and while visiting museums for eighteen months in order to reveal the interrelationships between the visits and other family activities (Ellenbogen, 2003). In this case, the researchers were able to document how learning is connected in different settings across a span of time.

Rationale for the Use of CML in This Study

Falk and Dierking (2000) summarized eight main focuses from numerous studies about museum learning that affect learning in these settings:

Personal Context:

    1. Motivations and expectations

    2. Prior knowledge, interests, and beliefs

    3. Choice and control

Sociocultural Context:

    4. With-in group sociocultural mediation

    5. Facilitated mediation by others—the role of museum staff as facilitators of

       learning.

Physical Context:

    6. Advance organizers and orientation

    7. Design

8. Reinforcing events and experiences outside the museum—the larger community society-wide context.

I believe the informal learning nature can be applied to this study, since most nature learning at this time for 5 and 6 year olds in Taiwan takes place in out-of-school contexts with minimum extrinsic manipulation. I believe this model helps link my research questions into one concept map and helps, in a more systematic way, in conducting the data analysis. I also believe the way this model looks at learning in informal settings reflects my belief in learning in many aspects. First of all, learning is affected by a wide variety of variables. It is not just a simple formula of adding learning materials (museum exhibits) and the learners (visitors) and educators can expect all the learning outcomes to turn out the same. Second, the model emphasizes looking at learning in a holistic way and appreciating the complexity of learning. Many influential factors can help in understanding learning, but need to be investigated under the context. Also, learning is a series of overlapping and related processes. Third, learning, especially out-of-school learning, is a human being's evolutionary nature. Learning for young children usually is a whole-body and emotionally satisfying experience. Not until school education does it sometimes make learning onerous, unpleasant, and discouraging when it needs to meet certain societal goals and expectations.

Family visits have become studied more often as a unit in the context of a museum (Falk & Dierking, 2000), especially family conversation in museums (Zimmerman, Reeve, & Bell, 2010; Leindhardt & Knutson, 2004; Ash, 2003). The recently published book *Learning Science in Informal Environments: People, Places, and Pursuits by* the National Academy of Sciences (2009), also pointed out that family

learning, though not a theoretical framework, has become one of the popular approaches for studying learning in informal settings instead of individual learning. However, I am not aware of any studies, as does this present study that uses the CML as the theoretical framework to investigate children's conceptions of and relations to nature with an added lens from parents' perspectives that leads to family influence.

I used the CML model to both frame my research questions and analyze the data. In my study, children's conceptions of and interests in nature are examined under a personal lens. The sources of children's ideas and family influence are analyzed within the sociocultural scope of learning. The larger impacts from the culture and society area also revealed from the investigation. Children's living environments are concerned as the physical context. Children and their family visits of nearby nature are studied to see an urban family's access to these places. How children use their after-school time was studied, too. I examined any changes that might have been mentioned in the interviews as they related to the time factor. It turns out that the time factor in the model was mostly displayed in children's memories about family outings to nature. Also, see table 3 for how the interview questions for the children tried to capture different aspects in the model. Figures 6 and 7 demonstrated how the model helped organize findings from this study.

Significance

Research has documented that children have their own understanding of nature from a very young age. It is important to include the children's own voices about their conception of nature. By knowing what children think and what concepts they bring with them to school and in informal science education contexts, educators can use that information as the foundation of biology education or environmental education.

First, the study particularly benefits urban children. "Urban" here may not refer to the term most Americans are familiar with. In Taiwan, a city usually links to prosperity and a fast-pace lifestyle. In the field of education, it usually is associated with better academic performance and more competition among students as compared to rural areas. In addition, *urban* usually does not imply race-related issues in Taiwanese schools, either. Urban children have limited access to nature and spend most of their time on academic activities. It is important to learn their existing ideas and assumptions brought to the classroom when the majority live in highly urbanized areas in Taiwan. It is also important to learn how these children learn their ideas of nature, as the foundations of environmental and biology education. It was found in this study that urban children in Taiwan develop their ideas about nature mostly from other family members and firsthand exposure to the surrounding natural environment, such as parks and mountains around Taipei City. Unlike most scholars' study findings that children only are familiar with remote environmental issues such as rainforest depletion or things they learn from books and media, children in this study did not seem to lack understanding of their surrounding environment. Instead, it was found that is important for children to learn from daily experience and direct contact, so that they care about the land and environment in ways they can relate to. Otherwise, environmental issues can only be something that is distant from their lives. In addition, policymakers, urban designers, and child caregivers may use this result to utilize these green spaces in the city more often, since children do learn a lot of their ideas about nature from these spaces.

Second, the theoretical framework, CLM, used for this study was mainly developed for museum learning and a broader context of informal learning. This study

provided examples of how the model can be used in a broader informal educational setting such as natural outings with families and how the model can help organize concepts around influential factors on children's conceptions and relations to nature. While many different frameworks might have been used for informal science education, this particular model strives to explain the complex and ongoing learning experiences in such settings. I found this model fit my study well, which sought to examine different factors that affect children's ideas of nature. This study especially wanted to tease out layers of influences from the time and personal, social, cultural, and physical contexts. Future research may also try to apply this framework on learning in other contexts.

Third, one of the unique aspects of this study is that, other than learning from children, I also investigated parents' opinions about children's ideas of nature. It is hoped to learn from the parents' angle and add a layer of our understanding of children's life and possible influential source. Young children spent most of their time with family, and they usually learned things from parents more than anyone else. Slaughter and Epps (1994) suggested that parental influence on a child's achievement is more direct in the early school years than after the middle-school years, when more-diverse influences include teachers' expectations, students' perceptions, and peer culture (Chin & Kameoka, 2002). Family influence could be rather complex. This study aimed to learn about family influence on Taiwanese children's experiences about nature. Educators and policymakers can apply what was learned from the study to teaching, curriculum development, and urban design. Parents could also learn from the study about what might provide a positive learning environment for their children if they want to enhance children's nature learning.

Finally, Taiwan's education reform launched years ago was designed to free children from the pressure of testing and credentialism. After being enacted for many years, it needs constant assessment in evaluating how the standard can reflect children's developments and living experiences. This study compares the result of children's ideas of nature to the environmental education guidelines to see where the two can meet. It is found that the guidelines do provide reasonable learning objects for children that are ready to enter elementary schools. Compared with children's existing ideas and the guidelines, it shows that children also need to learn more about human-nature relationships in order to have a better foundation for environmental education. They also need to develop a sense of the human's role and responsibility to the environment in school education in order to gradually learn other aspects of the environmental education guidelines.

Positionality

My past has formed who I am now, and how I will be in the future. My education background shows readers more information about education in Taiwan. I also included in this section what in the past has brought me to my belief and position in this study about children and nature.

I was educated in Taiwan from first grade through college. My experimental elementary school was affiliated to Taipei Municipal Teacher College (Now the University of Education). In the past, Teacher Colleges prepared teachers for kindergartens and elementary schools, and the Normal Universities prepared teachers for middle and high schools. Now, there are more routes opened to those who want to be a teacher. I remember in some periods of the years we had intern teachers from the

education college across the street. The entire school campus atmosphere felt different with young teachers in uniforms walking around. Their energetic teaching styles were full with colorful teaching materials. Pre-service teachers spend their last year interning in schools. I remember my third grade class teacher who was also a host of a children television show. She often took us to field trips and gave us assignments not like any other school homework. At that time, most of the homework was completing the government-published practice books that were well aligned with the textbooks. She wanted us to report our field trips to places such as wetlands and a silk factory in a blank notebook. I cannot recall the exact detail of the reports, but remember finding information from an encyclopedia and pasting pictures of water birds. My third-to-sixth-grade elementary school education was in a gifted and talented class among the eight classes in each grade. In those four years, I also recalled we had frequent visitors to observe our class or had activities that were not related to school subjects. For instance, each of us got a blank notebook with a monkey in the front cover and the instruction told us to write as much as we can think of what this monkey could possibly do. I also remember, in some period in my fourth grade, I and other four classmates would go to another classroom to have our mathematic course. After we graduated from elementary school more than 20 years later, I heard some past classmates said they had had a hard time transitioning from the unique context of our free and creative elementary school education to junior high school. I had no problems with the transition.

My single-sex public junior high school was close to home, since I attended school in our school district. In the junior year, I ended my dancing class and started to attend English and mathematics cram classes after-school. At that time, many Taiwanese

students at this age started to quit practicing instruments or going to classes like drawing or dancing. The academic pressure made school very competitive. There was no time to do things other than study. We had strict rules about our uniform and the length of hair. It is believed that students spending too much time on appearance are distracted from school learning. I recalled that we could have up to three tests per day in our last year. We sometimes stayed at school to study until eight or nine o'clock in the evening. There were also citywide practice exams that prepared us for the High School Entrance Exam. Every student's score and ranking was posted on the school bulletin board so that you were aware how much more you had to prepare for improvement.

My score ranking of the two-day Municipal High School Entrance Examination allowed me to attend the first-ranked Taipei First Girl High School. I enjoyed the girl-only atmosphere very much during my six years of high school. In our second year, all high school students needed to choose between natural science and liberal arts. I figured I did not like memorizing, but enjoyed understanding concepts. So, I chose natural science, which required students to take chemistry, physics, and biology and prepared students for college majors such as medical school. Some students chose natural science without biology. These students might have gone to engineering or physics in college. The ones that chose liberal arts needed to take history and geology added to the general required classes such as Chinese and English. No matter what area was chosen, students always stayed with the same class and stayed in the same classroom, except for science experiment classes or other specific subjects such as music or physical education. I recalled we had 59 students in my class and 29 classes for each grade. We also wore uniforms and followed rules about hair length, or color of shoes and hair clips. Some

independent school had strict rules about not talking to the opposite sex. Again, it was to

avoid distraction from learning. They were also often taught the three-year high school

curriculum in the first two years and spared the third year exclusively for reviewing

materials for the National College Entrance Exam. I attended chemistry and math cram

classes on the weekends and weekday evenings after long school hours that ended around

4:30 to 6:30 p.m. It was usually around 10:00 p.m. when I got home. My favorite subject

was biology. I did not like biology in junior high, but my high school biology teacher

made me realize biology is not just about memorizing but understanding. There are some

underlying principles among the biology world. In my last year in high school, I rented a

study cubical in a private studio that allowed students to leave their books there and study

until midnight. We could also stay at school until a certain time in the evening to study

and go to school on the weekends for study.

My grade had not been ranked well in my high school class. It was always hard

for me to present my grade card to my parents after the midterms and finals. Parents had

to sign the report card to show they were aware of the results of the formal school

assessment. However, my score for the two-day National College Entrance Examination

of ten subjects allowed me to enter the top-ranked National Taiwan University. I realized

that in the top high school, your low ranking among those top students probably still

meant a nationwide high ranking. However, my confidence had been crushed in those

three years. I loved biology. Getting into the Zoology Department was my first priority.

However, my national score ranking from the examination was not good enough to get

admitted there. I decided to go for Plant Pathology, which I though would keep me in the

biology field. At that time, many high school students chose their college majors based on

their score ranking of the two-day national examination without considering their interests or knowing a possible career in the future. For instance, if you ranked highest among those students who chose natural science without biology, you went to the department of Electrical Engineering in National Taiwan University without a second thought. Or, you went to the Law school if you had chosen liberal arts. We often heard students from top-ranked high schools stayed in a cram school for one more year after graduation and retook the national examination for getting into a medical school or better (higher-ranked) medical school.

In college, most students started to enjoy the free life with no more pressure from "getting into a better school." In our time, people joked about the English word *university* sounded like "letting you play freely for four years" in Chinese. Except for the requirement courses for Plant Pathology, I tried to expose myself to a wide range of courses such as philosophy, law, sociology, movie, and economics. I also went to a remote island, Lan-Yu, of Taiwan to teach summer elementary school in an indigenous village. After a typhoon hit the island and destroyed the electrical poles, we had to take showers in a natural cave where occasionally old ladies would come to do laundry or scoop river water right next to me as I bathed. We took turns cooking for all the teachers and slept on the classroom floor at night. We could hear the waves every day and night. Because the children grew up by the ocean, they often played in the water. There was one memory that I will never forgot. A child who was very young jumped from a cliff into the ocean. There was no adult supervision when a group of children played freely on the coast. I was amazed how they lived closely with nature. Children from a very young age were immerse in nature. Another thing happened that I could not forget from that summer.

Some children reported to us that a puppy was killed. We went to the "crime scene" and saw a puppy they had buried and smothered to death. I remember how my mind was shaken by the two scenes. How can a group of beautiful children torture a life to death, but at the same time seem to be so close to nature?

I also started to take classes from the Department of Zoology and the Conservation Program of the Department of Forestry: Introduction of National Parks, Animal Behavior, Ornithology, Wildlife, and Conservation. The same professor, who had a great impact on my passion for wildlife conservation, taught the last three courses. I realized that animal conservation could be my lifelong career. After graduating from College, I worked in the marine mammal lab in my university. I was exposed to marine mammal conservation issues and realized conservation was very much human-related, not merely simply about learning scientific knowledge. For instance, whale watching drew tourists to fishermen who usually ran those activities. It was critical to develop a good relationship with those fishermen, so that they could become the messengers of whale and dolphin protection to the public. However, dolphins often caused trouble to the fishing industry, and they threatened the fishermen's lives. I also learned that my personality fit well with people in this field. I was told several times that I did not look like someone who graduated from my high school or university. I believe that my tone of not being a fan of competition made people say this. It also showed how people project graduates from these top-ranked schools: ambitious and maybe threatening. I found I liked working with the people in the marine mammal lab. Graduate students there were relatively moderate, warm, with big hearts. I looked forward to those kinds of working environments for my future career.

During or after college, students in Taiwan also often attend months of cram classes to prepare for the GRE and TOEFL examinations. I was one of them. I went to Oregon, USA, to study wildlife, and I completed my Master's degree in Science Education at Ohio State University. In the latter school, two courses stood out from all others. One was a marine biology and geology course held in the Bahamas and the other was a waterfowl course held on a small island of Lake Erie. Both classes emphasized lots of hands-on experiences where we had field trips such as scuba diving everyday and lectures in the evening in the Bahamas and dissecting birds and collecting water microorganisms and having tests everyday of the readings and experiments on the island. The experience was very different from any of my science classes before. In my Master's program, my advisor taught a class in the Columbus Zoo for in-service schoolteachers and graduate students. My thesis was about comparing the educational programs in zoos between those in the States and in Taiwan. Before the class and my own study, I did not like zoos at all. I thought they deprived animals the right to live free. However, I learned that zoos could be very educational, and their potential value for our future generations is unique.

After I returned to Taiwan, I was lucky to work in the education division in the largest zoo, Taipei Zoo, in Taiwan after my Master's program. We designed activities for children, developed curricula, wrote signages for exhibitions, edited the zoo seasonal magazines, trained volunteers and sometimes led docent talks. I was assigned to design and execute the summer and winter camps for elementary school children. I also once worked with kindergarten schoolteachers to develop and edit a book of activities for young children to learn about animals and conservation. During those years, I gradually

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learned that the ultimate way to preserve wildlife was to save their habitats and find the balance between humans and nature. In my docent talks, I tried to link the idea of simply "love and protect animals" to a bigger idea of saving habitats and maybe limiting human use of resources, summer camp curriculum, or teacher training.

Because of my working with people who visited the zoo who were mostly enthusiastic about seeing animals and my frequent positive contact with children, I often wondered how people got interested in nature. What kind of life experiences might have brought people to care about nature? Were some people born with a special bonding with nature or did they develop that bond as result of playing in nature? Or is there a combination effect? I grew up in the city and seldom had opportunities to play outdoors when I was in elementary school. Not until my college years while taking a series of wildlife courses with one professor did I find my interest in wildlife conservation. Yet each individual's personal experiences could be dramatically different. Some more general questions arise in this area of interest, such as "What kind of experiences (formal and informal) can expose children to learn about nature?" "How old must a child be to understand it?" "How are children different in their degrees of interest in nature?" I entered graduate school with those same questions. I remember when I received a brief international phone interview about the possibility of my admission. I said I was interested in anything that could help children be better informed about conservation!

My interests were set on the informal science education ever since I entered my doctoral program. In researching for my final paper of my first semester, I began to learn there are many research studies in the field of informal science education in places such as museums, zoos, and environmental centers. We also had a group of graduate students

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in our department interested in informal science education that met periodically to exchange ideas and discuss papers. However, the class introduction of museums that I took in the department of history showed that the field seldom touches on the perspective of education. The cognitive development course taught me about children's learning and introduced me to the sociocultural theory. The course in urban education also taught me to adopt the structure-culture-agency framework (Brown & Rodríguez, 2009) that investigates different layers of a phenomenon. Reading the current literature about informal education, I found the theoretical framework, Contextual Model of Learning, captures learning in a fuller picture and broadened and deepened my perception when I investigated it.

I also had a chance to work with young children in a project that studied young Chinese and Korean American children's linguistic acquisition. Often in my contact with young children aged from 3 to 6, I learned that in using proper methods, children can communicate with quite amazing capability to adults. Also, young children at the age of 3 in general shied away from researchers whom they considered stranger in spite of the methods used. My work with Project Nexus, a NSF funded research project directed by Dr. Randy McGinnis also brought me back in contact with an informal science education setting, Hands On Science Outreach (HOSO). One of the many goals of the project was to place elementary intern teachers in the voluntary HOSO afterschool science courses for elementary children as a possible way to get them familiar working with upper elementary and middle school students. The goal was to get them comfortable teaching science. The successful project (success being determined by the empirical findings) not only reinsured my belief in informal science education, it also taught me much about data

collecting, interpretation, and reporting of findings. The observation, interviews, and collecting participants' artifacts showed me these methods can manifest in-depth information about a topic from the participants' point-of-views.

Now I have become a mother with a girl of age one and a half. I am even more interested in knowing if my child was born with an interest in nature or if the interest will develop only or in combination with learning experiences. What kind of environment can I provide, so that my child will have a chance to explore what she likes and does not like? What will she teach me from a young child's point-of-view? Once she started to walk, I could not wait to take her out to walk around our community. As I followed her around outside, she picked up grass, flowers, fallen leaves, stones, or twigs to bite on. I struggled everyday to draw the line between her free exploration and my negotiating tolerance level. I learned to let go when my first instinct told me to pull her away from these things. My instinct also told me young animals should have their own instinct to judge and learn by themselves. I believe nature can bring children open minds and carefree hearts which is critical for their entire life. They also "eat" things to understand the world around them. Once I heard a bursting sound in her mouth and quickly put my finger in her mouth to take the thing out. I pulled out the body of a stink bug! I screamed, and I could not forget the disgusting feeling on my finger tip, and the fact that my daughter actually ate a stink bug's head. I realized I still have limits to her free exploration! That was last fall when she started to walk and put everything in her mouth. She also recognized tiny prints of animals on the poster map we brought back from a safari park. She pointed on the poster to ask for names. I was amazed that she could distinguish each animal but ignored the vegetation in the poster. This spring, she is one and a half. She does not put everything in

her mouth anymore. She still loves to point out animals in books and asks me what are they? Apparently, now her fascination with animals is as much as to other babies and much more than plants. She screams excitedly whenever she sees an animal on television or on the street. She learned to say doggy as one of her first six words and called most four-leg animals doggy. She also notices birds in the sky and uses her right arm to draw a circle in the air every time I said the word bird. That is her own interpretation of birds. We did not teach her that. She seldom points to trees or grasses to ask me names, but sometimes flowers. Movement and color are probably what easily catches her eye. I learn from her everyday about how a young person perceives nature.

There is an old Chinese saying, 一種米養百樣人 "The same rice raises hundred of kinds of people." By knowing my own route of developing interests in, knowledge of, and experiences in nature, I need to keep in mind that each young child could come from very different experiences and living environments and not to judge any of those. In addition, since the study's main focal point is the children's individual voices, I need to report their views as closely as I can. Perhaps their views are very different from those from an adult's eyes (Hyun, 2005).

My Changing Definition of Nature

Even though this study was planned to understand children's ideas, I thought about my own definition of nature before the data collection process began. I thought that nature is everything except humanmade things and the unity that these things together create. After this study, I have somewhat changed my own thinking about nature. The idea of nature in my mind probably does sometimes include humanmade things. Does a humanmade trail in the mountains or a gazebo in the park make the environment not

nature? But how do we determine the limits for humanmade things and still deem an area nature? Are the parks in urban areas nature? I would have responded "no" to those questions before conducting this study. Yet in the study many children claimed these parks as nature. From the perspective of learning about nature, these parks seem to provide an opportunity for urban children to learn about the interrelations of living and nonliving things. I now believe they should not be excluded from children's nature and environmental learning. Teachers and parents should use these places more often. In addition, the Taiwanese government should consider opening more green places like these to provide children with a place to play and to learn and for parents to relax.

Limitations

This study investigated Taiwanese children's ideas about nature and their parents' thoughts about this topic. The first limitation is the limited generalizablity due to the small sample size and participant selection. While I tried to include children from different background (school systems, gender, age, and living districts of the city) in the study to show a broader picture of urban children's thinking, the selection process did not cover other aspects such as children's drawing's ability to provide readers more in-depth information about the children.

Second, young children could have a limited developmental ability or metacognition to fully express their ideas. I used different methods to understand their thoughts of nature. Parents' views were expected to expand our understandings of children's conceptions. Some challenges of determining young learners' thinking about science constructs, such as "nature," discussed in the last section of Chapter 5 may also provide future studies some insight.

Third, the meaning of terms might have gotten misconstrued in the translation from Chinese to English. For instance, the word nature could be translated into the word 自然 or 大自然. The former means natural as an adjective or nature as a noun. It was also the elementary-school-level science subject before the education reform in Taiwan. Science is now integrated in the subject *Living* for first and second grades, and *Science and Technology* (literally, it is Nature and Living Technology) for third to ninth grades. Moreover, people also use the latter noun 大自然 to describe nature, or Mother Nature. Some children might never hear both words, because it is not commonly used in daily language. If that is the case, then that is something to learn from the study, also. In order to continue the interview with some of my young participants, I showed them some photographs that included humanmade subjects and some that did not and asked the children to decide which were more like "nature" to them. A negotiated meaning of nature was then used to continue the drawing and interview. However, selecting only certain photographs may have limited children's thoughts and reflected some degree of the researcher's ideas of nature as discussed in the methodology section (p.54).

Finally, this study of young children's and parents' thoughts was relatively exploratory using the theoretical framework and different methods to find patterns among the influential factors. The results from the parents' survey and the links between children and parents may seem somewhat piecemeal. However, the study provided starting points for future research in this area. They may pursue case studies to investigate the complex links between children's ideas and their living environment and parental influences.

Summary

Taiwan, an island located in East Asia, has a rich biodiversity due to its unique landscape, which covers both tropical and subtropical habitats that range across plains and mountains with a 4,000-meter difference in altitude. The plains have, however, been greatly exploited and are heavily populated. As a result, most children, especially those living in the cities, do not have much access to nature.

A preponderance of research suggests that children learn about the environment and nature from direct experience such as sensory or first-hand interaction (Kellert, 2002; Kalvaitis, 2007). However, modern life has changed human life in many ways that may have changed our direct contact with and experience of nature (Kellert, 2002; Payne, 1998; Phenice & Griffore, 2003; White, 2006). Nowadays, children probably learn more about nature from the media, adults, and their peers (White, 2006; Louv, 2005; Littledyke, 2004; Walker & Loughland, 2003; Rickinson, 2001; Bonnett & Williams, 1998; Cohen & Horm-Wingerg, 1993; Payne, 1998) than from their direct experience. After starting school, children begin to develop scientific understanding of the natural world beyond their first-hand sensory and interactive experiences (Hyun, 2005; Wilson, 2006). It remains uncertain how modern urban living environment affects children's ideas of nature in Taiwan.

This study investigated children's emergent ideas of nature and the factors that influence those ideas as a way to contribute to curricula transformation, and suggest policy implications in Taiwan. I investigated how the urban living environment and children's families affected children's daily experiences and consequently their ideas about nature. Learning about the sources of the children's ideas also assists us both in

understanding what kind of experiences may enhance children's learning and in implementing them in informal and formal science

The following questions were investigated in this study:

1. What are children's conceptions of nature?
    a. How they define nature
    b. Their interests in nature
    c. How they feel about nature
2. What are the sources of these ideas about nature?
3. How do children's surrounding environment and lifestyle influence these ideas?
4. How do parents think about children and nature?
5. What influences children's ideas and experiences in nature?

Those questions were designed to cover aspects of in the Contextual Model of Learning (CML) (Lemke, 2001; Falk & Dierking, 2000; Schauble, Leinhardt, & Martin, 1997). The CML looks at learning from four contexts: personal context; sociocultural context; physical context; and a time dimension that emphasizes learning is a contextual, on-going process occurring in the interaction of several dimensions. The model was constructed for understanding informal education, mainly for museum learning (Falk & Dierking, 2000). This study adopted the model to frame research questions and data analysis beyond the museum settings into nature learning. My own positionality, the significance of the study and its limitation were also discussed in this chapter.

Chapter Two: Literature Review

The study investigated children's points of view about nature in the context of formal and informal curricula in Taiwan. This review will first discuss children's ideas of nature and the source of those ideas. The third section will discuss the methods used to investigate children's conceptions of nature. Since the study's main focus point is to investigate children's voices, I intend to weave the review around children's ideas about nature, and not to distract the review by other literature. Other background information such as informal education, environmental education, Taiwan's current curriculum and education trends, and the CML theoretical framework were introduced in Chapter One, and will be included also in chapters Three, and Five. An argument for that decision is that many articles about children's relationships with nature have an advocator's or disseminator's tone with very little empirical data supports (White, 2006). I decided to avoid citing many of these articles in the review in order to stay focused on the children's voice, and let this study's results tell the story. In addition, the possible factors that might influence children's conceptions and experiences about nature are rather exploratory in this study, since the interviews and survey questions were designed according to the CML, and the data will very possibly lead to a novel conclusion. To better hold on to this standpoint, I tried to include children from different backgrounds (Rickinson, 2001) and will compare my findings with other studies about the possible influential factors in the discussion of Chapter 5.

Comparing and contrasting from the body of literature that investigated children's ideas of nature, four themes emerged: Animals and Plants, Interrelations, Affections, Standpoints and Views. While children's conceptions about nature touch on

an array of ideas, animals and plants are often the main characteristic in children's mind about nature. Second, sometimes children, mainly the older ones, describe nature using its interrelations. Third, children show different positive or negative affection toward nature. Finally, how children define and view of nature may vary depending on their standpoints. I believe structuring the literature this way provides a clear understanding of current research on this topic.

Another emphasis of this study is to learn about the source of children's ideas of nature, particularly family influence on children when they are entering elementary schools. The current literature often reports that children learn about nature from direct experiences; however, as the contemporary industrial society changes and children more often in contact with the media, children learn from schools and other forms of media. The second part of the review discusses literature related to this manner. Finally, methods used to investigate young children's ideas of nature are discussed: Naturalistic observation, content analysis—drawing and writing, interviews, and using photographs and illustrations to understand children's voice. Benefits and negatives of different methods are discussed to provide insights for this study for the data collection method.

Children's Ideas About Nature

A review of the literature shows that many children thought of nature as a place where animals and plants lived, with or without human beings. Some also understood nature from its interrelations and interdependence. Children sometimes projected their affections in their definition of nature and may have different answers for the definition when the situation changes.

Animals and Plants

Children have diverse ideas about what is nature. One salient theme that emerged from these ideas is that many children thought nature was a place where animals and plants lived (Phenice & Griffore, 2003; Bonnett & Williams, 1998; Littledyke, 2004; Shepardson et al., 2007). In a study by Phenice and Griffore (2003), trained child-development professionals interviewed more than one hundred 32- to 72-month-old children about their perception of and their relationship to nature. In this study, 76% of the children answered "Yes" to the question Are trees part of nature? while 74% said "Yes" to the question Are animals part of nature? and 70% and 66%, respectively, to Are plants part of nature? and Are human part of nature? Moreover, 87% of the children responded "Yes" to the question, Is nature outside the building? and 52% thought nature was inside the building, meaning that some children thought nature was both indoors and outdoors. To summarize, more children included animals and trees than human as part of nature. It is also interesting to note that the authors separated trees and plants in their questions. They did not, however, provide further explanation and discussion of this aspect. If the interviewers had probed the question, we might have more to deliberate on children's responses.

From the discussions of a series of photographs with fifth- and sixth- graders, Bonnett and Williams (1998) observed that children seemed to understand nature in a number of ways. Among them, the idea that nature is living things stood out. Some children thought nature was only plants, but many thought animals were inseparable from nature. Children often talked about the animals they encountered in nature. They had different views about whether human beings belong to nature. Some children thought of

both animals and human beings as parts of nature, because human beings and animals have similar needs. The researchers also found that some children had developed a notion of degrees of naturalness, depending on how greatly a landscape was free from human interference. For instance, cultivated fields are less like nature than uncultivated fields (woodlands or meadows), but more like nature compared with towns or motorways.

Shepardson et al. (2007) found four different mental models emerging from children's drawings and writings of what constitutes the environment and from their justifications for whether a series of photographs depicted the environment. More than half of the students conceptualized the environment as a place where animals and plants live without human beings. Many fewer children thought of the environment as a place modified by humans, or as a place where humans, animals, and plants lived.

Littledyke (2004) interviewed first to sixth graders with the question, When people talk about the environment, what do they mean? and found that children had all sorts of answers across ages. During the interview, children spent a lot of time defining the environment as the world around, animals and plants, and environmental problems. However, it is unclear whether the concluded results were the children's own view of the environment or whether they were what they thought "people meant" by the word environment. Loughland et al. (2002) interviewed more than 2,000 students from both elementary and secondary schools in Australia with the question of what they thought the word environment meant. Six conceptions were concluded from students' responses and divided into two major groups. One was "object focus," including conceptions that the environment is "a place," "a place that contains living things," and "a place that contains

living things and people." Those conceptions resonated with the results from the body of research. The other group of conceptions in this study will be discussed below.

Interrelations

From the study of Loughland et al. (2002) investigating children's definition of the environment, the second major group of children's responses was "relational focus," which included ideas that "The environment does something for people," "People are part of the environment and are responsible for it," and "People and the environment are in a mutually sustaining relationship." The authors did not mention the distribution of students' answers in the six conceptions; instead, they stressed that even young children could see the environment as an interactive and holistic model from its attribute of interrelationship.

Bonnett and Williams (1998) discussed with fifth and sixth graders their ideas of nature and reported that children thought nature was important for many reasons. They thought trees were important because they provide food, shelter, and oxygen for animals. Animals need plants as food or places to live and humans, likewise, need plants. Yet according to the authors, the interrelations children understood varied. Some children talked about more specific relations existing in nature like species extinction caused by disappearing rainforest. Some children pointed out a more general relation. For instance, animals need plants as food and places to live. In those discussions, children would say "You need it (the environment) to live really" or "You wouldn't be alive (without it)." Children might not have seen the overarching idea of the interrelations in nature, because what they learned from schools and the media is not well connected or applicable to their

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daily life. It could also be that they have not experienced enough to see the underlying relations in nature.

In Shepardson's (2007) study of children's mental models of the environment, 20% of the children had the concept that the environment supported the resources necessary for life. "It provides oxygen, water, and sunlight. It is an environment that has everything you need to live on." These children saw both abiotic and biotic factors in nature and included human beings in the environment. Only about 3% of the students in the study knew the cycle of matter or energy in the environment: the sun provides energy to plants, plants provide energy for animals. When we try to understand how children define nature by its interrelation, we need to keep in mind that those ideas might be more difficult to show via drawings. In addition, the underlying interrelations may not be the first thing that comes to students' minds when they are asked about what the environment is.

Having the ideas of interrelations, some children were aware that they could take action to make changes regarding some environmental issues. Littledyke (2004) concluded that some older students articulated attitudes of sharing and responsibility for protecting the environment. Most children had an opinion on their environment and were willing to take action to make changes (Kwan and Miles, 1998; Littledyke, 2004). We do not know if those children thought of themselves as part of nature or outside nature, but they clearly saw a relation between human beings and the environment.

Affections

Children reported their emotions when they talked about nature. Even though students were only asked to draw and explain what the environment was in the

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Shepardson et al. (2007) study, there was one student who showed emotions in the drawing of nature. He or she drew three people with one of them flying a kite and labeled them as a "happy family." Bonnett and Williams (1998) analyzed fifth- and sixth-graders' drawings of their favorite places, listing things they would like to see changed, and their group discussions of several photographs of different landscapes. The research was designed to study children's perceptions of nature. In the interview discussing different landscapes, some children valued nature as a quiet and relaxing place for leisure activities. One child stated that "I'd like to go there because it isn't touched and there're not many people there." One of the children suggested that she sometimes appreciates a natural place: "It doesn't look as fun as you'd think as a theme park and stuff but in some ways it's nicer, if you're in that kind of mood to go and relax and stuff." A boy said that nature was sometimes where "You get away from your troubles. ..."and a girl thought "it's important that people should have somewhere calm and peaceful to go to, not just having a busy life all the time." Children frequently connected nature with their play. The authors suggested that children talk about different environments by thinking what they can do there. For instance, children thought of woodlands as a place where they could build a tree house or play hide and seek. On the other hand, some children suggested that nature (woodland and meadow) would be so boring that they would not like to stay very long. Some children associated nature with the danger of being mugged or with anxiety about being alone.

Standpoints and Views

Bonnett and Williams (1998) found that children thought of themselves in some sense as part of a natural process and interdependent with it. They knew that humans

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need nature for life. On the other hand, children also thought that nature was separate from their everyday life. Children said that nature is for people to "have a nice view," "get away from troubles," or "have somewhere calm and peaceful to go to." Nature is sometimes a sanctuary for getting away from daily life. Nonetheless, we do not know if the same child has different conceptions of nature in this study.

Payne (1998) examined his own Australian sixth-grade students' arguments, reflections, and drawings about nature and the environment. He first recorded students' arguments about what nature and the environment meant to them. Most children believed that nature is the same as the environment, and that nature does not include human-made objects. Second, he had children draw a picture of their local environment as seen from the schoolyard. Then, he asked them to list things that they left out of the drawings. Payne sought to discover whether children's conceptions of nature and the environment remained the same when the context was narrowed to their local environment. About half the children began listing some human-made objects but left out others, sometimes without supporting reasons. For instance, one child included a house but not its fence. Another included power lines but not bricks. The rest of the children continued to exclude humans and human-made objects in their drawings. The study concluded that sixth-grade children's views on nature were not fully developed or consistent across different contexts. They included and excluded varied humanmade objects in their drawings of their schoolyard environment when the context was narrowed from the general idea of "the environment." However, other studies also show adults may have different views about how many humanmade things could be included in their definition of nature (Ma, 2009; Liu & Lederman, 2007)).

Sources of Children's Ideas About Nature

A preponderance of research suggests that children learn about the environment and nature from direct experience such as sensory or first-hand interaction (Kellert, 2002; Kalvaitis, 2007; Sebba, 1991). Adults view nature more as the background of an event. Hyun (2005) found that young children interacted with and learned about nature by directly touching, chasing, smelling, and observing. While children mediate meaning from their own experiences as well as from adults' linguistic and behavioral cues in daily life, adults often interrupt children's discovery and pass along their fear or dislike of nature to the children. When beginning school, children start to shape their learning on cognitive models rather than perceptions. Those cognitive models assist them in developing scientific understanding of the natural world beyond first-hand sensory and interactive experiences (Hyun, 2005; Wilson, 2006).

However, modern life has changed human life in many ways that may have changed our direct contact with and experience of nature (Kellert, 2002; Payne, 1998; Phenice & Griffore, 2003; White, 2006). Nowadays, children probably learn more about nature from the media, adults, and their peers (White, 2006; Louv, 2005; Littledyke, 2004; Walker & Loughland, 2003; Rickinson, 2001; Bonnett & Williams, 1998; Cohen & Horm-Wingerg, 1993; Payne, 1998) than from their direct experience. Television programs and children's literature have a huge impact on children's views of nature (Littledyke, 2004; Bonnett & Williams, 1998; Payne, 1998). What they learn from the media can sometimes be contradicted by their own daily life experiences and understanding of nature (Payne, 1998). After starting school, children also learn more about nature and the environment from the school curriculum, projects, and other

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activities such as recycling (Bonnett & Williams, 1998; Littledyke, 2004). Because environmental education is often not mandatory in school curricula, children's varied degree of understanding nature mainly depends on their different life experiences (Littledyke, 2004). Littledyke (2004) found a class of students that held more sophisticated conceptions than other classes of students in her study conducted in United Kingdom. She concluded that their teacher, who was environmentally aware, had a great influence on those students. Another class of students talked a great deal about recycling in the interview, and the researcher found that those students had previously had a project on recycling. Even though this class of students was younger than others, they developed a more sophisticated understanding of recycling and had much to say during the interview. This finding resonates with the idea that even young children can understand a topic once they have experienced it through education.

If children learn about nature from direct experience, where they live should give us some insight about their conceptions of nature. If children and their families live in a more rural area, it is plausible that they could have a greater chance to interact with nature through direct experience. Sebba (1991) compared whether children's favorite places are different for those from urban or rural areas and found that more rural children preferred the outdoor environment. Shepardson et al. (2007) also showed that urban students were more likely to think of the environment as a place impacted or modified by humans than did suburban and rural students. However, Bonnett and Williams (1998) found no significant difference in general attitude about environmental awareness between students from urban schools and those from rural schools. Cohen and Horm-Wingerg (1993) studied the ecological awareness of children aged 3 to 5 and also

found no difference between children from rural and urban communities. The researchers believed that children's life experiences could account for different conceptions, so they proposed that something other than residency could affect children's ideas. For instance, most of the children in the study went to independent preschools and that setting might have provided similar experiences for those children. The documentary *Where do children play* (White, 2007) pointed out that many suburban children in the United States commute in parents' minivans and that they are isolated at home after school. They seldom have the chance to directly experience nature.

Discussion

We can argue that children's conceptions that are learned from either direct or indirect experience *are* their understanding of what is nature. It would also be hard to tease out different sources from firsthand exposure to nature or secondhand information from the media. Thus, following the question of how children define nature and the sources of ideas, I propose to ask the question, "What are children's *relationships* with nature?" That approach might show a sense of what nature personally means to children in this particular urban context and reflect their interpretations of nature closer to daily life. Otherwise, the definition given by children could come from a textbook that basically shows their understandings of the standard scientific concept, which is not what I am looking for in this study. Instead, I focus on how those particular living styles in the city shape children's understandings of nature.

Learning what children's personal relationships with nature are will then make sense when investigating those influential factors such as living environment and family impact suggested by the CML theoretical framework.

Methods Used to Investigate Young Children's Ideas of Nature

Most studies discussed earlier used qualitative methodologies to investigate children's ideas about nature. They collected data from observations, interviews, and content analysis, including children's drawings and writings. Many also utilized photographs and illustrations in the interviews to enrich the discussions or serve as visual cues or focal points.

Naturalistic Observation

Hyun (2005) analyzed her field-based vignettes to reflect how 3- to 5-year-old children's thinking process about nature is different from adults' thinking in their daily lives. The observed occasions happened in natural settings such as the playground, home, or parks. As an acquaintance of the children, the observer's presence was unobtrusive and the dialogue between children and adults was collected over a span of 8 years. The author argued that naturalistic observation can minimize the tendency for adults to use their own thinking to interpret children's talk and culture. Adults might easily impose their own frame of understanding on children and ignore the children's competence or epistemology. She found that young children interacted with and learned about nature directly— by touching, physical activities, smelling, and so on. Moreover, during their attempts to learn about and discover meanings in nature, children were often interrupted by adults, who frequently passed along their own fears and dislikes of nature to the children. While children were trying to understand the world around them, the linguistic mismatch with adults could alter the children's connections to and perceptions of nature.

Naturalistic method would be ideal to unobtrusively observe children in nature. However, we still need some form of communication between the children and others, so

that the researchers can document the ideas of children. For example, Payne (1998), as both a teacher and researcher, unobtrusively collected data from his students' conversations about nature, writing, and drawings.

Content Analysis—Drawing

Many researchers used drawing as a way for children to communicate and demonstrate their understanding of nature (Bonnett & Williams, 1998; Payne, 1998; Sebba, 1991; Shepardson, 2002, 2005; Shepardson et al., 2007). Kalvaitis (2007) asked first- to fifth-graders to draw a picture of themselves in nature and analyzed those drawings using visual content analysis software. Drawing was believed to be a child-friendly means that could be used particularly for young children with limited language skills to demonstrate their mental model (Shepardson, 2007). Bonnett and Williams (1998) used the drawing data collection method as a way to warm up at the beginning of interviews. Children were first asked to draw their favorite place (which was not limited to natural places) because the researchers intended to see if nature appeared in children's minds without prompting. Drawing can serve as a buffer that allows children to get settled and familiar with the interview situation and later have something about which to talk. In addition, drawing provides one more means for children to express their ideas which might be concealed by other methods (Shepardson, 2005). However, some ideas are hard to express in a drawing. Hence, providing children the opportunity to write or talk about their drawing could potentially allow them to reveal more of their ideas to others.

Content Analysis—Writing

Besides drawing, Kalvaitis (2007) asked children to write about their drawings and their relationship with nature. The materials were later used in the interviews. Bonnett and Williams (1998) asked fifth- and sixth-graders to write down things in general that worried them and what they would like to see changed or stopped and also the things that they thought were important and would be upset about if they changed or stopped. Children from upper elementary schools to high school in Kwan and Miles's (1998) study listed three things that they treasure very much, they would like to change, they think is important, annoy them most, and finally, that worry them a lot beyond their local areas. Students were encouraged to provide reasons for each item.

The written pieces were for children to clarify their concepts in the drawings and validate the meaning for the researchers (Payne, 1998; Shepardson, 2007). Added to the drawing, this writing was to let children express themselves in one more dimension.

Interview

All the studies that interviewed children used group interviews rather than one-on-one style interviews. Kalvaitis (2007) used grade- and gender-specific focus-group interviews along with children's drawing and writing as one more layer of data collection. Littledyke (2004) interviewed groups of first- through sixth- graders about their understanding of the word *environment* and their concerns about the environment. She argued that group interviews can stimulate ideas and extend the discussion among peers. Many strategies were used to foster children's expressions of their ideas in the interviews such as providing a trustful and secure atmosphere for the children. Children were grouped with the kids they knew and sat in a circle, with no

obvious authority. The interviews were conducted in a quiet room to minimize any distractions and the interview time was also limited in terms of children's attention spans. Children were told that the interviews were conducted as a way to understand what children think about certain things. The conversations were confidential. For transcription purposes, each child was identified by "thank you [name]" after his or her contribution to the discussion. That interjection may help children feel ownership in the discussion, too. Age-appropriate language was used to communicate with children and allow them to use their own wording about particular concepts. The interviews did not appear to be structured. They started with the question "When people talk about the environment, what do they mean?" and tried to have the interviews touch on several topics: Children's understanding of the word *environment*; their concerns for the environment; children's understanding of those concerns; their views on the interconnections of science, society, and environment; and the source of influence on children. Phenice and Griffore (2003) interviewed 32- to 72-month-old children about their perception of nature and their relationship to nature. The interviews were conducted by child-development professionals who were familiar with the children. The result showed that children were asked questions such as "Are trees part of nature?" "Are animals part of nature?" "Is nature inside the building?" and, "Is nature outside the building?" Most children gave a "Yes" or "No" answer to those questions, but the authors did not provide readers with more information about the children's thinking beyond those narrow "Yes" or "No" answers.

Bonnett and Williams (1998) interviewed groups of fifth- and sixth-graders about their views about the environment. They believed group interviews allowed children to

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express themselves with less pressure and use their own language among peers. They believed that the everyday form of communication among children could reveal their understanding more than in an adult-to-child interview. The one-on-one situation could intimidate children's willingness to talk, but the group interview can relax them and elicit a more natural result. In the study, each group interview had 4 to 6 boys and girls. The 50-minute interview started with a drawing and writing task, followed by a discussion of photographs and any environmental issues that came up in the conversation. The researchers also tried to find out the source of influence on children's understanding. Similar to Bonnett and Williams, Cohen and Horm-Wingerg (1993) also used a series of illustrations for their interviews. They found that 3-year-olds were not quite able to articulate needed information in their study. Four- and 5-year-olds, however, were capable of responding to interview questions.

Photographs/ Illustrations

Like children's drawings, photographs and illustrations also were used frequently in communicating with children. Cohen and Horm-Wingerg (1993) used a series of photographs in their research on 3- to 5-year-old children's ecological awareness. They used pictures in three different ways. First, in "picture discrimination," they asked children to look at six pairs of pictures and choose which is "nicer" from each pair. For instance, one of a pair is a picture of a house and the other is a house with lots of trash. The researchers designed the paired illustrations with the nicer ones being those that are not polluted. Second, for "picture arrangement," children were first shown a stimulus picture and asked to choose one consequence picture from two. Third, in the "picture comprehension" tasks, children were asked "What's wrong here?" while looking at

pictures of human actions--for instance, a person throwing trash out of a car. Even though they believed these methods were age-appropriate to understanding children's intellectual resources, they decided to drop data from the "picture arrangement" task that did not meet the reliability tests. On the other hand, the other two tasks showed that age-appropriate tasks can reveal children's rich resources for ecological thoughts.

Bonnett and Williams (1998) used photographs throughout their interviews as a talking point to initiate conversation among fifth- and sixth-graders. Moreover, by using photographs in the interviews, they wanted children to use their own words expressing their understanding and concerns for the environment, rather than having adults' words imposed on them (Kwan & Miles, 1998). The photographs they used included "woodlands, a meadow with wild flowers, fields with a gate in the foreground, a man sitting down and looking towards some mountains, a man cutting down a tree, litter on a beach, boy scouts planting a tree and some adults and children putting bottles in a bottle bank"; these photographs were shown to children in that order of more general to more specific environmental issues. The sequence also provided a structure for the interviewers to follow. However, if the conversation was led into other directions by the children, the interviewers did not stick to the order. They found children thought of the environment as three different kinds: personal and immediate environments, social environments, and natural environments. Different age groups showed their willingness to make changes to those environments.

To study children's mental models of the environment, Shepardson (2007) presented to fourth- to twelfth-graders photographs of "natural and human-managed environments: desert plants in the desert, rows of urban houses, bears in a stream, a

woodland stream, cornfields with farmstead, an industrial plant with trees in the background, and a deciduous forest." Students needed to tell the researchers if each photo represented the environment and to provide their justifications. The author concluded four mental models from students' responses along with their drawing and writings.

Using pictures seems a promising way to communicate with children. However, it will be difficult to choose what to use in the interview so that the pictures will not constrain children's thoughts. Any selected pictures may also reflect some degree of the researcher's ideas of nature. Since my research is to study children's own voice, I need to be careful not to impose my own thoughts' on children's interpretation of nature.

Discussion

Postpositivist research assumes reality is relative and that it develops or changes across time and contexts (Gall et al., 2003). Alternatively, positivists believe there is only one reality regardless of the context. Postpositivist researchers investigate a social phenomenon by studying the meanings individuals make of their life experiences. To capture the reality, they collect verbal and pictorial data from many different angles to study the social phenomena in a holistic way in its natural setting.

First, as a result of what I learned from my literature review regarding data collection with young children, I used a variety means to understand children's views and to allow children to express themselves (Cohen & Horm-Wingerg, 1993; Kwan & Miles, 1998; Payne, 1998). Various means also helped me to triangulate children's understanding (Shepardson et al., 2007) and to understand the phenomena from different layers of constructions.

Second, the assumption of using drawing is that children have inner representation, a mental model, as their understandings of a phenomenon (Moseley et al., 2010; Greca & Moreira, 2000; Shepardson et al., 2007; McClary & Talanquer, 2011). It is constructed from one's conceptions and experiences and may change over time with new experience and knowledge. We can learn their definition of nature from what they include in the drawings and, from how they situate themselves in the picture, can understand their relation with or feelings toward nature. Drawing is believed to be a child-friendly means that can be used particularly with young children, whose vocabulary is still underdeveloped, to communicate with adults (Bonnett & Williams, 1998; Payne, 1998; Sebba, 1991; Shepardson, 2002, 2005; Shepardson et al., 2007; Kalvaitis, 2007). In addition, drawing can explore children's understanding that may be hidden by other methods, such as interviews or surveys (Shepardson, 2005).

Third, although verbal communication served as a means to express ideas, share information, and mediate through the socialization process, what children expressed in the interview was what they were able to express at that time. There might be things that they were not able to fully express by spoken language. I had to be aware that those cultural representations—languages and illustrations—are in some ways limited for measuring children's intellectual resources.

Many researchers agreed that children's responses to interviews or any measurement was not the reality or that there is no one reality. They did not jump to conclude that what they saw was the totality of what the children knew about nature or the environment. Shepardson (2007, 2002) underscored that what researchers see in children's comments could be only certain facets of the phenomena and also interpreted the data with

the understanding that children told what they wanted to say to the researchers at that particular moment or in that sociocultural context. Children can think about the same topic in different ways, depending on the circumstances and what intellectual resources are pulled together (Shepardson, 2002). Sometimes they are not able to retrieve and assemble their intellectual resources as efficiently as adults. However, some time spent probing can cue children's additional thoughts (Shepardson, 2002) or help interviewers confirm what they hear and want to know about more.

Finally, I decided to use both group interview and individual interviews in the data collection process discussed in Chapter 3. Individuals can freely express their own thoughts and group interviews were hoped to provoke more ideas from the conversations. However, group interview data was dismissed in the data analysis process. See Appendix D for more details on this decision.

Summary

A review of the literature shows that many children most often defined nature as a place where animals and plants lived, with or without human beings. Some children thought nature was only plants. More children thought of nature as outdoor rather than as indoors. Some children had developed a notion of degrees of naturalness, depending on how greatly a landscape was free from human interference.

Some children also could understand nature from its interrelations and interdependence. Several researchers argued even young children could see the environment as an interactive and holistic model. However, others concluded that there are those who might not have seen the overarching idea of the interrelations in nature,

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because what they learned from schools and the media is not well connected or applicable to their daily life.

Children sometimes projected their affections, both positively and negatively, in their definition of nature. Children linked nature to happiness, relaxation, calmness, peace, and sometime with boredom and danger. One study also suggested that children talk about different environments by thinking about what they can do there.

Children also might have different answers for their definitions when the situation changes. Some sense as part of a natural process and interdependent with it. They knew that humans need nature for life. On the other hand, children also thought that nature was separate from their everyday life. In another study, children included and excluded varied humanmade objects in their drawings of their schoolyard environment when the context was narrowed from the general idea of "the environment."

Where do children learn about their conceptions of nature? A preponderance of research suggests that children learn about the environment and nature from direct experience such as sensory or first-hand interaction. However, modern life has changed human life in many ways that may have changed our direct contact with and experience of nature. Nowadays, children probably learn more about nature from the media, adults, and their peers than from their direct experience. Some concluded that children's life experiences could account for different conceptions.

Most studies discussed in the review used qualitative methodologies to investigate children's ideas about nature. They collected data from observations, interviews, and content analysis, including children's drawings and writings. Many also utilized

photographs and illustrations in the interviews to enrich the discussions or serve as visual cues or focal points.

For naturalistic observation, researchers argued that it can minimize the tendency for adults to use their own thinking to interpret children's talk and culture. Adults might easily impose their own frame of understanding on children and ignore the children's competence or epistemology. However, we still need some form of communication between the children and others, so that the researchers can document the ideas of children. Drawing was believed to be a child-friendly means that could be used particularly for young children with limited language skills to demonstrate their mental model. It also can warm up the interviews. Writing also helped children to clarify their concepts in the drawings and validate the meaning for the researchers. Each method provides one more means for children to express their ideas which might be concealed by other methods.

All the studies that interviewed children used group interviews rather than one-on-one style interviews. Researchers argued that group interviews can stimulate ideas and extend the discussion among peers. It is also believed group interviews allowed children to express themselves with less pressure and use their own language among peers. The one-on-one situation could intimidate children's willingness to talk, but the group interview can relax them and elicit a more natural result.

Finally, the chapter ended with a discussion about my rationale and assumptions of data collection and data interpretation learned from the literature.

Chapter Three: Methodology

Qualitative methods were used in this study to investigate children's conceptions and relations to nature. The research context section included an overview of the kindergartens in Taiwan, the elementary schools, how the current national curriculum guidelines cover the topic of nature, and introductions of the particular four schools in this study. Participant selection, data sources, data collection process, data confidentiality and storage, and data analysis follows.

Research Contexts

Kindergarten in Taiwan

Kindergartens in Taiwan usually take students from age 3 to 5. It is part of the basic education for young children, but it is not compulsory. The government is planning to include 5-years-old children's education as part of the free compulsory education. It also just launched a new policy to subsidize disadvantage families in remote area with their 5-year-olds' independent kindergarten education. The ultimate goal is to make kindergarten education free for all. The enrollment rate in the school year 2009 to 2010 for 5-year-olds was 92.12 % (Ministry of Education, 2010). The average class size in 2008 was 18.91. Kindergarten children, most of the time, are grouped by age in separate classes. Schools in remote areas, such as villages in the mountains with small populations, could have very few students in one class, one grade, or even the entire school. The kindergarten context was selected from Taipei City, the capital, which has a population of 2.5 million. In the cities, each class generally has two teachers. There is no national curriculum standard to follow. However, children's activities are scheduled by a routine of different subjects or units. Teachers can decide how much time they spend on different

subjects. No formal regular assessments are conducted in kindergartens. Teachers may use student participants or homework to evaluate their learning outcomes.

Most public kindergartens are affiliated with elementary schools. They share the same campus or have their own building and use a part of the campus of the elementary schools. School playgrounds are fairly small in size and have limited access to nature. Urban children usually play or do homework indoors after school.

Elementary Schools in Taiwan

The free compulsory education in Taiwan consists six year of elementary school education and 3 years of junior high school education. The compulsory education enrollment rate has been higher than 99% since 1976. The literacy rate for citizens above 15 years old in 2009 is 97.9 (Minister of Education, 2010). The Elementary schools have students between the ages of 6 and 12. The average class size in 2008 was 27.7. Most students in first and second grades have a half-day schedule. All schools follow a national guideline that includes on average 1 to 3 hours per week of natural science in the first and second graders' curriculum. In elementary school, students begin to have regular assessment schedules for each subject. It is in general believed that children with good grades will be better prepared for future education. In addition, many families with two working parents have very long working hours and tight schedules. Consequently, many parents send their children to private after-school centers that help children get their homework done before going home. Parents may also arrange weekend activities to further the children's learning out of school.

The elementary school science education curriculum in Taiwan follows a "one national curriculum standard, multiple textbook" policy launched since 1999. It used to

be that the only version of textbooks was published by one institute, the National Institute for Compilation and Translation. Now school teachers are encouraged to organize committees for textbook selection that suits their students' needs. Classroom teachers are free to select their use of teaching strategies and student activities. Yet the content of each textbook still follows the National 1-9 Curriculum Guidelines, first published in 2003 and modified in 2008. More details about topics of nature covered in the curriculum will be discussed in the next section.

For teacher education the Universities of Education and Teacher Colleges prepare most of the teachers for kindergartens and elementary schools. All teachers are prepared in the four-year college including internships. In the past decade, teacher positions were opened to those who earned educational course credits in addition to their regular college degree and passed the interviews by individual schools. In elementary schools, teachers of grades 3 to 6 only teach classes related to their majors in college. First- and second-grade teachers usually teach all subjects as in kindergartens. Most also serve as the class teachers who always stay with the same class of students, and manage students' lives in school and communicate with parents on a daily bases. Each student has a "communication book" that parents need to sign everyday and in which they can write things down to communicate with the class teacher. Teaching is a relatively stable position in Taiwan society. However, it is getting more competitive to be hired by a school, since less children are born in the country and more routes are opened to be a teacher. Most teachers do not change careers once they start teaching. It is also a relatively respected job in the society.

National Curriculum Guidelines

The ultimate goal of this study is to suggest policy and curriculum implication based on the understanding of children's ideas of nature and their parents' influences. The children in this study have only just entered the school system and are bringing these ideas to school mainly from home. School teachers need to pick up these ideas and help children make the connection from daily life to classroom knowledge. Here, I will first briefly introduce the Environmental Education Law in Taiwan and then discuss how the topic of nature is covered in the Grade 1-9 Curriculum Guidelines used nationwide (Ministry of Education, 2008b). I will compare what the children in this study already knew with the competence indicators in the curriculum guidelines in Chapter 5.

In its midterm goals (2009–2012), the Ministry of Education listed environmental education that leads to sustainability as one of its many goals. The document refers to the Environmental Education Law recently announced in May 2010. Its purpose is to have Taiwan catch up with current worldwide environmental efforts so as to meet the nation's needs for sustainability. The law was passed to confer on one official the power to implement and organize environmental education in accordance with a legislative budget source. Elementary and middle schools are encouraged to integrate environmental education into their school-based curriculum so that students learn about their local environment from a worldwide point of view. In addition, all personnel in K-12 schools, government-run corporations, and government-funded organizations need to take at least 4 hours of environmental education every year. It can be in the form of classes, speeches, forums, e-learning, experience, experiments, outdoor learning, visits, film watching, and the like. The content may include information about sustainability, energy and resources,

oceans, biodiversity, ecology conservation, green consumerism, or special issues such as global warming and climate change.

The national Grade 1-9 Curriculum Guidelines was last revised in 2008 for enactment in 2011. The guidelines include goals and competence indicators for seven subject areas—Language, Health and Physical Education, Social Studies, Arts and Humanities, Science and Technology, Math, and Integrative Activities—as well as seven significant issues—Gender Equality, Environment, Human Rights, Information Technology, Home Economics, Career Development, and Oceans. Teachers are encouraged to integrate these issues into the main subject areas or introduce them during the school-based curriculum class hours (2-3 hours per week). Instead of reporting how the topic of nature is portrayed in the K-6 science curriculum, the environmental education guidelines are reported, since it is more closely related to the topic of nature than the science education guidelines. Listed in Table 1 are the competence indicators related to the topic of nature for the first and second grades in the standard guidelines for environmental education. I list only those for first and second grade because this study focuses on the transfer period between home and the standardized school curriculum. Other learning goals and measures of competence can be found online in Chinese.

Table 1

Main Learning Goals and Competence Indicators for Environmental Education for First and Second Grades in the Grade 1-9 Curriculum Guidelines

Main Learning Goals	Competence Indicators (1st and 2nd grades only)
1. Be Perceptive and Sensitive to the Environment	a. Able to use the five senses to experience and explore things in the environment.
2. Environmental Concepts	a. Know the surrounding natural and humanmade

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and Knowledge	environment and the animals, plants, microorganisms, and their interrelations.
3. Environmental Value and Attitude	a. Through contact with living creatures, learn to protect and respect life and to understand the importance of ecology conservation. b. Nourish curiosity. To understand what role human beings play in the ecosystem and the relationships between the natural environment and human beings.
4. Environmental Action Skills	a. Able to use language, writing, drawings, etc., to communicate one's experience or ideas about environmental conservation. b. Able to use language, writing, drawings, etc., to record school and home environmental events under families' and teachers' guidance.
5. Environmental Action Experience	a. Participate in community environmental protection activities with families or teachers. b. Take simple action for campus conservation activities and practice them at home.

Schools in This Study

In this study, efforts were made to select 4 schools with varied characteristics in the heavily populated Taipei city, the capitol of Taiwan. Independent and public schools in different districts of the city were both chosen to include parents with varied incomes and the portions they were willing to invest in their children's education. If parents decide that their children should enter a public school, they usually go to the ones within the school district. This does not apply to private schools where children often travel across school districts to the schools that match their parents' educational beliefs.

The first school, Gu-Shin, is an independent school that takes students from kindergarten to junior high school. Its elementary school, which was founded in 1956, has 36 classes, around 1,500 students, and approximately 110 teachers. The school locates in southern Taipei City. Students in the first grade take many more classes than

those in public elementary schools. They have a full-day schedule in school. The tuition for this school is more than 50 times that of an average public elementary school.

The second school, Ge-Chen kindergarten, is a 25-year-old public kindergarten that shares a campus with Ge-Chen elementary school. It has 5 classes with 10 teachers and around 135 students. The school is located in one of the districts in north Taipei with an average lower income than other districts in the city (Department of Budget, Accounting and Statistics, Taipei City Government, 2010). Its curriculum was developed by all school teachers based on children's development, parents' background, and local environment. To integrate the six main subjects: language, music, commonsense, work, health, and play, they design thematic units, role playing, exploration, group activities, corners, and field trips.

The third school, Lu-Dye, is a small public elementary school founded about 50 years ago. It has 17 classes with about 35 teachers. Its affiliated kindergarten shares the same campus. The school is located in southern Taipei City, a few streets away from Gu-Shin elementary school. The district average income rank is about the same average among other districts in the city (Department of Budget, Accounting and Statistics, Taipei City Government, 2010). The campus is very small with only one building with three wings that bound a ball court. The small school characterizes a warm atmosphere and close connection with the community. Although the tuition is free in public schools, parents still pays a nominal amount of mandatory fee varied from school to school.

The fourth, Pu-Lin kindergarten, is part of a k-18 newly founded bilingual independent school. The school was founded less than 10 years ago by its associated educational textbook publishing company, Pu-Ma. The company is also one of the four

publishers that edit elementary school textbooks. The kindergarten has three different campuses. The studied kindergarten is located in a high-rise building with the publishing company while the other two are located on the hills surrounding Taipei City with a bigger campus. Many students' parents work for the company. The school also offers bilingual and all-English programs, which usually mean much higher tuition in Taiwan. The tuition for this kindergarten is higher than the private elementary school, Gu-Shin, in this study. They use mainly thematic curriculum units with a diverse emphasis on both western and eastern holidays, ethic, health and safety, and reading, in addition to the use of field trips and extracurricular activities.

Participant Selection

This study targeted twelve pairs of children and parents (N=24) as participants for this study. The number of 12 pairs was decided before the data collection process to make the study simultaneously doable and provide in-depth information. Sixteen children between the ages of 5 and 6 were selected from four schools in Taipei City as participants. Data from 4 more participants than the targeted number was collected to balance 2 girls and 2 boys from each school. It was also done to ensure that if any cases withdrew from the study that the sample size would not fall below 24. It also would increase my flexibility to select cases from the total pool of case that would provide the most rich information.

Before I went to Taiwan, I contacted personnel from four different schools by emails and phone calls to confirm the data collection time and criteria for participant selection. Teachers were told to select children according to criterions that would provide rich information. First, the children had to be able to express themselves in front of

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strangers. Second, they should select some children with special interests in nature and some without. Third, two girls and two boys would be needed from each class (school). Fourth, teachers should try to select children from families of different socioeconomic status or with different beliefs about nature education—such as families that often participate in nature-oriented activities, in order to include a wide range of Taipei City's children's ideas about nature (Rickinson, 2001).

Participants' school, grade, and gender are listed in Table 2. For differing reasons, four samples were removed, to make a total of 12 children participants as suggested by my dissertation committee. Number 10 participant was the first to be removed as a study participant because the parent later withdrew from the study. Number 3 was removed because the girl was very shy and did not contribute much in the drawings and interview. A third participant, Wen-Yong, was removed because the interview was not very productive due to the many "I don't know" responses. Yen-Jhao was removed in order to have each school end up with three samples and to balance the gender of the 12 participants. Compared with the other male student in Ge-Chen Kindergarten, Huan-Mong provided richer information from both child and parent than Yen-Jhao's. Removing Yen-Jhao resulted in 6 girls and 6 boys the final participants. Children in the two elementary schools are respectively from the same class. The children in kindergartens are from different classes in the same school. Yet they are all acquainted with each other.

Table 2

Number of Participants and the Removal Priority

#	Name	Gender	Grade	School	Child Interview	Drawing	Parent	Data Removed

								Order
1	An-Jhen	M	1st	Gu-Shin	✓	✓	✓	
2	Yen-Pin	F	1st	Gu-Shin	✓	✓	✓	
3	Hua-Ho	F	1st	Gu-Shin	✗	△	✓	2
4	Si-Chen	M	1st	Gu-Shin	✓	✓	✓	
5	Huan-Mong	M	K	Ge-Chen	✓	✓	✓	
6	Ning-Chen	F	K	Ge-Chen	✓	✓	✓	
7	Suan-Hui	F	K	Ge-Chen	✓	✓	✓	
8	Yen-Jhao	M	K	Ge-Chen	△	△	✓	4
9	De-Lu	F	1st	Lu-Dye	✓		✓	
10	Shin-Guan	M	1st	Lu-Dye	△	✓	✗	1
11	Chi-Z	M	1st	Lu-Dye	✓	△	✓	
12	Yu-Ting	F	1st	Lu-Dye	✓	✓	✓	
13	Jin-Ge	M	K	Pu-Lin	✓	✓	△	
14	Chen-Yu	M	K	Pu-Lin	✓	✓	✓	
15	Wen-Yong	F	K	Pu-Lin	△	✓	✓	3
16	Jin-Ruei	F	K	Pu-Lin	✓	✓	✓	

Research Questions and Data Sources

1. *What are children's conceptions of nature?*

    a. *How they define nature*

    b. *What are their interests in nature*

    c. *How they feel about nature*

       Children's drawing and photograph interpretation

       Children's interviews

       Parents' surveys

2. *What are the sources of these ideas about nature?*

       Children's interviews

       Parents' surveys

3. *How do children's surrounding environment and lifestyle influence these ideas?*

Children's drawing and photograph interpretation

Children's interviews

Parents' surveys

4. *How do parents think about children and nature?*

Parents' surveys

5. *What influences children's interests and experiences in nature?*

Children's drawing and photograph interpretation

Children's interviews

Parents' surveys

Data Collection

Student participants (N=16) were asked to respond to drawing prompts and interview questions. Their parents (N=16) were invited to respond to the surveys. Informed consent was obtained from participants and parents to collect data prior to beginning the study. Only data from 12 pairs of parents and children were used in the data analysis and final report.

Children's Drawings, Interviews, and Photograph Interpretations

Each child participated in the tasks of drawing, being interviewed, and photograph interpretation. They were taken to a quiet room, such as the library, activity room, or conference room, during the school day. Crayons were supplied for them to do the drawings. A drawing prompt was used in this research: "Please draw a picture of yourself in nature." The method that includes children themselves in the drawings was anticipated to manifest their relationship with nature. Any description they wanted to add regarding their drawings was welcomed. Participants were given as much time as needed to

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illustrate their thoughts in response to the prompt and were encouraged to add things that they did not include at first. Most children understood the prompts well and started their drawings immediately. When the child did not have any idea about what nature was, I provided photographs with different scenery and landscapes to provide the child a framework about the topic. Later, I decided to ask all the children about the photographs in the end of the interviews. If the child hesitated to draw anything, I encouraged him or her to draw anything that came up when I read the prompts without pushing them any further. I made sure they were all administered in a consistent manner by reading the prompts printed on my note. Interviews were conducted immediately after the drawing.

The drawings served as a talking point for the semi-structured interview that commenced upon completion of the drawing. Sample questions included: Tell me about your drawing. "What are you doing there?"" What is nature?" "Who told/taught you that?" "How do you feel in nature?" "Do you like it?" "What do you do after school?" "How often do you go outside and play after school and during the weekends?" The interview questions were designed to reflect different aspects in the Contextual Model of Learning (Table 3). I brought my list of questions (see table 3) to each interview as a way to ensure that the conversation touched on all the research questions. I also added things to my notes if the conversation brought up good questions along each interview and asked the same questions to the rest of the children.

Table 3

Interview Questions Reflecting the Theoretical Framework, Contextual Model of Learning

Interview Questions	Aspects of the Contextual Model

	of Learning
1. Let's talk about your drawing "You in nature." Please describe your drawings. Probes: What is this? Where have you seen this? What is happening in the drawing?)	
2. What is nature? Where else did you see nature?	Personal Context
3. Do you like nature? Why?	Personal Context
4. How do you feel about nature?	Personal Context
5. Who told/taught you that? How did he or she say that?	Sociocultural Context
6. Have you ever seen books or TV talk about nature? What did you read or see?	Sociocultural Context
7. What do you usually do after school? Where do you go or where do you play?	Sociocultural Context Physical Context

Questions added along the data collection process that were recorded in my note too were:

What else do you want to include in your drawing?

Where have you seen these things (in your drawing)?

Where do you see nature? Is any nature close to your home?

Are you nature? Are you related to nature?

Is a human being nature?

I tried to ask more questions when a child brought up some experiences related to nature to see if that could elicit more details about children's daily lives and thoughts about nature. For instance, if a child talked about an animal, I asked more about where

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the child saw that animal, who brought him or her to that event and who told him or her things about what the child had told me. I believed children felt relaxed and excited by this kind of chatting. I believed I could learn about their daily lives and thoughts from natural conversations guided by semi-structured interviews.

Eleven photographs taken by me over the years had been prepared for children who had no clue about nature. Example photographs were of prairies, cities, deserts, ocean, an elementary school campus, a living room, and natural trails. The decision making in selecting the particular photographs was to show a wide range of scenes that include different landscapes and varied degree of humanmade and natural elements. I showed each photograph on my laptop screen to the interviewees. I will elaborate on all photographs further and list them in Table 7 in chapter 4. It was hoped that the photographs would give the children some hints or provide a framework without directly telling them what is nature. It turned out that only one child (from the 12 participants selected) used the photographs before drawing and did show some understanding about nature without me giving any verbal cues. From the first interview, I decided to ask all children to interpret these photographs to enrich the data. Children were asked, "Is this nature?" and "Why?" After the interviews, I gave the children little gifts to thank them for their participation and cooperation. I used a digital recorder and also took notes during the interviews. The drawing and interview took about 30 to 45 minutes for most children.

Group interviews were conducted after individual interviews. I hoped that this practice would play two roles in the study: first, to see if a group discussion would bring up any new ideas; and second, to triangulate individual responses. Children were asked mostly the same questions as in the semi-structured individual interviews and any new

ideas emerged from the discussion. Group interviews were also recorded by digital recorder and transcribed later. However, it was later decided that the group interviews were not to be used in the data analysis. The group interiew was not as successful as I expected. Details for this decision are included in appendix D.

Parent Surveys

I crafted the 10-item survey for the parents in order to provide insights as to how families influence children's ideas about and interactions with nature. They were asked to respond to items about their children's understanding and ideas about nature. The survey took approximately 10 minutes to complete. Sample items included the following: "Do you believe your child likes or dislikes nature?" "Do you believe your child has a special interest in nature?"" What makes you hold that belief?"" What do you think contributes to your child's interest in nature?" "Do you believe your family influences his or her interest in nature?" "Why or why not?" "What makes you want to or not want to take your children out to nature?" "Where and how often do you usually go to visit nature?" (see Appendix C)

The surveys for the parents were brought to the children in sealed envelopes on the interview day, and I went back to each school to collect them when the teachers reported they were ready. Parents of children De-Lu, Yu-Ting, and Chen-Yu had not returned the surveys by the time I first went to collect them. In addition, without giving a clear reason, a parent of Shin-Guan told the teacher she wanted to withdraw from the study, despite her earlier agreement. Parent Yu-Ting said that she was too busy to complete the survey when I first collected them, but later the parent promised to leave the survey at the school after the semester ended. The parent of Chen-Yu stated that the

survey was lost. After returning to the United States, I approached the teacher of Chen-Yu

to see if it is appropriate to contact the parent again. The parent responded positively this

time and emailed the survey back. Parents of An-Jhen, Yen-Pin, Sh-Chen, Huan-Mong,

Ning-Chen, Suan-Hui, Ning-Chen, Suan-Hui, Chi-Z, Jin-Ge, and Jin-Ruei returned the

survey without complication. Their demography is shown in Table 4.

Table 4

Demography of the Parents

	Children Names	Gender	Age *	If Crossing School District**	Occupation
1	An-Jhen	M	41		Business
2	Yen-Pin	F	38	Cross School District	Business
4	Si-Chen	F	32	Cross School District	Housewife
5	Huan-Mong	M	38	Cross School District	Academic
6	Ning-Chen	M	36	Cross School District	Technology
7	Suan-Hui	F	42	Same School District	Insurance
9	De-Lu	F	35	Same School District	Military
11	Chi-Z	F		Same School District	Government
12	Yu-Ting	F	38	Same School District	Technology
13	Jin-Ge	M	40	Same School District	Education
14	Chen-Yu	F	41	Same School District	Housewife
16	Jin-Ruei	F	35	Same School District	Education

* Calculated from Birth Year

** Comparing with Residential Area

Data Storage and Confidentiality

All the information collected in this study is confidential to the full extent

provided by law. The identities of students, parents, and schools were disguised through

the use of pseudonyms in all written materials. Information was recorded in such a

manner that the participants could not be identified either directly or through identifiers

linked to them. The interviews were conducted in private areas away from others. The

surveys were provided with envelops that can be sealed to the parents so that the teachers did not have the access to the surveys when they passed them to me. Digital files of the interviews, transcripts, drawings, and artifacts collected during the program remain private and will not be made publicly available.

I transcribed the audiotape data for analysis. All data collected during the course of the research is stored at my home and is in a secure cabinet. Electronic copies of data are stored on my computer. Only I have access to the hard copy and electronic data. After 10 years, shredding will destroy all hard copy data; all electronic data will be deleted from all storage devices.

Data Analysis

Digital recording files for each interview, including children's photograph interpretations, were transcribed. All drawings were scanned to digital files for easier viewing and for data backups. The overall qualitative data (drawings, interviews, and survey) were analyzed for common patterns and themes in answer to the research questions.

All drawings were coded using the system modified from Kalvaitis' (2007, p. 207). A mental model approach was used when analyzing the drawing that children's drawings as a way to show their inner representation of their understanding and relation to nature (Moseley at al., 2010; Shepardson et al., 2007). Table 5 in Chapter Four shows the drawing coding sheet used to identify the ideas of the children in this study. Each drawing was coded, and all the codes were counted, as shown in Table 6, to understand children's definition of and feelings to nature.

The photograph interpretations from children were coded by their responses to the Yes or No question, "Is this nature?", and counted as shown in Table 8. It is also used for understanding the children's definitions of nature along with their explanations to the Yes or No question that were coded with the interviews to inform other research questions. It turned out the photograph interpretations were most useful in examining whether children think humanmade things are nature and how children perceived these things.

Both drawings and photograph interpretations were also quantified into numerical items, so that it would be easier to examine any trends among children's definitions of nature. Each child's drawing and photograph interpretation received a score based on the scoring rubric listed on page 142. The higher the score, the more complex were the child's understandings of nature. The scores were then compared according to their different school systems, genders, and ages, and parents' scores and other responses from the children's interviews and parent surveys to see influences on the children's definitions of nature.

The children interviews were coded and the codes were modified and re-grouped several times every time I re-read the transcripts. I listed all the codes under different themes in a Word file so that I could move around the codes in the electronic file. I also highlighted important excerpts in the transcripts when the group of codes started to make sense under each emerging theme. The themes from the interviews are reported in Chapter 4. The interview responses are also compared with the children's definitions of nature scores as described in the previous paragraph.

Parent surveys are analyzed in two forms. First, responses for each survey question are counted and summarized. Coaxial coding was then performed as way to

detect possible connections among the parents' responses. The parents' responses were also compared with the children's definitions of nature scores, as described previously. To analyze if any common pattern emerged from pairs of children and parents and to present an intact portrait of each pair that might be missed by other means of data analysis, I used the constant comparison method to find similarities, contrasts, or salient perspectives in each pair's transcripts.

Finally, all emerging themes were analyzed together by plotting them in the actual visual representation of the Contextual Model of Learning framework to better understand the nature and interrelation of children's ideas about nature.

Summary

This study used a qualitative method especially designed to investigate young children's conceptions (Kalvaitis, 2007; Shepardson et al, 2007; Littledyke, 2004; Loughland et al, 2002; Bonnett & Williams, 1998; Payne, 1998). The research settings are located in the heavily populated Taipei city, the capitol of Taiwan. Twelve children ages 5 and 6 and their parents (N=24) are selected from 2 kindergartens and 2 elementary schools to study the children around the time they start school. Independent and public schools in different districts of the city were both chosen to include parents with varied incomes and the portions they were willing to invest in their children's education. Teachers of the 4 classes of the four schools (2 grade level * 2 school types) were told to select both boys and girls who would provide rich information and better represent children from a variety of background and interests.

The data collection included data sources such as children's drawings, interviews, photograph interpretations, and parents' surveys. The children were taken to a quiet room,

such as the library, activity room, or conference room, during the school day. Crayons were supplied for them to do the drawings. A drawing prompt was used in this research: "Please draw a picture of yourself in nature." Any description they wanted to add regarding their drawings was welcomed. Participants were given as much time as needed to illustrate their thoughts in response to the prompt and were encouraged to add things that they did not include at first. Interviews were conducted immediately after the drawing.

The drawings served as a talking point for the semi-structured interview that commenced upon completion of the drawing. Sample questions included: Tell me about your drawing. "What are you doing there?" "What is nature?" "From where did you get those ideas about nature?" "How do you feel in nature?" "Do you like it?" "How often do you go outside and play after school and during the weekends?" "Where do you go and what do you do?" Each question was followed up along the conversation. Questions that brought up rich information were also added to other interviews.

Eleven photographs had been prepared for children who could have no clue about nature. It was planned that the photographs would give the children some hints or provide a framework without directly telling them what nature is. Example photographs were of prairies, cities, beaches, deserts, elementary school campus, and natural trails. Later, the researcher decided to interview all children about the photographs as an extra data source. Children were asked about the photographs, "Is this nature?" and "Why?" The drawing and interview took about 30 to 40 minutes for most children.

The 10-item survey for the parents was designed to provide insights as to how families influence children's ideas about and interactions with nature. They were asked to

respond to items about their children's understanding and ideas about nature. Sample

items included the following: "Do you believe your child likes or dislikes nature?" "Do

you believe your child has a special interest in nature?" "What makes you hold that

belief?" "What do you think contributes to your child's interest in nature?" "Do you

believe your family influences his or her interest in nature?" "Why or why not?" "What

makes you want to or not want to take your children out to nature?" "Where and how

often do you usually go to visit nature?" They surveys were brought home by the children

with sealed envelops and were collected when the teachers reported they were ready.

Chapter Four: Results

Children's definition of nature was identified from use of several data collection methods: drawings, interviews, and their interpretation of photographs. Five themes emerged from the children's definition of nature. One, *children use different elements to define nature*. Two, *plants create the space called nature*. Three, *nature sometimes contains different degrees of natural and artificial elements*. Four, *nature grows and moves*. Five, *human beings are not nature*.

Most children (10 out of 12) expressed positive feelings about nature. They enjoyed nature because of its aesthetic and social value as well as the chance to interact with living things. Fears and dislike of nature sometimes arose when they felt helpless or encountered insects they do not like. Children's definitions are developed mainly from what parents and grandparents told them and their firsthand exposure with nature.

In terms of children lifestyle that included their after-school time and living environment, I learned that weekdays are mostly for homework and after-school class; and visiting nature is often part of the weekend family activities. What activities children usually do in nature are reported as part of their daily life as well. They do physical and social activities, enjoy the beauty, and interact with living things in nature. However, it was learned that very often parents miss those teachable opportunities to make these experiences meaningful to children. Children's immediate living environment as reported in the parents' survey data was also examined as a way to investigate their access to nature in the urban setting.

Parents' ideas and influence on children's experiences of nature were reported primarily by the parent surveys. Coaxial comparison was performed to see how different

factors may associate to each other. It was found that most parents in this study are aspired to nature and are very willing to bring their children out to nature.

From the themes that emerged from the study, I used three methods to organize the influences on children's ideas and experiences of nature for meaning making. First, I used a rubric to quantify children's definition of nature from their drawings and interpretations of the photographs. The scores were then compared according to their different school systems, gender, and age, and other parent survey items. Second, I used the Contextual Model of Learning to frame those influential factors on children's experience of nature. Finally, using the method of constant comparison, I tried to seek patterns from the twelve pairs of children and parents. My analysis of the data revealed that children remember many meaningful moments with their family in nature.

For readers to better understand how each research question, its data source, and its findings are linked and structured in Chapter 4, I put the chapter structure in a clear concept map as shown in Figure 2. The first section, including the first three research questions, covered children's own voices. The second section, responding to the fourth research questions, reported mainly parents' thoughts about children and nature. The last section, answering the fifth research question, added parents' thoughts to children's voices, for understanding the influential factors.

Children's voices about…   Parents' thoughts about…   The influential factors are…
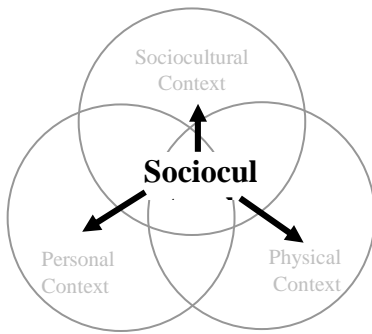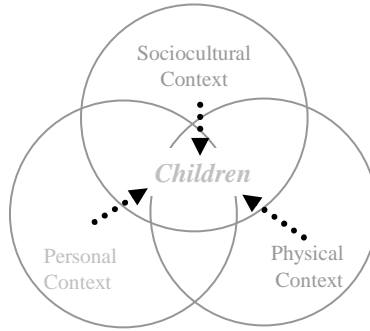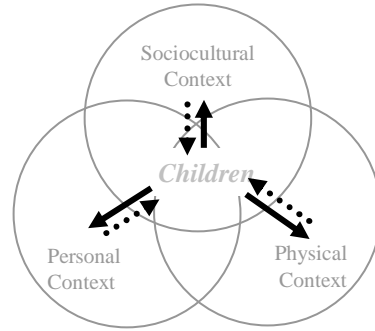
Research Questions:

1. What are children's conceptions of nature? --Definitions of, interests in and feeling about nature

2. What are the sources of these ideas about nature?

3. How do children's surrounding environment and lifestyle influence these ideas?

4. How do parents think about children and nature?

5. What influences children's conceptions and experiences in nature?

Subtitles in this chapter:
l   Taiwanese Children's' Definition of Nature
l   Children's Interests in Nature
l   Children's Feelings About Nature
l   Sources of Ideas
l   After-school Time and Surrounding Environment

l   Taiwanese Parents' Thoughts about Children with Nature

l   Influential Factors on Children's Ideas and Experiences of Natur

Figure 2. Concept map of the research questions with findings organized in Chapter 4

Different Elements of Nature

In the beginning of the interview, each child in the study was asked to draw a picture of herself/himself with her/his family and a picture of herself/himself in nature. Drawing was used as a way to get children to relax and as a means, in addition to talking, to express their ideas. It was also used as a starting point for the interviews: "What is in your drawing?" In the interview, children were asked indirectly about their definition of nature. I asked questions such as "Where have you seen nature?" "Is there any nature close to your home?" At the end of the interview, children were shown 11 photographs and asked "Is this nature?" "Why is this [not] nature?" "I used the simple question. "Is this nature?" to eliminate any confusion that might be caused by the wordiness in such language as, "Does this scene in the photograph represent nature?"

Ten of the 12 children started the drawings immediately after the prompt. Exceptions to this reaction included Chi-Z and Jin-Ruei. Chi-Z said that he only knew how to draw planes. I let him draw a plane. In later conversation, he provided me with an answer of his definition of nature. The other child, Jin-Ruei, responded that she did not know enough about nature to draw the picture. I showed her the 11 photographs before beginning the drawing and the interview, but the other 11 children did the drawing first and followed up with the interview and interpretation of the photographs. She got the idea from the photographs without my further explanation of nature and continued her drawing and other part of the interview.

Children's drawings were analyzed using a coding system modified from Kalvaitis' (2007, p. 207). I found his system very much depicted the children's drawings

in my study. Many items identified in Kalvaitis' study were also identified in my study. In addition, his way of categorizing the codes was very similar to the way I wanted to group the items shown in my children's drawings. My study builds on and extends upon previous research. His coding system is composed of seven main categories: style, tone, settings, people, living elements, activity, and time period. To fit my data, I modified the coding system to five main categories: tone, people, natural elements, humanmade elements, and activity. Two categories in Kalvaitis coding system, "style" and "time period," were not applicable to the present study. None of the drawings indicated a symbolic style or timeframe. I added and removed codes from Kalvaitis' coding system to fully depict this study's results. Elements in all drawings were categorized and are listed in Table 5. For example, under the category of natural elements, evergreen trees and vegetables are absent from the plants subcategory in this study. Subcategories of pets and domesticated animals were removed from the animals category, but wild animals was added to this study's coding system. Half of the animals children drew in this study were insects, which reflected the fact that insects are probably the most commonly encountered animals in urban areas of Taiwan. None of the children included snow in their drawings, since it never snows in Taipei City, which is in the subtropics.

Under the original "activity" category, there were four subcategories: play, work, mixed, and no activity. I found it more explanatory to replace all four subcategories with physical activity, interaction with or observation of living things, leisure activity, and intellectual activity. Leisure activities included watching the sky, looking at nature, or sunbathing. All kinds of ball games under the original play category were removed. They somehow seemed not as popular among children in the study.

Table 5

Drawing Coding Sheet

1 Tone	1.1 Positive: Smiling figures 1.2 Unclear 1.3 No facial expressions	
2 People	2.1 Self	
	2.2 Family	2.2.1 Dad 2.2.2 Mom 2.2.3 Sister 2.2.4 Brother
	2.3 Friends 2.4 Farmers	
3 Natural elements	3.1 Plants	3.1.1 Trees 3.1.2 Grass 3.1.3 Flowers 3.1.4 Falling leaf
	3.2 Animals	3.2.1 Bees 3.2.2 Butterfly 3.2.3 Beetles 3.2.4 Ant 3.2.5 Ladybug 3.2.6 Snake 3.2.7 Fish 3.2.8 Squirrel
	3.3 Abiotic elements	3.3.1 Sun 3.3.2 Clouds 3.3.3 Wind 3.3.4 Sky 3.3.5 Water
4 Humanmade elements	4.1 Buildings	4.1.1 Home 4.1.2 Other buildings
	4.2 Planter 4.3 Airplane	
	4.4 For activities	4.4.1 Bike 4.4.2 Frisbee 4.4.3 Chess
5 Activity	5.1 Physical	5.1.1 Biking 5.1.2 Playing Frisbee
	5.2 Interaction with and observation of living things	5.2.1 Observing animals 5.2.2 Looking at trees 5.2.3 Looking at flowers 5.2.4 Looking at grass
	5.3 Leisure	5.3.1 Looking at nature 5.3.2 Sun bathing 5.3.3 Watching sky

	5.3.4 Posing for a photo
	5.3.5 Resting
	5.3.6 Spacing out
5.4 Intellectual	5.4.1 Playing chess

Each drawing was coded and all the codes were counted, as shown in Table 6. People were counted only when someone other than the child was included, since the prompt clearly asked the children to draw themselves in the pictures. The result shows that three children included someone else in their drawings of nature. Fifty-two counts of natural elements and eight counts of humanmade elements showed in children's drawings in this study. Among the natural elements of plants, animals, and abiotic elements, 26 counts of plants were the most common element in children's drawing of nature.

Table 6

Frequency of Elements Included in Children's Drawing of Nature

Coding Category	Counts
3.1.1 Trees	9
3.1.2 Grass	9
3.1.3 Flowers	7
3.3.1 Sun	7
3.3.2 Clouds	4
2 People (other than self)	3
3.2.2 Butterflies	3
3.3.3 Wind	2
3.3.4 Sky	2
3.1.4 Falling leaf	1
3.2.1 Bees	1
3.2.3 Beetles	1
3.2.4 Ant	1
3.2.5 Ladybug	1
3.2.6 Snake	1
3.2.7 Fish	1

Summary

Coding Category	Counts
2 People (other than self)	3
3 Natural elements	52

3.2.8 Squirrel	1	3.1 Plants	(26)
3.3.5 Lake	1	3.2 Animals	(10)
4.1.1 Home	1	3.3 Abiotic natural elements	(16)
4.2 Planter	1	4 Humanmade elements	8
4.3 Airplane	1		
4.4.1 Bike	1		
4.4.2 Frisbee	1		

The photographs (shown in Table 7) were prepared ahead of the data collection experience to prepare for instances in which children had no ideas about how to define nature. I intended not to provide my definition of nature but to elicit as much as I could from the children's perspectives. It turned out that most children started their drawing immediately without the photograph prompts. I decided in the first interview to show all children the photographs anyway to enrich and triangulate the data of children's definition of nature. Children were also asked about the reasons why they thought each photograph was or was not nature. Photograph #6 (elementary school campus) and #7 (living room) were added after the first few interviews, because one child (Yen-Pin) brought up the idea that "indoors is not nature and outdoors is nature" in her interview. Therefore, An-Jhen, Yen-Pin, and Si-Chen in Gu-Shin Elementary School did not have data recorded for those two photographs.

For the Yes or No question, "Is this nature?", I found that most children provided direct answers for most of the photographs without much hesitation. Some photographs that mixed natural things with humanmade things could seem confusing to some children, so that they asked about which part of the photograph to which I was referring. I encouraged them try to answer it as the entire photograph. When providing the reasons, many children picked out individual elements in the photographs such as trees or roads.

For example, they explained it was nature because there were trees. Fewer children were able to provide a consistent reason to differentiate the photographs. Table 7 shows the 11 photographs with the numbers of children's Yes (Y) or No (N) answers. Where the children could not provide a direct answer, but pointed out some things in the photograph that were nature and some that were not, the code "I" (for itemized) was used. One case of "I don't know" was coded as "U" and "It is half nature, half not" as "H."

Table 7

Children's Responses for Different Photograph

Photograph Number	Photograph	Children's responses			
		Yes	No	Itemized (I)	Do not know(U)/ Half and half (H)
1.		6	4	3	
2.		6	3	3	
3.		10	2		

4. 11   1

5. 7   2   3

6.* 4   3   2

7.* 1   5   2   1 (U)

8. 8   3   1

9. 9   1   2

| 10. | | 8 | 1 | 3 | |
| 11. | | 9 | 0 | 2 | 1 (H) |

* Photographs added for interviews with children in Ge-Chen Kindergarten, Lu-Dye
   Elementary School, and Pu-Lin Kindergarten

For the pictures that exclusively showed natural elements, most children had no

problem making their decision that the photograph represented nature. Photograph #4 is a

good example. It was composed of trees and a field with flowers. Most (11 out of 12)

children said it is nature. An ocean view is another natural environment that children in

Taiwan are probably familiar with, since the ocean can easily be accessed in a one-hour

drive from Taipei. Ten out 12 children thought that was nature. When the photograph

contained a few humanmade elements, as in most of photographs #5 and #10, children

still thought it was nature. Children's responses diverged when it was an outdoor scene

with lots of humanmade things in the photographs, such as in #1 and #2. The one that was

most commonly referred to as not nature was photograph # 7, the indoor scene with

mostly humanmade things.

As to the reasons that children provided whether the photograph was or was not of

nature, just a handful of children was able to use a consistent overarching idea to support

their answers. I believe a "consistent" definition indicates a more solid understanding of

the subject. During the interviews, a few children said that humanmade things are not nature and that things that had existed on earth a very long time ago are nature. Some had vague ideas to distinguish photographs throughout the interviews. For instance, one child interpreted nature as any photograph that showed good weather. In that sense, the former two reasons were viewed as correct and consistent, and the latter was viewed as consistent but not correct.

Table 8 shows how often an explanation or element was used by the children to interpret the photographs. Some provided an overall reason for their choice; most children used different items in the photograph to decide if the photograph represented nature. Each reason is counted separately from photograph to photograph. If a child used "it is beautiful" to differentiate all 11 photographs, the counts are 11 rather than 1. As shown in the first part of the table, throughout the interviews, children decided humanmade material was not nature nine times, "it is beautiful" as nature seven times, and "the weather is nice" as nature four times. Cities were used four times, but in one out of the four times the child thought the photograph represented nature because the photograph was of a city.

Table 8

Children's Responses and Counts of Reasons for judging the Photographs as Nature or Not

Using one reason to judge the entire photograph				
It is nature, because….. [Y…]	It is not nature, because….. [N…]	Counts for each reason used to define	Counts for each reason thought of as	Notes

		nature	nature
7 It is beautiful		7	7
4 Weather is good		4	4
2 It has been there for a long time		2	2
1 It's nature		1	1
	9 Humanmade or artificial	9	0
1 City	3 City	4	1
	1 It is polluted	1	0
	1 It is small town	1	0

Using different items to judge the photographs

Because there are…, it is nature	Because there are…, it is not nature	It's half and half, because there are…	Counts for each item used to define nature	Counts for each item thought of as nature	Notes
51 Trees *(1/51 [A lot of] trees)			51	51	
29 Flowers			29	29	
27 Grass *(2/27 [A lot of] grass)			27	27	
22 Water	1 Water		23	22	
5 Building	11 Building (One said high buildings, and one said many buildings)	1 Building	17	5	
4 Car	7 Car		11	4	

9 Animal	2 Animal		11	9	
7 Sand	1 Sand	1 Sand	9	7	
2 Bridge	6 Bridge		8	2	
	5 Road		5	0	
4 Sky	1 Sky		5	4	
1 Trail	3 Floor		4	1	Both referred to the bare ground
3 Cloud			3	3	
	1 House "stuff"		3	0	
	1 Home				
	1 In the house				
1 Human	1 Human	1 Human	3	1	
2 Plant			2	2	
2 Forest			2	2	
	2 Electricity poles		2	0	
1 Mountain			1	1	
1 Wind			1	1	
1 Leaf			1	1	
1 Stone			1	1	
	1 Concrete		1	0	

*[A lot of] There not only has to be [], but it has to be a lot of [] to be nature.

In contrast to the children who provided an overall reason to distinguish between the photographs, most children used individual elements to explain their answer by saying, "It is nature because there are .…" that is shown in the second part of the table. Some items were reasons to explain the photograph both as nature and as not nature. For instance, children used water to decide that a photograph represented nature 22 times in the 11 photographs, but one child once said the photograph did not represent nature because there was water. Hence for the item "water," "Counts for each item used to

define nature" is 23 and "Counts for each item thought of as nature" is 22. The former counts indicate how often children used an item as criteria to define nature and the latter counts indicate how often children actually thought an item was nature. For another example, buildings are often used as a criterion for children to judge if the photograph is nature (17 counts), but only five of the 17 times did children think the buildings were nature.

        Summary. Children in this study often used different elements to define nature. In their drawings, plants were almost the must-have while humanmade elements and human beings are much less included. They had no problem identifying all- or mostly-natural-element photographs as nature and indoor settings as not nature. On the other hand, their responses diverged when it was an outdoor scene with many humanmade things in the photographs. Moreover, they used trees, grasses, and flowers to define nature and all of them thought these represented nature. Clouds, plants, forests, mountains, leaves, and stones are used less frequently to define nature, but all the children that did use these elements thought they were nature. Water, sand and, sky were used often by children to define nature too, but with very few occasions they did not think these represented nature. All children that used roads, household stuff, (human's) home, electricity poles, and concrete to distinguish if the photograph is nature thought these did not represent nature. More children thought buildings, cars, bridges, trails (referred to as "floor," sometimes), and humans were not nature more than the ones that thought they were nature. It is worth noting that 2 out of the 3 children that used humans to determine if the photographs were nature did not think humans were nature.

Nature Is the Space Plants Create

Table 8 showed that children thought plants were essential in defining nature. Trees (51 counts), flowers (29 counts), and grasses (27 counts) were the elements most often used in children's definitions of nature. This result matches the results from their drawings where children included 26 counts of plants in their drawings of nature (as shown in Table 6). Eleven of the 12 children included trees, grasses, or flowers in their drawings. The one who did not include any plants was the one who drew only a plane.

Plants created the space in which children can play, do things with families, or observe living things. Plants do not just *live* in nature (Littledyke, 2004; Shepardson et al., 2007), but they themselves *are* nature. Similar results from other study is that Phenice and Griffore (2003) found 74% and 66%, respectively, of studied children under 6 years old answered "Yes" to the questions, "Are trees part of nature?" and "Are plants part of nature?" Bonnett & Williams (1998) found also that some children thought nature was only plants. The statement is close to the idea that children clearly thought "nature is where the plants are" in this study. When I asked if there was any nature close to home, Suan-Hui said "Hmm… yes. Like the sidewalk in Yu-Chen Park near our home--there are rows after rows of big trees." De-Lu described the nature close to her home as "the big area of grass." When I asked Ning-Chen where she ever saw nature, she said, "There are trees at my grandmother's place." To the same question, Jin-Ruei said "Hmm…nature…I went to their [our] grandmother's home with my brothers and sisters…and there are trees and grass." When I asked Ge-Jin how he knows there is nature in Brazil (he had mentioned that there is nature in the Amazon River), he responded "because there are many trees." Si-Chen, pointing to the world map on the wall of the library, said, "That prairie is nature. Yeah, prairie is nature. You see Africa with its prairies? That's nature.

Mountains are nature, too. Because there are many trees in the mountains. There are fewer trees in the high mountains. But it is nature too." They all expressed the ideas that plants themselves are nature.

It is worth noting that while many children thought of plants as nature, some seemed to have a sense of difference in the amount of naturalness. They said that there has to be lots of grass (De-Lu, Chen-Yu, Jin-Ruei), lots of trees (Chi-Z, Ge-Jin, Chen-Yu, Jin-Ruei), and lots of flowers (Jin-Ruei) to be nature. Si-Chen told me that it has to a lot of building to not be nature.

Summary. Plants, especially trees, are the most critical elements for children in defining nature. Some children thought only a few trees or plants *can* be called nature, while others believed it has to be a wide range of plants to be called nature.

Different Degrees of Nature

I found that for the children in my study as long as plants were the main elements in a space, it could be called nature. When talking about the natural trail photograph (#10) that contained a bridge, Si-Chen stated that it was nature "even though this [pointing to the bridge] is not nature. This is a bridge but there is also a river here. And mountains. So this is nature." Some children (Yen-Pin, Suan-Hui, Yu-Ting, and Ge-Jin) claimed that parks in the city are nature and one noted parks in which they can swing (Ge-Jin). That means, in their minds, that nature can include things that are not natural and that it is just a matter of proportion of the vegetation. Similarly one parent (of Huan-Mong) pointed out that "Nature is anything that excludes humanmade things However, in Taiwan, if humanmade things are less than 30%, it could be counted as nature."

When talking about the mountains surrounding Taipei City, Si-Chen stated that they are volcanoes. In the conversation, he showed a sense that there were different degrees of naturalness and that some may include humanmade material.

Amy (interviewer): Is a volcano nature?

Si-Chen: A volcano…is.

Amy: Is there any nature that you don't like? Or do you like them all?

Si-Chen: …like? Bi-Tan is the kind I don't like that much. (Bi-Tan is a riverside recreation area in Taipei City.)

Amy: Why?

Si-Chen: I prefer this kind (pointing to a book that had a forest on the cover).

Amy: And don't like what kind?

Si-Chen: Parks, that kind. It's got to be a mountainous area.

Amy: Why do you like [those kinds]?

Si-Chen: The roads in the mountains are fun. You can walk on those trails…

When he talked about the photograph of the beach, he said, "This! This! This is nature! You see, there are no houses at all. There is nothing. Nature is what has been there for a long time. Cities are built later. Nature is the entire area with no houses. Sometimes there are some houses, but not many houses. Like the ones full of houses—it's a city. Like Taipei City is a city."

I found that when the children were asked where they saw nature, parks were often mentioned. Yet, it seems as if parks in the city are not 100% nature, so that a child could sound conflicted. When I tried to affirm Yen-Pin's ideas, she sounded unsure.

Amy: So there is not much nature around your home?

Yen-Pin: Um. Only in our community [the park].

Amy: What's in your community?

Yen-Pin: There are swing seats.

Amy: Are swing seats nature?

Yen-Pin: (Shakes head)

Amy: So what's nature in your community?

Yen-Pin: Places to rest.

Summary. For the children in my study, nature can include things that are not natural as long as plants were the main elements in a space. Yet, if I probed further, the children sounded uncertain about whether nature should include humanmade things or not.

Nature Moves and Grows

Nature apparently links to living things. "This is [nature]. Trees…and trees and…the leaves on the trees *move* when the wind blows." Ning-Chen thought things that grow and move are nature. Electricity poles are not nature because "they aren't plants and they don't move." Cars are nature because "they can move and [you] can do lots of things in them. [You] can listen to songs."

Ning-Chen: Flowers and trees [are nature]…hmm…and human beings in it (the*

photograph) are nature.

Amy: Human beings are [nature]?

Ning-Chen: Human beings move. They're half [nature].

Amy: Why is the other half not?

Ning-Chen: Because human beings are not plants…also they are not the things

that grow things.

Suan-Hui also mentioned that trees are nature because they grow from the soil.

Amy: Your drawing is very good. Who taught you this is nature?

Suan-Hui: These very slim hands [stick figure]—*Li Chi-Z taught me how to draw*

that way.

Amy: Who taught you this is nature? How do you know trees are nature?

Suan-Hui: I just know it! Because it grew from the soil.

Amy: How about the flowers [in your drawing]?

Suan-Hui: Flowers grew from the soil too.

Huan-Mong talked about photograph #9 of a natural trail.

Huan-Mong: Grass and trees are both [nature]. The floor (the unpaved trail) *is*

not.

Amy: Why isn't the floor [nature]?

Huan-Mong: Because it is not plants and it doesn't move. I don't think it is.

It is informative that the children who talked about nature as it moves and grows

are all from the same kindergarten, Ge-Chen. The explanation could be that they believe

nature is somehow living or, rather, they mix up the definition of living things with nature.

There is no doubt that to these kindergarteners, nature is associated with living things.

In terms of the things that move, in Chinese the word for animals is 動物. The

first Chinese character means "move," and the second character means "things." Literally,

animals are the "things that move." Past studies have shown that children often thought

nature is a place where animals and plants live. In this study, plants are predominantly the

essential element that created the space. For animals, it is another story. Seven out of 12 children included animals in their drawings (see Table 6), but two children (De-Lu and Jin-Ruei) said animals are not nature when interpreting the photographs but they both had animals in their drawings. Another example that children link nature to living things is Huan-Mong's statement that the entire earth is nature.

Amy: [Is there] anything that is nature that you did not include in your drawing?

Huan-Mong: Yes, but it can't fit on this paper.

Amy: What is it?

Huan-Mong: The earth!

Amy: Wow, so the entire earth is nature, is it?

Huan-Mong: Hmm, I think so.

Amy: Why is that?

Huan-Mong: Because there are many living things in it.

Summary. Children in this study sometimes linked nature to things that move and grow (or they can grow things from it). They also used that argument to support the idea that plants *are* nature. For animals and humans, they, on the other hand, may be less sure about the definition of nature includes the things that move and grow.

Humans Are Not Nature and Not Related to Nature

Only four children in the present study thought human beings were nature. Yu-Ting told me that human beings are nature because human beings are animals. Conversely, some children said human beings are animals, not nature. (These children also did not think animals were nature). Others either did not know or thought human beings were not nature. A few children included other people in their drawings (which

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will be reported later in Figure 4). However, in the interviews, they clearly told me they do not think human beings are nature. Instead, the humans in the drawings represented to them social interaction in nature. Several explained that humans were not nature because they do not grow grass or have no flowers (Ning-Chen, De-Lu, and Chen-Yu). Chen-Yu used a unique way to describe how animals are nature, but human beings are not.

Chen-Yu: What's this (pointing the deer in the photograph)?

Amy: A deer.... Is it nature?

Chen-Yu: Yes.

Amy: Is it?

Chen-Yu: Should be.

Amy: But it doesn't grow grass. (The boy had responded many times earlier in the interview that things have to "grow grass" to be nature.)

Chen-Yu: Yeah, it doesn't grow grass. But it is nature because it walks in forests.

Amy: Okay, because human beings don't walk in forests, they are not nature? (Earlier in the interview, the boy said human beings are not nature because they don't grow grass.)

Chen-Yu: Forest. But he wants to take... [When] human beings want to take a walk, they take a walk. So they are not [nature].

Amy: So only the ones that always live in forests are [nature]?

Chen-Yu: {Does} anyone live in forests? Human beings?

As the interview went on, he evolved his definition of nature from things that grow grass to include the animals that *live* in forests. Si-Chen also said human beings are not nature.

Amy (Interviewer): How about human beings?

Si-Chen: About human beings... Human beings are not nature. Because human beings are not the land. Only the land can be [nature or not]. Human beings are living things.

I did not ask Si-Chen whether trees were living things or the land, but apparently he thought plants were nature. This resonates with the results that children thought plants are essential for nature. The plant part is clear to children. However, although they believed human beings are animals and animals seem to be nature, they got confused as to whether human beings are nature.

Amy (Interviewer): So living things are nature, right?

Huan-Mong: Animals are [nature] too.

Amy (Interviewer): But you just said human beings are not nature. Is a human being an animal?

Huan-Mong: Yes.

Amy (Interviewer): So human beings are not nature but other animals are?

Huan-Mong: Some [animals] are and some are not….

Some more of this inconsistency will be discussed in Chapter 5. Children hesitated to claim human beings are nature and they did not understand the relationship between humans and nature.

Amy (Interviewer): (Pointing An-Jhen's drawing) *Are these animals related to the plants?*

An-Jhen: Animals and plants…yes! It (pointing to the butterfly) *eats that* (the flower).

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Amy (Interviewer): A butterfly eats flowers?

An-Jhen: Yes. It (pointing at the bee) *too. And it* (pointing at the beetle) *sucks on trees.*

Amy (Interviewer): How about you?

An-Jhen: Me…hmm...I have no relation!

Amy (Interviewer): So when you play there, you don't feel you are related to them?

An-Jhen: Yes.

Only a very few children thought humans are related to nature when I brought up this topic.

Amy (Interviewer): Do you think you are related to nature?

Si-Chen: Yes. We all need nature so we can walk for pleasure. Like there is lots of exhaust gas on the streets. Who can stand that? In nature, then you can chat, chat with others. And it can...produce carbon dioxide. And the trees keep absorbing it and emit good air. …

Summary. Children in this study hold very blurry beliefs about whether human beings are nature or not. How humans are related to nature is also a very abstract concept for them at this age.

<center>*Children's Interests in Nature*</center>

For children of this age, I decided using the word "like" was appropriate for investigating their interest in nature. I only reported the parents' responses on this issue, because I did not bring up this question to all the children in the interviews. The four children who did answer (Si-Chen, Huan-Mong, Suan-Hui, and Jin-Ruei), even with a

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positive response, did not elaborate more than just a short answer. Responding to the question, "Do you find that your child particularly likes or dislikes nature? What makes you think that your child likes or dislikes nature?" nine of 12 parents believed that their children liked nature. Four of the nine said their children enjoyed observing or interacting with living things. Two thought their children looked happy in nature, two mentioned that their children like to go out to nature, and one observed that the child likes books about nature. Two parents did not answer, while the parent of Chen-Yu provided more than one answer.

Two of the 12 parents (parents of Huan-Mong and Jin-Ruei) thought their children did not show special interest in nature. One parent (of Chi-Z) responded that there were not many chances for the boy to experience "real" nature, but that he obviously loves science.

Five parents believed that family influence is the most important factor determining whether their children like or dislike nature. Two believed that interest in nature is innate in children. The parent of De-Lu claimed, "The children's soul inside guides them to cherish and appreciate nature. With parents' positive attitudes, children like to get close to nature." One thought it was school education that made her child liked nature. Her boy (Si-Chen) was in a kindergarten that adopted the Reggio Emilia approach that emphasizes real-life experiences to help children make sense of the environment and nature. One parent (of Yen-Pin) thought her daughter was carefree in nature, where it was not stressful like being at home or school. That is why she thought the child liked nature. One parent (of Suan-Hui) thought her daughter liked nature because she loved the earth and wanted to conserve the environment.

Three out of 12 parents thought their children liked or disliked nature from a very early age (from pregnancy, from birth, from the time the child started to play). Three observed their child favor nature before the age of 3, three thought it began between the ages of 3 and 5, and two saw that tendency develop from age 5 or 6. Two parents did not answer this question.

To the questions, "Does your child often express a desire to engage with nature outside of school?" and, "Where does she or he usually like to go?" 10 out of 12 parents responded that their children often expressed a desire to engage with nature outside of school, one responded it was not often the child did so (parent of Jin-Ruei), and one said no (parent of Huan-Mong). This survey item about children's desire was hoped to triangulate with the item of parents' ideas about whether the child likes nature or not. The results of the two items turned out to match well (Table 9). The children who were thought to like nature also told their parents that they liked to go outside. The ones who did not show interest in nature to their parents also did not often express their desire to go outside.

Table 9

Parents' Views about Children's Interests in Nature and Their Desires to Engage With Nature

Does your child like nature?	Yes #1, 2, 4, 6, 7, 9, 12, 13, 14	Not much chance to experience nature #11	Interest not shown #5, 16
Does your child often express a desire to engage with nature			
Yes	1, 2, 4, 6, 7, 9, 12,	11	

	13, 14
No, not often	5, 16

Three of the 12 parents reported that their children liked to go to beaches, three to parks, two to the mountains, one to the countryside, one to zoos, one to the riverside, one to theme parks, and one said the child did not prefer any specific place. Seven of the 12 parents responded that their children liked to go to nature to play with sand, stones, water, swings, slides, balls, and kites. They liked to observe or interact with living organisms in nature, two liked biking, one liked to enjoy the scenery, one liked to take a walk, one liked to exercise, one to eat, and one to enjoy the hot springs. The parent of Si-Chen stated, "If he could make plans by himself, he would go to the beach. So far [the] boy[s] still prefer building sand castles, splashing in the waves, and feeding animals. For knowledge, he still needs adults to guide and inspire him (and help him to organize his learning network)."

Summary. Children that were asked directly in the interviews if they liked nature all responded they liked nature without further explanations. Parents have very different observations about children's interests in nature or when those interests emerged. One thing learned from parents' views was that the children who were thought to like nature also told their parents that they liked to go outside. The ones who did not show interest in nature to their parents also did not often express their desire to go outside.

Children's Feelings About Nature

Children were asked to draw two pictures at the beginning of the interview. One was of themselves with the family and the other was of them in nature. Chi-Z did not draw any human beings for the two pictures but did draw airplanes. All children who

actually drew the family pictures showed a smiling face. Comparing each child's two drawings, only those of An-Jhen and Chen-Yu did not show a smiling face in the drawing of nature as they did in the drawing of their families (Figure 3). But neither was their facial expression negative (Figure 3). And in the interviews when asked about what their mood was or how they felt in the drawings, both An-Jhen and Chen-Yu responded that they were very happy, as did most other children. There is no particular explanation in the Taiwanese culture of why children had smiling faces in drawings. The smiling face could very possibly represent their feelings in nature.

	Drawings with family	Drawings in nature
An-Jhen	(Me; Father; Yu [One word of his brother's name])	
Chen-Yu		
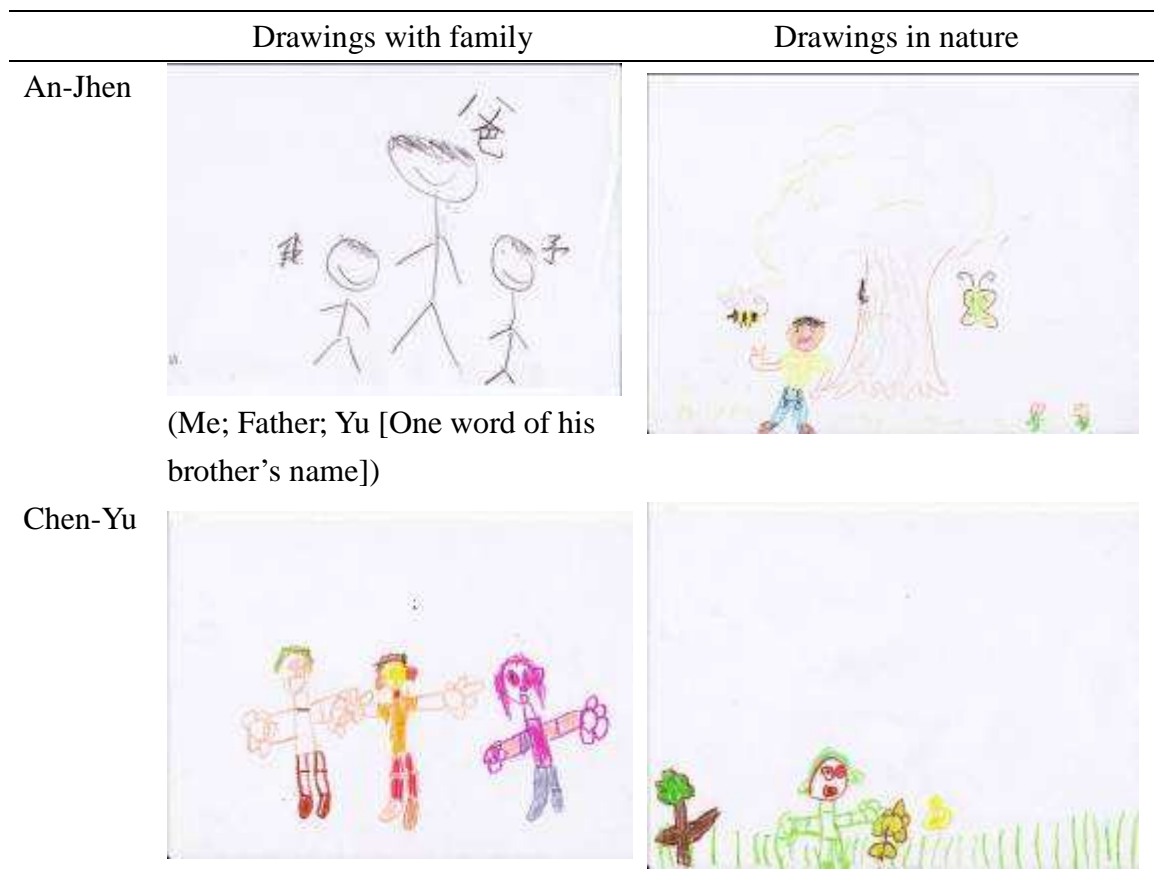
Figure 3. Examples of children's drawings of themselves with families and in nature

In the interviews, only one child (Huan-Mong) said, "It's okay," when asked about how he was feeling in his drawing of himself in nature.

Amy: How do you (Huan-Mong) *feel when you are in nature?*

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Huan-Mong: It's okay.

Amy: Okay. Why so? Do you like watching ladybugs or playing in the vegetable garden? (He had talked about these experiences earlier in the interview.)

Huan-Mong: Sometimes I like it.

Amy: When do you not like it?

Huan-Mong: When there is nothing to see.

Amy: Nothing to see? What do you like to see? What kind of things do you like to see? What kinds of things you do not like to see?

Huan-Mong: Not like to see?… Things such as the larva of the rhinoceros beetle. It is very disgusting. (Note that more than one child has mentioned about this beetle. Raising rhinoceros beetles recently becomes quite popular for the children in Taiwan.)

Most other children seemed to enjoy nature by responding that they were in a good mood. When asked about the reasons, a group of children said that nature is beautiful or that you can see living things in nature. Yu-Ting: "Because you can see many beautiful things. Flowers are beautiful. Grass is beautiful. Big trees are beautiful." Yen-Pin said that she was watching the sky in her drawing. I asked her why she was happy. She responded "Because I think the sky is beautiful." Ning-Chen was looking at flowers in her drawings. She said she was happy "because…looking at flowers is pretty much fun and makes me pretty happy." Suan-Hui said she was very happy "because the flowers smell good…and it's breezy." She likes nature "'cause you can do some wonderful things--like…you can play with the ducky in the pond." In examining the photographs, she often (6/11 photographs) used "it is beautiful" as a reason to explain

why a certain photograph was nature. Ge-Jin also described a happy mood in his

drawing. I asked him why and he stated because it is beautiful. With the photographs, he

very often used "good weather" to define nature. Later in the interview, he explained

that good weather makes people feel good.

Amy: Why [is this photograph nature]?

Ge-Jin: Because there is sea.

Amy: What else?

Ge-Jin: And also the weather is nice.

Amy: How do people feel when the weather is nice?

Ge-Jin: Nice, too. They go out to play, too.

Amy: Why do people feel nice when the weather is nice?

Ge-Jin: Because there is sunlight.

Amy: You like sunlight?

Ge-Jin: Umm. Because the Sunlight Exercise Park is in Bi-Tan….

It is apparent, therefore, that children easily connect nature with a delightful mood (10

out of 12). The reasons varied. Three thought that nature is beautiful, three felt happy

because of observing or interacting with living things, and one said that there were

friends (in her drawing) that she can play with. Yu-Ting seemed to have a unique bond

with trees at school and at home.

Amy: What do you do after school?

Yu-Ting: I go to after-school classes and eat lunch and have recess time. I go to

hug the magnolia at every recess time…

Amy: Why do you hug it at recess time?

Yu-Ting: Because I like that tree. It tells me stories…When I feel sad, I go hug him. It makes me feel better… It tells me not to be sad…to get better soon, if I am hurt. It …I sometime feel mad, sometimes sad, and sometimes I go to him when I feel happy … I tell him what happened at school. […]

Amy: How did you find it among the many trees at school?

Yu-Ting: Because we studied tree types. One "Living (a learning subject at school)" homework assignment required us to draw a tree. I saw this magnolia and I did a rubbing of his bark.. […]

We recently …we moved. There were many trees close to where we lived before. Whenever I was free, I went downstairs to hug them…I usually go to my grandparents' place after school. There are more trees over there. When my grandma cooks, my grandpa brings me downstairs to hug trees, to chat with them. Because I am the only child at home, I often feel bored. My grandparents sometimes can't play with me.

In Yu-Ting's case, she seemed to have an intimate friendship with trees. The starting point was a school lesson that introduced her to the idea of hugging trees. More than just observing or interacting with living things, this relationship showed a deeper emotional bond with plants. De-Lu also talked about making friends with nature in a more playful and anthropomorphic manner.

Amy: Do you think you have any relations with nature?

De-Lu: If I can, I really want to make friends with nature.

Amy: Why?

De-Lu: Because I think nature is very beautiful.

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Amy: Are you friends with nature now?

De-Lu: But she can't talk.

Amy: What do you want to say to her?

De-Lu: I want to say, "Can we be friends?" If she says okay, I want to play with her every day.

Amy: Play with her every day. Playing what?

De-Lu: It's...it's...inside. For example, the butterfly plays the seeker. She hides behind the trees. Little snake can be the seeker and hide in the bamboo grove. If I can, if clouds can hide me, I will hide behind the clouds. Or little flowers can be the seeker. And can hide behind the sun. If I am the seeker, I will go find them. If the butterfly plays the seeker, it can hide behind the flowers.

In comparing children's ideas with parents' thoughts of children's feelings toward nature, from my careful inspection of the data I found that none of the parents thought that their children enjoyed nature because of its aesthetic or social value. Nevertheless, some parents did observe that their children seemed happy in nature because they ran and played freely, but none of the children mentioned this carefree feeling in the interviews. Both children and parents talked about children enjoying nature because children can observe and interact with plants and animals. The parent of Ning-Chen said, "When we went to forest parks or the countryside, she [Ning-Chen] slowed down to look closely at the flowers and grass and appreciate the insects and butterflies."

I found that some negative feelings were also expressed in the conversations. One type of negative feeling was mainly directed toward ants, bees, mosquitoes, or

caterpillars-- insects that are typically viewed by Taiwanese as pests. Another was a kind

of more general fear and wish to avoid danger and even dirtiness in nature.

Yen-Pin: What is this (pointing to the desert photograph)*?*

Amy: That is a desert.

Yen-Pin: Ai Yo (a small embarrassed sound…). *I don't dare to go to the desert.*

Amy: So is desert nature?

Yen-Pin: No.

Amy: Why not?

Yen-Pin: Because there is no water. And it's strange. Unless you bring your own

water.

Adults also showed this type of fear of nature and its unpredictability. The father

of Huan-Mong stated that no one would like nature if they got trapped in snow for10

hours. Ning-Chen told me her grandmother taught her about trees as trees are nature but

that some trees were not to be touched. The grandmother also did not allow her to climb

trees because they are dirty. Chi-Z's mother also talked about her mother-in-law, who did

not like them to go outside, and her husband who thought parks were dirty.

Vivid memories in outdoor places sometimes linked with encountering scary

insects. Jin-Ruei described her memories of how they encountered many caterpillars

covering the entire roof of a gazebo in the mountains. "Lucky that we did not bump into

them. They could be very poisonous. We could tell. We thought they had too much

color." I asked her how she knew that colorful things are poisonous. She responded, "I

read something somewhere that the more colorful the more poisonous things are." De-Lu

talked about her seeing a wasp on her desk and she was frightened. She tried to step on it

and killed it, "it is not pitiful at all, because it stings!" However, when talking about bees, she said "I like them because they are cute and very diligent!" An-Jhen and De-Lu both talked about slapping mosquitoes outdoors. An-Jhen described how he enjoys climbing trees because he can step on ants on the limbs. "They always like to climb up on my desk!" As humid and warm as it is in Taiwan, it is not surprising that children often encounter mosquitoes, ants, or cockroaches outdoors or at home.

Summary. Children easily connect nature with a delightful mood for its beauty, social value, and access to living things. Parents did observe children being happy in nature for its access to living things and its unique carefree atmosphere. Some negative feelings were also expressed in the conversations. One type of negative feeling was mainly directed toward insects that are typically viewed by Taiwanese as pests. Another was a kind of more general fear and wish to avoid the danger and dirtiness in nature.

Sources of Ideas

Firsthand Exposure to Nature

I concluded from the children's drawings that they defined nature based on their direct contact with their surrounding environment. None of the children drew something outside the context of their immediate environment. For instance, none of the children's drew animals that do not typically live (and are seen) in Taiwan, nor did they draw rainforests or snow scenes. No children offered a textbook answer with which they sounded unfamiliar. They all seemed comfortable talking about their drawings. When they were asked where they had seen the things they drew, they responded "outside." Unlike conclusions from past studies (Bonnett & Williams, 1998; Cohen & Horm-Wingerg, 1993; Littledyke, 2004; Payne, 1998; White, 2006), this study showed

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that urban life in Taipei may not have entirely hampered children's contact with nature. Children may not have as many direct connections as did their grandparents' generations (Hofferth, 2007; Sebba, 1991), but that did not result in their ideas about nature being constructed completely from the media or textbooks. In the interview, Chen-Yu told me he would rather go out and see nature himself than learn about it from books.

Amy: Who taught you what is nature?

Chen-Yu: No one.

Amy: How do you know what nature is then?

Chen-Yu: (Smile) *I go outside and see.*

Amy: No one taught you?

Chen-Yu: I saw it myself. You see it, you know it.

Amy: Where did you see it?

Chen-Yu: Hmm. I don't know where it is. It's a place. I don't know where it is.

Amy: Did books or television or any other place teach you what is nature?

Chen-Yu: No.

Amy: It's all learned by yourself, right? Books didn't talk about what is nature, right?

Chen-Yu: Yes, it did. But that…that book about nature…I want to see it myself. I don't want to read that in books. Because it is better to see the real nature.

Family and School

In the interview, I asked children who taught them things in their drawings. I also frequently used opportunities to ask them "Who taught you that?" whenever they mentioned some new ideas about nature. If a child mentioned more than one source for

different ideas about nature, the responses were counted separately. My intention here is not to emphasize the importance of any particular source, but to illustrate the power of various data sources. From the interviews, I found that children in my study constructed their ideas of nature from multiple sources, primarily reporting that they were told by parents or grandparents (Si-Chen, Huan-Mong, Ning-Chen, De-Lu, and Yu-Ting), were self-taught or by figuring it out by themselves (Si-Chen, Ning-Chen, and Suan-Hui), or had learned by simply "going out" or "watching nature" (De-Lu, Yu-Ting, and Chen-Yu). "Going out" or "watching nature" again shed light on children who learned from immediate surroundings about nature. There were also children who said that their ideas about nature were from books and television (An-Jhen and Ge-Jin). However, the books mentioned by one of the children were not nature-related. They were, instead, his favorite books. One child (Si-Chen) mentioned school, one (Chi-Z) did not remember, and one (Yen-Pin) said she forgot where she got her ideas.

> *Amy: Who taught you that this* (the child's drawing) *is nature?*
>
> *An-Jhen: From reading books.*
>
> *Amy: What books?*
>
> *An-Jhen: Read…*Noddy! *and* Mr. Men & Little Miss. (Both are British children's
>
> books.)
>
> *Amy: What is the book about?*
>
> *An-Jhen: Hmm… it's about…*
>
> *Amy: Does it talk about what is nature?*
>
> *An-Jhen: No, I just think it's very funny.*

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Comparing children's responses with the parents' survey (Figure 4), half of the parents thought their children got their ideas about nature from books; five from visual media such as television, films, tapes, and DVD; and four from school. Only three parents thought children learned those ideas from direct experience with nature and two thought from family.
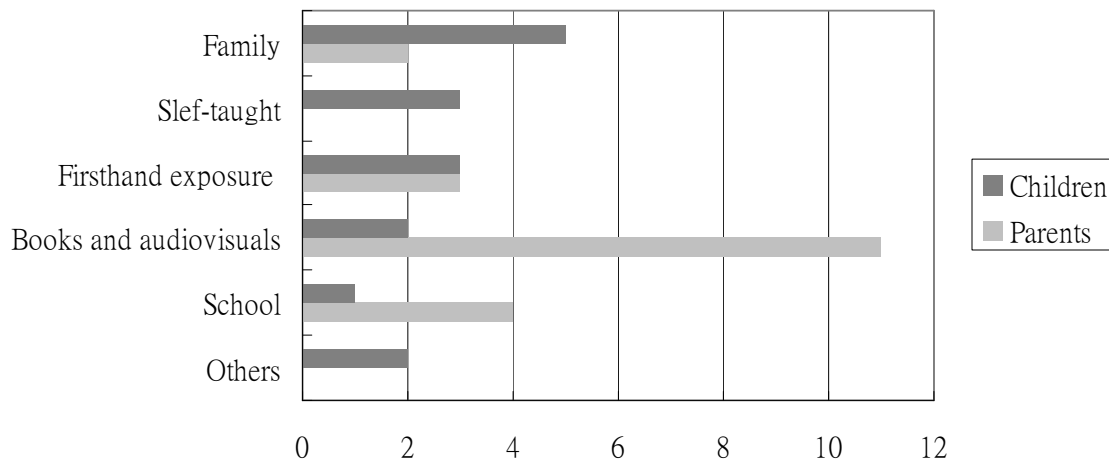
Figure 4. Children's sources of ideas about nature

It is interesting to note from a review of the data that only one child (Si-Chen, a first grader) traced his learning about nature back to school education whereas four parents thought school education was the main learning source. This is also the child whose parent talked at different points about how the child's kindergarten education made a big change in his affectional and philosophical thinking about life. The parent of Ning-Chen stated, "It's mostly taught by school. Because my knowledge about nature is limited. I can only appreciate it. Not much academic understanding." Also many more children remembered occasions of their parents telling them things about nature than the parents actually thought of themselves as the sources of ideas. Moreover, a lot more

parents thought children learned from books and audiovisuals than children actually talked about things learned from these materials.

Following the question in the survey of children's sources of ideas about nature, parents were asked, "Do you think what your child learns from home affects their learning about nature at school? How so?" Four parents thought that what their children learned from home affected their learning in school, three did not think so, two parents said most learning was from school, and one parent believed school learning and family learning was mutual. Two parents believed that whether it was school learning or family learning, real experience in nature was more vital than anything. The parent of Suan-Hui said that her daughter caught on to ideas better at school if they had taught her the idea before. A parent of Yu-Ting provided an example of the child bringing to school to show classmates the shredded skin of cicadas they found on the hiking trails. Neither of the parents claimed it was a one-way influence. The one (parent of Chen-Yu) that called it a mutual influence said she was not sure which one affected the other. However, the family impact did come in earlier than school education in affecting the child's attitudes toward nature. The ones who did not think family education influenced school education were not sure about what was taught at school about nature. One thought that the child learned about nature mostly from books and television programs.

Summary. I concluded from the children's drawings that they defined nature based on their firsthand exposure with their surrounding environments. In the interviews, many more children claimed things about nature were told by parents than the parents actually thought of themselves as the sources of ideas. Moreover, many more parents thought children learned from books and audiovisuals than children actually talked about

things learned from these materials. There is no consensus on whether their family education affected school education about nature.

<div align="center">*After-school Time and Surrounding Environment*</div>

To understand the children's daily life, I investigated their after-school time and surrounding environment to see how these factors might have influenced their ideas and experiences of nature. In addition to ideas (in my original research question), I added the word *experience* here. Experience seems to better describe my survey about what kind of nature-related experience parents offer their children.

In the interviews, I asked the children what they did after school and on the weekends (after school in Chinese usually means the time after school on the weekdays). I also asked the parents about their family activities on weekends and about their immediate natural environment to see how often these families visited nature and to understand their access to nature. The children and their parents could mention more than one thing for their after-school time, and each thing mentioned was counted once. The purpose was to depict their lifestyle and to see what was important to each child and family.

Weekdays Are for Homework and After-school Class

Six of the 12 children mentioned doing homework when I asked what they did after school. Five mentioned going to after-school classes, five mentioned eating snacks or dinner, four playing indoors, three watching television, and two practicing instruments. The activities that were mentioned once were walking around, going to Taekwondo class, listening to music, hugging trees, playing on the computer, cleaning, and chatting. Acknowledging their parents long work hours, two children (Yu-Ting and Chen-Yu)

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mentioned that they usually got home fairly late and did not do much at home during the weekdays.

Their conversations also revealed that children (Huan-Mong, Ning-Chen, and Suan-Hui) started to have homework even in kindergarten (Ge-Chen). De-Lu said, "[I] go to after-school class after I leave school. You have to finish homework before you go home from the after-school class. If you finish it before your parents come, there might also be tests. Or you have to read a book, and then have recess time." The results indicate what after-school time represents in children's minds. Free outdoor play was almost absent from children's conversations with me. Homework is the most important thing on the weekdays. Among the four schools, only children from Pu-Lin kindergarten did not mention any homework.

Visiting Nature Is Part of the Weekend Family Activities

Compared with weekdays, weekend activities seemed more diverse. Fewer children mentioned doing homework. More outdoor and physical activities took place on weekends than on weekdays. Four out of 12 children mentioned nature-oriented activities such as hiking and bird watching. Four mentioned outdoor activities that were not nature-oriented such as biking, playing badminton, and playing on slides and swings. One talked about going to parks, but did not mention what kind of activities he did in the parks. Three said that they played indoors on the weekends. Two mentioned going to visit grandparents and friends. Two mentioned doing homework and two spoke about dining out. The things that were mentioned once were going to mass, practicing violin, enjoying hot springs, going to "play class," and playing educational computer games.

One child said they did not go out on the weekend if the mother was not in a good mood. Another said that the family did not go out if a school exam period was coming. Older siblings' study time for preparing tests seem to lesson the family time in nature. Yen-Pin stated, "We sometimes go out [on the weekends]; sometimes we don't, except for when my older sister is going to have exams." The parent of Yen-Pin also said that they went out if they had not been out for a while or after the school test periods. Tests for elementary school students usually mean school-wide examinations two or three times a semester and with tests for every academic subject taking place in two days. The scores in elementary schools do not directly affect any school options for the future educational path. But in the case of Yen-Pin, the older sister could be in middle school where the scores are taken more seriously. Chen-Yu talked about his older brother in middle school: "My mom said I can not play with him [older brother]. He needs to do his homework. He always ranks 39th [in his class]." The ranking might be from the school-wide midterms, which, in some school cultures, rank students based on scores. This statement shows that from daily conversations at home a first grader probably already knows the importance of grades. Weekend activities usually have to meet the needs of every member of the family. It is understandable that all kinds of activities are needed to run a family. However, when parents talked about weekend activities, all of them mentioned some kind of outing to nature. Except for one, all the activities mentioned by parents were also mentioned by the children. The only activity children did not mention was shopping.

To the questions, "Do you take your children out to nature? How often does your family go out into nature? Where do you usually go?" six of the 12 parents said they took their children out into nature more than twice a month. Three did that about one or two

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times a month. One parent took her son out into nature during summer and winter breaks. Because transportation is a concern for that mother, she usually stayed in the city on weekends. Two parents did not answer this question. For those who took their children out into nature, nine took their children to natural trails in the mountains; five went to parks; three to beaches, rivers, and shores; one to "many places"; one to "places that can connect with what the children learn in school"; and one did not answer.

What Children and Family Do in Nature

It was found that children do physical and social activities, enjoy the beauty of nature, and interacting with living things in nature. On the other hand, parents sometimes missed the opportunities to make those family outings in nature meaningful experience for the children.

I asked children what they were doing in their drawing. They told me they were posing for pictures, biking with mom, playing Frisbee with friends, watching sky, looking at grass, trees, and flowers; observing ants, resting, and spacing out. When coding for the interviews, another category emerged, although it had not been intentionally designed as a research question in the study. An analysis of the data reveal that many children talked about nature by describing their activities in nature. Those physical activities included hiking, biking, and playing. During the data collection process, I sensed that many children had mentioned their experience of hiking in nature. I added questions like "What do you do when you go hiking with your family?" "Several children (An-Jhen, Yen-Pin, De-Lu, and Chi-Z) told me they did nothing, they just walked. De-Lu related, "When hiking, we just walked and walked. When there were places to rest, we took out the

snacks we brought. Also we needed to remember to bring water bottles and some clothes to avoid sunburn. [We] just kept walking and walking."

Amy (Interviewer): Did you play anything with your sister when you went hiking?

Yen-Pin: (Shakes head)

Amy (Interviewer): Just hiking with your parents?

Yen-Pin: (Nods) *And it's very tiring. From morning to afternoon.*

Amy (Interviewer): Did you look around at things like the trees?

Yen-Pin: There are many.

Amy (Interviewer): Did daddy or mommy explain anything to you?

Yen-Pin: (Shakes head).

Amy (Interviewer): They also just hiked?

Yen-Pin: Yeah. Mom was tired to death. She always waited for us in the car.

Even though hiking was just tiring, walking and walking did not necessarily make children (De-Lu and Chi-Z) hate to hike. Hiking could be fun (Si-Chen and De-Lu) and educational. Si-Chen said, "There are hot springs in the mountains. There are hot springs and cable cars in Wu-Lai [a mountain area close to Taipei]. It's very fun. There are also dead volcanoes. The lava was far away from the volcano's hole. There is a volcano in Yang-Ming Mountain too [another mountain close to Taipei City]. The lava is very close outside [so close it can be seen from the trail]. It's still smoking in Yang-Ming Mountain." Yu-Ting mentioned something besides just walking, and said she liked to hike because "you can see many interesting small animals. We once saw many bees in a garden. My mom told me to make friends with the bees. 'Don't be afraid,' she said. I was taking pictures but there were so many bees, I was fearful that they would sting me. So

again my mom told me not to be afraid, to make friends with the bees. So I walked in…At the beginning, I felt they were scary. Later I felt that as long as we didn't do bad things to them, they wouldn't attack us." She also talked about some fun, intimate, and educational moments between her and her mother when they hiked. She said that because her mother was busy working on weekdays, they often spent time chatting when they went hiking. They once saw a four-leaf clover: "My mom told me not to pull it out of the soil. If it is pulled out, other people will not have a chance to see it." This mother seemed to use various occasions to introduce the ideas of conservation to her child.

Another group of children's activities in nature was socially oriented: outings with families, playing with friends, chatting, or dining out (some restaurants in the mountains prepared food with local ingredients). The third group of activities involved observing or interacting with living things. Finally, a group of activities was enjoying the scenes and beauty of nature. No children mentioned nature as a mental and spiritual sanctuary as did some parents who talked about how they found peace and solutions to life in nature. Comparing the children's interviews with their drawings, physical and social activities were mentioned much more often in the interviews than in their drawings.

Immediate Living Environment—Parks and Mountains are Important Natural Environment

To the questions "What kind of building do you live in?" Please describe the surrounding environment and if there is any natural environment nearby. "What do you do there?" five of the 12 parents responded that they lived in high-rises, five lived in 5-story apartments, one lived in a house, and one lived in a condo in a garden complex.

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In terms of the natural environment near their homes, six parents mentioned that there were hills, mountains, and natural trails in the mountains; five mentioned parks; four, waterfronts and riversides; one mentioned botanical gardens and museums; and one responded that there was no natural environment around.

To better describe the natural environment that Taipei citizens might encounter in their daily life, I summarized the responses of parents of Suan-Hui, Yu-Ting, and Chen-Yu, which together depict pretty much the full picture of the city's natural spaces: mountains surround the city, rivers pass through, and parks lie in between. The parent of Suan-Hui stated, "There is a busy boulevard in front [of our house]. There is a hospital, middle school, and big park nearby. [The researcher is not sure if there is more than one hospital or school nearby, because there is no difference between plural or singular in Chinese.] There is a river and bike path. [You can] ride bikes along the river and follow a stream ecosystem. [I] often used opportunities to educate the children about plant names, birds, pollution, cherishing [nature]…issues like that. Those places are pretty close [to our home]." A parent of Chen-Yu stated, "There is Yang-Ming Mountain and a seashore area close to the city that are within a one-hour drive. In the city, there are forest parks, botanical parks, and museums that can be reached in 30 minutes or an hour on public transportation [like the metro]." The parent of Yu-Ting stated, "There is a natural mountain trail 'Shian-Gi-Yan' nearby. From our home, it's a one-hour walk roundtrip. Very convenient."

One parent (of Ning-Chen) responded that they visited the community park just downstairs almost every day, since they pass by it daily. Four responded that they visited those nearby natural places often or every week. Five responded "not often" or

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"sometimes." One did not answer. For those who visited natural places near their home, four of them went hiking, three went for exercise, three went for play, two for walking, two to observe plants or animals, and one to relax and enjoy the view.

Summary. To study children's daily lives has possible influences on their experiences about nature, their after-school time and surrounding environments were investigated. It was found that free outdoor play was almost absent while homework and going to afterschool classes were the most important thing on the weekdays. As reported by the children, more outdoor and physical activities took place on weekends. They said they did a variety of physical and social activities, enjoyed the beauty of nature, and interacted with living things in nature. All parents claimed to include some sort of outing to nature once in a while. They often took their children to natural trails in the mountains and parks around the city.

Taiwanese Parents' Thoughts about Children with Nature

Before examining parents' influence on children's ideas about and experiences of nature, we first need to understand parents' own definition and attitude toward nature. It was found that many parents have a very positive feeling toward nature and believe nature is important in terms of physical and mental health and philosophical solutions to life.

Moreover, I reported the results of parents' thoughts about their influence on children's ideas of nature and the reasons why they want to take their children to visit nature. Coaxial coding was then performed as way to detect possible connections among the parents' responses.

Definition of Nature

To the question, "What is nature?" eight of the 12 parents excluded humanmade elements to define nature (the parent of Ge-Jin: "Those that are not humanmade facility and buildings."). Six parents included living things in their definition of nature and four included abiotic elements. Five mentioned environment to describe their definition of nature. Out of these five, two used an "original on earth" expression as a description: "Natural scenery and objects that were original on earth" (the parent of Jin-Ruei). The parent of Chi-Z: "Environments that were originally existing and the living and nonliving things in the environment; living things include animals, plants, and microorganism, etc., and nonliving things include mountains, water, minerals, stars, and air, etc." One parent said that nature is what God made.

The parents of An-Jhen, Yen-Pin, Si-Chen, Ning-Chen, De-Lu, Chi-Z, Yu-Ting, and Chen-Yu had more than one way to define nature. The parents of Huan-Mong, Suan-Hui, Ge-Jin, and Jin-Ruei had single definitions of nature. Two of them defined nature by excluding any humanmade material and the other two used the word *environment* to define nature. Parents' definitions were also calculated into numeric scores so that they could be compared with the complexity of children's definitions of nature. The results will be reported later. No clear associations were shown between children's complexity of understandings about nature with their parents' understandings of nature.

Attitude and Nature's Personal Meaning

To the questions, "Do you like nature?" and "What does nature mean to you?" seven out of 12 parents reported that they liked nature a lot, four liked it, and one said it

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depended on the situation and the mood. As mentioned earlier, the parent of Huan-Mong said, "It is okay. It depends on the situation and the mood. I like it when it is for leisure or a holiday and when it is safe. If your car breaks down in the snow for 10 hours with no cars passing by, no one would like that, right?

When parents were asked about what nature personally means to them, eight parents said nature is good for mental health, relaxing, bringing joy, and as a retreat from urban life. Four said that they enjoyed the aesthetics of nature. Three mentioned that nature is good for physical health or can be a place for exercise and physical activities. (The parents of Yen-Pin wrote, "I like it, but it has no special meaning to me. I like to take the kids for a walk and let them experience the scent of grass, trees, and flowers—and also to have contact with animals.") Three saw nature as having spiritual, religious, or philosophical functions in that sometimes people seek the essence of or solution to life in it. The parent of Suan-Hui expressed it this way: "Nature is the best gift from the universe. For example, we work in the city. Our busy life makes us live in a tense atmosphere. But, through nature, you can recharge the meaning of living, learn a relaxing attitude, readjust your life pace. Furthermore, you can think calmly to find a good solution to problems [in life]." Another wrote, "I like nature very much. The feeling wasn't that strong when I was young. But through the years, I have found the essence and lovability of life. Many reasons pushed me to find Zen in nature. Sometimes it's just watching a stream or conversing with a dog or the magpies by the riverside. Observing their status [what they are up to] and activities can inspire you to find ways to solve difficulties in life." Three said that nature is where they can have some connections with living things. One linked nature to her childhood memories. Finally, only one mentioned

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that sometimes one is helpless in the wilderness. The parents of An-Jhen, Yen-Pin, Si-Chen, Suan-Hui, De-Lu, Chi-Z, and Yu-Ting provided more than one dimension of meaning that reflected nature to them.

Interests in Nature

Coaxial coding was performed as way to detect possible connections among the parents' responses. Table 10 shows the comparison of parents' fondness for nature with their definition of nature and with the reasons they like or dislike nature. No clear patterns among the three factors emerged from analysis of this data. Parents' fondness for nature did not necessarily promise a more complex understanding of nature.

Table 10

Parents' Interests in and Definition of Nature

Do you like nature?	Like it: #1, 2, 7, 9	Like it a lot: #4, 6, 11, 12, 13, 14, 16	Has some fear: #5
Definition of nature	2 (parents) Exclude humanmade elements 2 Natural environment 2 Natural matter: organisms 1 Natural matter: abiotic elements 1 God made	5 Exclude humanmade elements 4 Natural matter: organisms 3 Natural environment 3 Natural matter: abiotic elements	1 Exclude humanmade elements
Why do you like or dislike nature?	3 Mental health 2 Physical health 2 Contact with living things 2 Spiritual and philosophical 1 Enjoy the natural environment	4 Mental health 3 Enjoy the natural environment 1 Physical health 1 Contact with living things 1 Spiritual and philosophical 1 Childhood memories	1 Enjoy the natural environment

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Influence of Parents' on Children's' Interests in Nature

To the question, "Do you think you influence your child's interests in nature? How so?" nine out of 12 parents believed they influenced their children's interests in nature, two responded "to some degree", and one thought she did not have an influence on her child's interests in nature. How did those nine parents believe they had influenced their children? Some of them mentioned more than one way. Five of them influenced their children by taking them out into nature, three by providing them materials about nature, two by guiding them to appreciate nature, one by arranging group activities and encouraging drawing and hands-on learning, and one by educating a child who feared natural disaster. The parental influence could possibly have been negative. One parent mentioned that children may sometimes get bored by adults' activities such as hiking in nature.

I also compared parents' interests in nature with whether they thought their children are interests in nature, as shown in Table 11. Most of the parents who liked nature also thought their children liked nature, except the parent of Jin-Ruei who liked nature a lot but did not think her daughter liked it. The mother of Chi-Z liked nature a lot, but thought that there were not many chances for her son to experience nature. However, in another survey question, she responded that they visit nature twice a month. Responding to another survey question, she also did not believe family education affected children's ideas of nature very much. This might explain why she liked nature, but at the same time, did not think her child particularly liked nature. The father of Huan-Mong was the only one who mentioned occasional fear of nature. He thought his son did not show an interest in nature.

Table 11

Parents' Interest, Children's Interests, and Parents' Influence

Parents Do you like nature?	Like it: #1, 2, 7, 9	Like it a lot: #4, 6, 11, 12, 13, 14, 16	Has some fear: #5
(Parents think your) child…			
likes nature	1, 2, 7, 9	4, 6, 12, 13, 14	
doesn't have many chances to experience nature		11	
doesn't particularly favor nature		16	5

In examining the factor of whether or not the parents thought they influenced their children's interests in nature, some parents' responses showed discrepancies. For instance, the mother of Jin-Ruei believed she influenced her child's interest in nature because she liked nature a lot but said she did not observe her child's favoring nature. In another instance, the mother of Yen-Pin said that she liked nature and also thought her daughter liked nature, but she did not think she influenced her child's interest in nature. That is probably why she responded to the question, "What makes you think your child likes or dislikes nature?" by saying she believed children just like nature. She probably thinks it is innate for children to love nature, not something they learn from parents. This response led to another question about whether children's fondness for nature is innate or something they learn.

Innate or Learned?

I examined how parents' believed school education related to their views on children's innate fondness for nature. Did they think all ideas were learned or did some children just tend to like nature more than others? Table 12 shows that some parents

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believed liking nature is innate in children. For instance, the parent of Huan-Mong thought that children liked nature from birth. The parent of De-Lu said her daughter started to like nature when she learned how to play. The parent of Yu-Ting said it was hard to answer when her daughter started to show an interest in nature because they brought her into nature when she was still in the womb. The parent of Si-Chen believed her son's interest in nature was influenced by his school education. She is the only parent who mentioned school in the question about influencing factors. The questions "Anything about your child's ideas about nature that you want to add? Or any suggestions or thoughts you want to include about current environmental education?" prompted the parents of Yu-Ting and Chen-Yu to state that the schools have to develop a strong connection with the family education on this topic. The table shows that parents' ideas about school's nature education do not reflect whether they believe children have an innate fondness for nature. School education was seldom voluntarily mentioned by the parents in the surveys. Among the very few parents that did mention it, they did seem to weight school education as important as family education and looked for the links between them. It could be that whether the interests in nature are innate or not, they do need to be supported by continuous exposure and education. It could also be that the survey did not directly ask parents about how innate interests can be linked to school education so that no parents thought to link these two at they time they filled out the survey.

Table 12

Parents' Views on Children's Innate Interest and the Influence of School Education

Parent of	When did your child show an interest in	Parents' perspectives about the influence of school education on children's ideas about

	nature?	nature
An-Jhen	4-5 yrs	
Yen-Pin	(Did not answer)	
Si-Chen	3 yrs	I think school education made him like nature.
Huan-Mong	From birth	
Ning-Chen	3-4 yrs	
Suan-Hui	6 yrs	
De-Lu	When she started to play	
Chi-Z	5 yrs	
Yu-Ting	Hard to say, we brought her to nature when she was in the womb.	Children are deeply influenced by parents in all aspects. The ideas of conservation need to be seeded from a very early age by both the family and through the schools.
Ge-Jin	3 yrs	
Chen-Yu	2 yrs	Schools need to link and encourage family education to have the same practices and attitudes toward environmental education so there is consistency between schools and home.
Jin-Ruei	(No response)	

Firsthand Exposure to Nature

Some parents stated that direct contact is important for children to learn about

nature. I wanted to know if those parents often took their children to nature. The parents

of Suan-Hui and De-Lu both believed that direct contact with nature is an important

source of children's ideas about nature and both stated that they took their children to

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nature four times a month. The parent of Ge-Jin said that children learned mostly from direct contact with nature. The father did not reply as to how often they go to nature, but said that they went "everywhere," in responding to the question "Where do you take your child to nature?" The parent of Jin-Ruei said children learned ideas about nature mainly from school, but real experience with nature made a stronger impression than learning at school, such as raising the rhinoceros beetles. They did not, however, often visit nature. Table 13 shows parents' views concerning direct contact with nature. The trend shows that believing in the benefits of direct contact with nature tends to motivate those parents (Suan-Hui, De-Lu, and Ge-Jin) to often bring their children outdoors (marked grey in Table 13).

Table 13

Parents' Ideas About Children's Direct Contact With Nature

	Where do you think your child learns those ideas of nature?	Do you think what your child learns at home affects his or her learning about nature at school? How so?	How often does your family go to nature?
An-Jhen	Family Books	Yes	3-4 times/month
Yen-Pin	Books TV	No	2 times/month
Si-Chen	School	(did not directly answer the question)	During summer or winter break
Huan-Mong	Children's books, DVD, VCD	Yes	1-2 times/month
Ning-Chen	School	(did not directly answer the question)	2-4 times/ month

Suan-Hui	Direct contact Tapes	Yes	4 times/month
De-Lu	Direct contact Books	No	4 times/month
Chi-Z	Books TV	No	2 times/month
Yu-Ting	Home School	Yes	4 times/month
Ge-Jin	Direct contact		We go "everywhere"
Chen-Yu	Books Films	Mutual	4 times/month
Jin-Ruei	School	Direct contact with nature (rhinoceros beetles) makes a stronger impression than learning at school	Not often

Visiting Nature

To see if parents' personal preference made a difference in how often the family visited nature, I compared their responses to the question "Do you like nature?" with their responses to "How often do you take your child to nature?" It seemed that there was no clear tendency for parents to often take their children out to nature even if they liked nature intensely. It is interesting that although some parents claimed they like nature intensely, it does not necessarily motivate their self-reported behaviors of taking their children out to nature.

Table 14

Comparison of Parents' Fondness for Nature With Their Frequency in Visiting Nature

Do you like nature?	Like it #1, 2, 7, 9	Like it a lot #4, 6, 11, 12, 13, 14, 16	Has some fear #5
How often do you take your child to nature	(2 parents) 4 times/month (1) 3-4 times/ month (1) 2 times/month	(2) 4 times/month (1) 2-4 times/ month (1) 2 times/month (1) Not often (1) During summer or winter breaks (1) Didn't answer	(1) 1-2 times/month

Children's Desires and Families' Decisions

As shown in Table 15, children's favorite natural places were also compared with where the family actually visited nature. Parks (Ning-Chen and Chi-Z), mountains (Suan-Hui and Chen-Yu), and beaches (Chen-Yu) were places where the desires of parents and children overlapped. Other pairs of parents and children did not show correspondence between places that the child liked and places that the family visited.

Table 15

Where the Family Goes vs. Where the Child Desires to Go

	Where does your family usually go in nature?	Where does your child like to go in nature?	What does she or he do there?
An-Jhen	Mountains	Countryside	Biking, watching butterflies
Yen-Pin	Mountains	No specific place	Biking
Si-Chen	Places that can connect to what the children learn from school	Beaches	Playing with sand, playing in the water, feeding animals
Huan-Mong	Parks,	None	Taking a walk, hiking,

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	mountains		playing in the water
Ning-Chen	Parks, fields, forest parks, mountains	Parks	Taking a walk, playing on swings
Suan-Hui	Mountains, lakes, shore, trails, farms	Mountains, zoos, parks	Playing, exercising, enjoying hot springs,
			Eating, getting to know animals, exercising
			Enjoying the view, trees, and water
			Playing on swings and slides and with stones
De-Lu	Parks, mountains, trails	Theme parks	Playing
Chi-Z	Parks, mountains, trails	Parks	Playing with sand, kites, and on playgrounds
Yu-Ting	Trails in mountains	Beaches	Playing with sand and water
Ge-Jin	Everywhere	Riverside	
Chen-Yu	Mountains, beaches, parks	Beaches, mountains	Playing with sand and water, hiking, playing ball
Jin-Ruei		Not often [expressed by the child]	

Responding to the questions, "What makes you want to take your children to nature? What makes you *not* want to take them to nature?" five of the 12 parents wrote they took their children to nature to get them close to nature, one (the parent of Suan-Hui)

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wanted the children to have fun, and one wanted the children to have some physical activities outdoors. One parent responded that they took the children to nature when others invited them, one said when they had free time, one responded when the children wanted to go, and two wrote when they felt like "it's time to go out!"

Parents reported various reasons for not wanting to take their children out to nature. Two wrote that when they were tired, two wrote when they were busy or other things occupied the weekends, one wrote when it rains, one wrote when transportation was not very convenient, and one (mother of Chi-Z) wrote when others family members did not like the children to go out: "My mother-in-law doesn't like the children to go out. Their father thinks it's dirty in the parks."

To answer the question of whether children were the ones who decided whether the family would visit nature, I compared the children's expressed desires to engage with nature with the reasons parents wanted to go out or not, as shown in Table 16. It is interesting that for the ones who often expressed desire to engage with nature, their family decisions were often made according to the children's need or interests. The parents of the children who infrequently or never expressed a desire to engage with nature made their visiting-nature-related decision according to the adults' need or interests. The parents' decisions about not going out were not strongly associated with the children's needs or interests. I do not claim it is causality, but connections between the factors.

Table 16

Whether Children's Desire Related to Parents' Decision to Visit Nature—Who decides to go out?

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	Children who often express a desire to engage with nature	Children who *not often* express a desire to engage with nature	Children who *do not* express a desire to engage with nature
	#1, 2, 4, 6, 7, 9, 11, 12, 13, 14	#16	#5

What makes you want to take your child to nature?

Children-centered	Want them to get close to nature 1, 11, 12, 13, 14		
	Want them to have fun 7		
	Want them to have some physical activities 9		
	When the children want to go 9		
	When we feel like "it's time" 2, 7		
Adult-centered		When others invite us	When we have free time

What makes you not want to take them to nature?

Children-centered	Needs to spend some time studying 7	
Adult-centered	When [I am] tired 4, 6	Don't have free time
	When the kids don't behave 7	
	Need to do some cleaning at home 7	
	Other adults in the family don't like children to play outdoors 11	
Other conditions	When it rains 12	
	When transportation is not very convenient 4	

The Impact of the Living Environment

To learn if the dwelling places make a difference in parents' ideas about nature, I compared their definition of nature, the meaning of nature, surrounding natural environment, frequency of visits to that natural environment, and things they did in the natural environment, as shown in Table 17. Compared with the ones who lived in 5-story apartments, more parents who lived in high-rises stated that nature restored their mental health through relaxation and recharging. There was no apparent difference among the families' surrounding environment and the frequency and activities in the natural environment. However, parents living in different kinds of buildings all mentioned similar natural environments nearby their homes--parks and natural trails in mountains and hills. Hiking was the only activity that was mentioned by parents living in all the different types of buildings.

Table 17

The Influence of Dwellings

	High-rises #1, 6, 7, 13, 14	5-story apartment #4, 5, 11, 12, 16	House/condo #2, 9
Do you like nature?			
Like it	1, 7		2, 9
Like it a lot	6, 13, 14	4, 11, 12, 16	
Has some fear		5	
Definition of nature	3 EX	4 EX	1 EX
	2 NE	3 NE	1 NO
	3 NO	2 NO	1 NA
	2 NA	1 NA	1 GD
Meaning of	4 MH	2 MH	1 MH

nature	1 PH	2 EN	1 PH
	1 LC	1 PH	1 LC
	1 SP	1 LC	1 SP
	1 EN	1 SP	1 EN
		1 NE	
		1 MO	
Surrounding natural environment	3 Park	2 Waterfront/river	1 Parks
	3 Mountains, natural trail/hill	2 Mountain, natural trail/hill	1 Natural trail/hill
	2 Rivers	1 Trees	1 Trees
	1 No natural environment around	1 Park	
	1 Bicycle paths		
	1 Botanical garden		
	1 Museums		
Does your family visit those places often?	1 Almost every day	1 Every week	1 Often
	2 Often	2 Sometimes	2 Not very often
	2 Didn't answer	2 Not very often	
What do you do there?	1 Play	1 Bike	1 Hike
	2 Walk	1 Exercise	1 Exercise
	1 Enjoy the view	1 Bird watch	
	1 Relax	2 Hike	
	1 Exercise	2 Play in water	
	1 Hike	1 Feed fish	
	1 Observe plants		

MH: Relaxing, feeling happy, good for mental health, away from urban life
EN: Connections with the environment, enjoy the aesthetics
PH: Good for physical health or physical activities
SP: Spiritual, religious, philosophical, seeking solutions for/essence of life
LC: Connections with living creatures
MO: Childhood memories
NE: Negative feeling toward nature when a human being is helpless in the wilderness

Gender Influence

Only two parents reported that their children's gender affect the way they raise them, especially the way they approach or play in nature. The mother of Si-Chen wrote, "I am a mother. The fact that I only have sons makes me realize that boys and girls are very different. They [boys] are more "free" and "wild," and not as cautious as girls do. I usually prepare some clothes for them [to change] and just let them play! Children learn and exercise from play. The father of Huan-Mong wrote that "For boys, they [need to] find themselves a restroom in the wilderness, but for girls, I will make one for her." To see if parents' gender affected the way they raised children of a different gender, I compared the parents' gender with their responses to the question about raising children of a different gender. It turned out that gender did not seem to be a factor in parenting style in terms of nature-related issues. A father or a mother can have different responses about their parenting styles with girls or boys.

Table 18

Parenting Style of Different Gender of Parents

Does your child's gender affect the way you raise her or him, especially the way he or she approaches or plays in nature?		Mother of	Father of
	Yes	#4	#5
10/12	No	#2, 7, 9, 11, 12, 14, 16	#1, 6, 13

Summary. To summarize parents' belief and attitude, many parents have a very positive feeling toward nature and believe nature is important in terms of physical and mental health and philosophical solutions to life. Parents' fondness for nature did not necessarily promise a more complex understanding of nature.

For parents' thoughts and possible influences on children's nature-oriented experiences as well as the children's interests, it was found that, first of all, most parents believed they influenced their children's interests in nature by taking them out into nature, providing them materials about nature, and guiding them to appreciate nature. Second, most of the parents who liked nature also thought their children liked nature. Third, those parents who believe in the benefit of direct contact with nature tended to be motivated to often take their children outdoors. Fourth, families whose children often expressed their desire to engage with nature often made the decision to go according to the children's needs or interests. But deciding which natural environment to visit might not be based on the children's favorite places. Finally, parks and mountain areas are the most often visited natural places by families in this study. No matter what kind of dwelling the families live in, hiking is a popular activity among them.

There were also no clear patterns that emerged in several items and coaxial comparisons. First, no consensus on whether parents thought children's interests in nature were innate or not. Second, belief about innate fondness did not reflect how parents thought about the continuous school education on the topics on nature either. Third, it is interesting that although some parents claimed they liked nature a lot, it did not necessarily motivate their self-reported behaviors of taking their children out to nature. Fourth, what kind of dwelling (5-story apartments or high-rise buildings) the families live in did not affect their frequency and activities in the natural environment. Finally, both parents' and children's genders did not seem to be a factor in parenting style in terms of nature-related issues.

Influential Factors on Children's Ideas and Experiences of Nature

While mainly parents' thoughts about children and nature were reported in the previous section, I will add parents' thoughts to children's opinions in this section to answer the last research question about what the influential factors are. Three methods were used to study the influences on children's interests, ideas, and experiences of nature. I wanted to find out which method might best explain these intertwining impacts and reveal other emergent themes. First, I compared the children's definition of nature with other factors. Each child's drawing and photograph interpretation received a score based on a scoring rubric. The higher the score, the more complex the child's understanding of nature. The score was then compared with parents' scores and other children's and parents' responses from the interviews and surveys. Second, the Contextual Model of Learning helped to organize the circumstances in which children personally, socially, and physically met with nature—or what nature offered children in terms of these aspects. I also used the model to help organize the different factors that might influence children's ideas and experiences of nature. Third, I used the method of constant comparison between each child and parent pair to closely observe how parents' and children's ideas connect or contrast.

Comparing Children's Definition of Nature With Other Factors

To see how children's definition of nature is affected by other factors, I quantified their definitions into numerical items so that it would be easier to examine any trends (Moseley at al., 2010). All the children were prompted to draw a picture of themselves in nature. In the interview, they were also shown 11 photographs of city, indoor, and natural environments and asked to tell me if they thought these were nature. All their responses

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were coded and listed in a table to see if their definition of nature was consistent in all the 11 photographs. Their drawings and the photograph task were scored based on the rubric I created, as follows:

> 5: Consistently includes animals (A), plants (P), abiotic elements (B), and excludes humanmade material (M), with a consistent and correct overarching way to define nature (C)
>
> 4: Consistently includes animals, plants, and abiotic elements and excludes humanmade material
>
> 3: Any three of the A, P, B, M, or C
>
> 2: Any two of the A, P, B, M, or C
>
> 1: Any one of the A, P, B, M, or C
>
> 0: Only humanmade things

Developed from the drawings' coding category (see Table 5), the rubric scores 1 point for each category of animals, plants, or abiotic things; 1 point for exclusion of humanmade things; and 1 point for consistently using a correct overarching definition of nature. Items A, P, B, and M are used to rate both the children's drawings and the photograph interpretation. Table 19 shows how each coding was rated as a numeric score.

Table 19

Children's Drawings Codes and Rated Scores

Children	Coding of drawing	Items included	Score

An-Jhen	3.1.1 Trees	APM	3
	3.1.2 Grass		
	3.1.3 Flowers		
	3.2.1 Bees		
	3.2.2 Butterfly		
	3.2.3 Beetles		
Yen-Pin	3.1.2 Grass	PB	2
	3.3.1 Sun		
	3.3.4 Sky		
	4.1.1 Home		
Si-Chen	3.1.1 Trees	P	1
	3.1.2 Grass		
	3.1.4 Falling leaf		
	4.4.1 Bike		
Huan-Mong	3.1.1 Trees	APBM	4
	3.1.2 Grass		
	3.2.2 Butterfly		
	3.3.1 Sun		
	3.3.2 Clouds		
Ning-Chen	3.1.2 Grass	APB	3
	3.1.3 Flowers		
	3.2.4 Ant		
	3.3.1 Sun		
	4.2 Planter		
Suan-Hui	3.1.1 Trees	PBM	3
	3.1.3 Flowers		
	3.3.2 Clouds		
	3.3.3 Wind		
De-Lu	3.1.1 Trees	APBM	4
	3.1.2 Grass		
	3.1.3 Flowers		
	3.2.2 Butterfly		

	3.2.6 Snake		
	3.3.1 Sun		
	3.3.2 Clouds		
Chi-Z	4.3 Airplane		0
Yu-Ting	3.1.1 Trees	APBM	4
	3.1.2 Grass		
	3.1.3 Flowers		
	5.2.3.4 Ant		
	3.3.1 Sun		
	3.3.2 Clouds		
	3.3.3 Wind		
Ge-Jin	3.1.1 Trees	PBM	3
	3.1.3 Flowers		
	3.3.1 Sun		
Chen-Yu	3.1.1 Trees	APM	3
	3.1.2 Grass		
	3.1.3 Flowers		
	3.2.5 Ladybug		
Jin-Ruei	3.1.1 Trees	APB	3
	3.1.2 Grass		
	3.2.7 Fish		
	3.2.8 Squirrel		
	3.3.1 Sun		
	3.3.4 Sky		
	3.3.5 Lake		
	4.4.2 Frisbee		

For item A, I had intended to include human beings, but then thought the children might have drawn families and friends to represent the social function of nature. Figure 5 shows how Si-Chen drew himself with his mother biking and An-Jhen drew herself playing Frisbee with a friend and also included a farmer in her drawing. Realizing the

people might not necessarily represent their definitions of nature, I went back to the interviews with Si-Chen and Jin-Ruei and both of them had said that human beings are not nature. Jin-Ruei specifically told me that in her drawing the farm is nature but the farmer is not. As a result, my coding for A (animals) is entirely based on animals (coding category 3.2) not people (coding category 2).

Left: Si-Chen's drawing (Me; Mother). Right: Jin-Ruei's drawing (Farmer; Me; Friend)

Figure 5. Children's drawings that include other people

In addition, item C exclusively applied to the photographs because there was no consistency issue for a drawing. Offering a consistent overall idea about a photograph showed that that child had developed a more mature understanding of nature than those who just looked at separate elements in the photographs and changed their ideas from photograph to photograph.

The rubric was later found to be very similar to that used in a study of teachers' mental models of the environment (Moseley at al., 2010). Their study's rubric included four main categories--human, living, abiotic, and human-built or designed—and scored 0 points for factors absent, 1 point for the presence of factors with no apparent interaction, and 2 to 3 points for factor interactions or explicit system interactions shown in the

drawings. In my study, no young children drew any sort of interaction of factors so it became apparent that was why my rubric did not score anything other than concrete elements in the drawings.

Each child's photograph interpretation was rated based on the same rubric. If a child consistently claimed, "This is nature, because there are trees," she or he received 1 point for P for consistently including plants in the definition of nature. The child does not get a C because she or he was not looking at the picture as a whole and failed to use an overarching idea to judge. If the child consistently said, "This is not nature, because there are artificial things," 2 points for M and C were given. The child not only excluded humanmade things but also used an overarching concept throughout all the photographs.

Each child received three scores: one for the drawings, another for the photographs, and the last to combine the two. That is, the combined score tried to include the child's definition from both methods, since the different methods were designed to understand children's ideas of nature from different aspects. Later the scores were compared with each child's interview and parent's survey to look for any patterns or insights. The drawing rating, photograph rating, and combined rating are listed in the first three columns in Table 17. If a child included A and P in the drawing and B, M, C in the photographs, the combined score was 5. Of the 12 children, three got a C and scored 5. Si-Chen defined nature as "that has been there for a long time." Chi-Z thought, "It is not nature if it is human–manipulated." Yu-Ting claimed that anything *made* are not nature and used that concept throughout the interview.

The difference between the drawings and photographs is listed in the last column in Table 20 to show if some ideas about nature are easier to discover in drawings or

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through photographs. The results show that excluding humanmade things (M) is the one definition most often used either only in drawings (Huan-Mong, Suan-Hui, De-Lu, Yu-Ting, and Ge-Jin) or only for photographs (Si-Chen, Chi-Z, and Jin-Ruei). More children did not include humanmade things in their drawings than those who defined nature as excluding humanmade things in the photographs. That is, children more often not include humanmade things (in the drawings) when I did not prompt the question. However, in the photographs, whether or not to include humanmade things become confusing for children in defining nature when they had to face this question. This resonates with the results that the children started to sense the different degrees of naturalness in photographs and sometimes got confused as to whether humanmade things were or were not nature. As for animals (A), five children (Yen-Pin, Si-Chen, Suan-Hui, Chi-Z, and Ge-Jin) did not include animals (other than human beings) in their drawings but did think the deer in the photograph was nature. De-Lu and Jin-Ruei had animals (other than human beings) in their drawings but at the same time did not think the deer in the photograph was nature. Even though the sample size is small, it is apparent that the different methods of drawing and using photographs elicited children's different points of view about nature.

Table 20

Children's Scores for Definitions From Drawings and Photographs

Children	Drawings	Photographs	Combined	Difference between photographs and drawings
An-Jhen	3APM	4APBM	4	B
Yen-Pin	2PB	3APB	3	A
Si-Chen	1P	5APBMC	5	ABMC

Huan-Mong	4APBM	2AP	4	BM
Ning-Chen	3APB	3APB	3	
Suan-Hui	3PBM	3APB	4	AM
De-Lu	4APBM	1P	4	ABM
Chi-Z	0	5APBMC	5	APBMC
Yu-Ting	4APBM	4APBC	5	MC
Ge-Jin	3PBM	3APB	4	AM
Chen-Yu	3APM	3APM	3	
Jin-Ruei	3APB	3PBM	4	AM

Table 21 shows the children's average scores according to their different school systems (public and independent), gender, and age (kindergarten and first grade). Children from public schools received a higher average score (4.59) than the ones in independent schools (3.88). Girls got a higher average score (3.59) than boys (3.00). First graders got a higher score (4.59) than kindergarten children did (3.59). Moreover, different methods (drawings or using photographs) did not change these results. This is, children in public school had a higher average score than those in independent schools for both drawings (4.33: 2.5) and photographs (4.44:3.50).

Table 21

Children's Scores for Nature Definition by Different School Systems, by Gender, and by Age

Child's #	School	Drawing	Photographs	Combined	Drawing average	Photographs average	Combined average
1	Independent	3	4	4			
2	Independent	2	3	3			
4	Independent	1	5	5			
13	Independent	3	3	4			
14	Independent	3	3	3			

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16	Independent	3	3	4	2.50	3.50	3.83
5	Public	4	2	4			
6	Public	3	3	3			
7	Public	3	3	4			
9	Public	4	1	4			
11	Public	0	5	5			
12	Public	4	4	5	4.33	4.44	4.59

	Gender						
2	Female	2	3	3			
6	Female	3	3	3			
7	Female	3	3	4			
9	Female	4	1	4			
12	Female	4	4	5			
16	Female	3	3	4	3.33	3.44	3.59
1	Male	3	4	4			
4	Male	1	5	5			
5	Male	4	2	4			
11	Male	0	5	5			
13	Male	3	3	4			
14	Male	3	3	3	3.00	3.00	3.00

	Grade						
1	First Grade	3	4	4			
2	First Grade	2	3	3			
4	First Grade	1	5	5			
9	First Grade	4	1	4			
11	First Grade	0	5	5			
12	First Grade	4	4	5	4.33	4.44	4.59
5	Kindergarten	4	2	4			
6	Kindergarten	3	3	3			
7	Kindergarten	3	3	4			
13	Kindergarten	3	3	4			
14	Kindergarten	3	3	3			
16	Kindergarten	3	3	4	3.33	3.44	3.59

Since the study sample size is so small, the trend cannot lead to a conclusion or be generalized to other populations. But because the data collection process endeavored to balance the children's schools, gender, and grades, it is worth noting that these factors could affect children's understanding of nature and be used as variables in a future study.

Finally, I put each child's score and interview responses and the parents' survey responses into two spreadsheets to see if any particular reason or a child's background accounted for a higher score. The parents' definitions of nature were also rated using the same rubric. Almost all parents got a score of 4 or 5. Only the parent of Jin-Ruei did not think that animals and human beings were nature and was therefore rated lower than the other parents. There is no clear relation between parents' scores and children's. There is no clear pattern in the two spreadsheets, either. The items in the spreadsheets included the children's sources of ideas, feelings about nature, what they do in nature, and after-school activities. For the parents, it included all the survey questions: parents' definition of nature, the personal meaning they derive from nature, their living environment, and the like. It seems that no one practice or factor contributed to a higher score or a more complete understanding of nature. The quantitative method of nature definition might not be the most ideal way to explain influences on children's ideas. But what is clear is that the analysis (Table 20) ensures that using different methods (drawing and photographs) for children to express their ideas can broaden our chance to learn about their conceptions. In addition, children's age, gender, and their school system may make a difference in the complexity of their concepts about nature.

Summary. The first method used to study influences on children's experiences and understandings of nature was to compare their definitions of nature (the complexity

of their understandings of nature) to other factors investigated in the study. It was found that, first of all, there is no clear pattern between the complexity of children's understandings of nature with other factors, such as children's sources of ideas, feelings about nature, what they do in nature, and after-school activities, parents' definitions of nature, the personal meaning parents derive from nature, families' living environments and so on. No one practice or factor contributed to a higher score or a more complete understanding of nature.

Second, different methods of drawing and using photographs apparently elicited children's different points of view about nature and broadened our chance to learn about their conceptions. The results show that excluding humanmade things is the one element most often used either only in drawings or only for photographs. Children more often not included humanmade things (in the drawings) if I did not prompt the question. However, in the photographs, whether or not to include humanmade things become confusing for children in defining nature when they had to face this question. Children's ideas about animals and human beings also reveled differently in their definition of nature than from the drawings and photographs.

Third, in this study, no matter with drawings or photograph interpretations, children from public schools showed a more complex understanding of nature than the ones in independent schools. Girls showed a more complex understanding of nature than boys. First-graders showed a more complex understanding of nature than kindergarteners. Since the study sample size is so small, the trend cannot lead to a conclusion or be generalized to other populations. But, it is worth noting that these factors could affect children's understandings of nature and could be used as variables in a future study.

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*Influential Factors Plotted in the Contextual Model of Learning*

The majority of the interview and survey questions in this study were designed around the Contextual Model of Learning with the expectation of portraying a more comprehensive picture of children's ideas of nature and the interactive influential factors, especially family influence in this study, through the personal, sociocultural, physical, and time lens. Placing the themes that emerged from the data into the model helps to summarize the themes in a more organized and meaningful way. It also provides focal points for a discussion of the implications in terms of policy and curriculum. Moreover, it makes good sense to use this model to see where children meet nature in the context of this study, as shown in Figure 6.

It turns out that most of these focal points resulted from the children's interview data. Personally, children's interests in nature make them enjoy nature. Their curiosity about nature attracts their attention to observe and interact with living things such as smelling the flowers, observing ants, and so forth. They do physical things in nature such as biking, hiking, and playing. Children also enjoy the beauty of nature. They think nature is beautiful. They watch the sky. They observe nature. And lastly, nature sometimes arouses their imagination and offers them intimacy. They fantasize about playing with nature. They make friends with nature.

Regarding the sociocultural aspect, they visited nature with their families on the weekends. They ate, chatted, and enjoyed different aspects of nature together. Were I to make an extreme claim, I would say that nature outings on weekends seem the cultural norm in this society. In terms of physical environment, children mostly encountered green

space comprised of plants either in the mountains that embrace the city or in parks

embedded in the city.
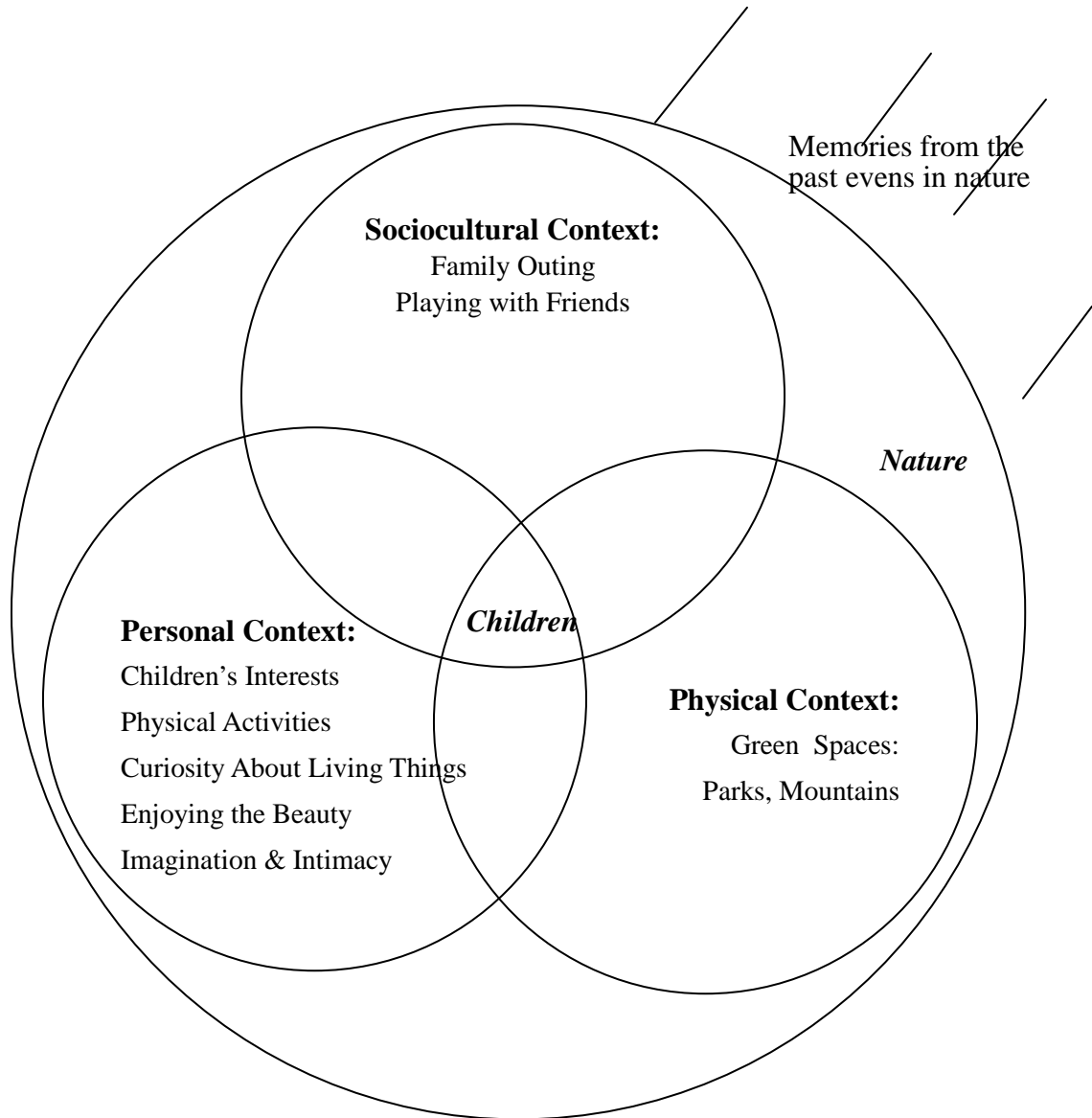
Figure 6. Where children meet nature

The time factor is this study did not reveal as much as in other aspects. The survey

question about when children started to like nature did not elicit much discussion about

the changing nature of learning. However, many children talked about nature as vivid

memories with family and friends.

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The more often children expressed their desire to engage in nature, the more often parents considered nature-related activities based on children's needs.

Sociocultural Context:
Culturally: Academic Performance
Socially: Parents' Attitude
Parents' using educational moments
Activities that meet the family's need
Constraints: Dirt & safety concern

Personal Context:
Children's Interests & Desires

Children

Physical Context:
Access to nature
Constraints: Weather, Time, or Traffic

Figure 7. Influences on children's ideas and experiences about nature

Placing the influential factors in the model mostly reveals themes resulting from the parents' surveys, as shown in Figure 7. My original research question "What influences children's interests in nature?" intended to emphasize the children's interests. However, as the data analysis progressed, the idea broadened into what influences children's ideas and experience of nature because the children did not have much to say about their own interests in nature. So, the sociocultural and physical factors did not seem to directly affect children's interests in nature, but parents' beliefs and the children's daily lifestyles did shape different experiences in the children's contact with nature.

Culturally, homework and exams are important practice in school and are believed essential in Taiwanese society. In this study, the social factor was mainly the family

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influence—how the parents' beliefs and attitude could affect both a family's choice for nature-oriented activities and a child's experience in nature. Family outings to nature were mediated by and depended on the family's need. The result "The more often children expressed their desire to engage in nature, the more often parents considered nature-related activities based on children's needs." clearly overlaps the personal and sociocultural aspects of the model. Considering the parents' influence, it was found that some parents used those educational and social moments in nature to teach their children something. The meaningful moments could be conveyed through parents' knowledge, attitude, or simply as anecdotes. On the other hand, attitudes that playing in nature is dangerous or dirty might constrain children's contact with nature. Of course, it is the parents' responsibility to teach children about the possible risks in nature. Yet how it is taught depends greatly on parents' cues in language (Hyun, 2005) and the society's norms, such as the attitude toward pests. I believe *pest* is value-laden from humans' perspectives. In terms of physical context, this study manifests how the city's geological features and urban design offer people various access to nature. The access may be hampered by weather (rain or humid summer), limited transportation (cutting out access to nature), and time (parents' usually work late and children have very limited access to nature during the weekdays).

Use of the Contextual Model of Learning was helpful to identify themes in a structured way, as I have reported them. However, the CLM did not assist beyond that accomplishment such as to help in the identification of direct links between children's ideas of nature and parents' influence. As a result, I decided to use the constant comparison method to see if the child and parent pairs revealed any patterns.

Summary. The visual representation of CML helped to organize and focus on themes emerged from this study to look at the phenomenon in a more complete picture. First, children *meet* with nature (Kalvaitis, 2007, p127) in different aspects. Personally, children's interests in nature make them enjoy nature. Their curiosity about nature attracts their attention to observe and interact with living things such as smelling the flowers, observing ants, and so forth. They do physical things in nature such as biking, hiking, and playing. Children also think nature is beautiful. They watch the sky. They observe nature. And lastly, nature sometimes arouses their imagination and offers them intimacy. They fantasize about playing with nature. They make friends with nature.

Regarding the sociocultural aspect, they visited nature with their families on the weekends. They ate, chatted, and enjoyed different aspects of nature together. In terms of physical environment, children mostly encountered green space comprised of plants either in the mountains that embrace the city or in parks embedded in the city. Moreover, many children in this study talked about nature as vivid memories with family and friends.

Second, possible influential factors learned from this study are visually plotted in the model, as well. Culturally, homework and exams are important practice in school and are believed essential in Taiwanese society. The social factor was mainly the family influence—how the parents' belief and attitude could affect both a family's choice for nature-oriented activities and a child's experience in nature. Family outings to nature were mediated by and depended on the family's need. Sometimes children's desire to engage in nature also brought the family out more often. In these family outings to nature, some parents used those educational and social moments to teach their children

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something. The meaningful moments could be conveyed through parents' knowledge, attitude, or simply as anecdotes. On the other hand, attitudes that playing in nature is dangerous or dirty might constrain children's contact with nature. In terms of physical context, this study manifests how the city's geological features and urban design offer people various access to nature. The access may be hampered by weather, limited transportation, and time constraints.

Constant Comparisons of Pairs of Children and Parents

Using the constant comparison method, I read through the transcripts, codes, and surveys of each parent and child pair and constantly compared them to find similarities, contrasts, or salient perspectives. Each of the following sections starts with the parent's responses followed by the child's ideas, especially those excerpts that reflect or contrast with the parent's. It was hoped this method would present an intact portrait of each pair that might be missed by other means of data analysis. Following the participants' names, I added, as a reference, each child's combined score for definition of nature from the drawing and photograph differentiation.

An-Jen and His Father (4)

The father believed children learned about nature mostly from family and books. They often went hiking and bird watching on the weekends. It seemed that the parents were very interested in nature-related activities. The father stated that they tried to guide and encourage their children to appreciate nature when they went out.

An-Jhen's interview reflected these family influences. He could name many insects and birds, which he learned from bird-watching with his parents. He also talked about raising beetles at home and seeing chameleons in an ecological farm. The

conversation with him also revealed some of his understanding about the food chain. For books, he talked about his favorites--*Noddy* and *Mr. Men & Little Miss,* which are not necessarily nature-related.

Yen-Pin and Her Mother (3)

The mother believed her children learned ideas about nature mostly from books and television and that she had no influence on Yen-Pin's interest in nature. At the same time, she believed all children love nature, because they can run and play freely with not as much stress as at school and at home. The family sometimes went hiking. They especially liked to go out when they had not done so for a while or after the school tests periods. The mother recognized that her daughter liked to ride her bike outdoors.

Yen-Pin talked about biking in the community park. She also liked to watch the sky and play at the beach. She said they do not go out when her sister is having school exams. When talking about hiking, she remembered they had been to many mountains, that it was tiring, and that sometimes her mom stayed in the car to avoid fatigue.

Si-Chen and His Mother (5)

The mother said that they lived very close to the riverfront park, but it was a shame that they did not go there very often. The child was at school all day and needed to practice instruments after school. Because the father needed to work (and use the car) on the weekends, she tended not to take the children out of the city due to her physical limitation and the constraints of transportation. The mother believed Si-Chen is very interested in science, especially earth science. She also seemed deeply appreciative of the child's kindergarten education, which had guided him to develop deeper feelings and thinking about life science.

Si-Chen talked about biking in the riverfront park close to their home, even though his mother said they do not have much time to visit it. He also talked about how he has to practice violin after school. In the interview, many of Si-Chen's ideas about nature were very mature and interesting. For instance, he said that "desert is nature. Even though there are no trees. It was there from a long time ago. The city was built later --buildings after buildings. Of course that is not nature. How can so many houses be nature? Cities are not." In the interview, he also told me a lot of information and that showed scientific knowledge, not just the names of plants and animals.

Huan-Mong and His Father (4)

Both parents worked in schools. He is the only parent who mentioned doing homework on the weekend. The father believed his boy did not show any special interest in nature and seldom voluntarily wanted to go out. He is the only parent who mentioned that sometimes nature can be a fearful place and that sometimes nature can include up to 30% of humanmade material (if defining nature in Taiwan). He also thought that children learned things about nature from books, DVDs, and VCDs. Ninety percent of the books in their home were related to natural science.

Huan-Mong mentioned in the interview that "there are books in our home that are nature [nature-related]. But I did not read them. Because I sometimes forgot." When he talked about the birds he saw in a large city park, he was able to name many of them. I asked him how come he knew so much. He responded that they have a bird guide at home. There was also a book telling about the ocean, shells, and fish. Huan-Mong was one of the few children in the study who did not give me a straightforward positive reaction about nature. He did, however, talk about several instances of his experiences of

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digging in the soil at his grandparents' home, predator-prey relations, and a ladybug's hatching, all of which showed several kinds of detailed knowledge about nature.

Ning-Chen and Her Father (3)

The father observed that Ning-Chen liked nature a lot. She often stopped to observe the flowers, grass, insects, and butterflies. The parents often took the children out or visited grandparents in the countryside. In their surrounding environment, there was a big park in their community that they passed by every day. They sometimes went there to play. The father said that he believed children learned their ideas about nature mostly from school, because he only knows to appreciate nature without much knowledge of it.

Interestingly, Ning-Chen's interview coincided with the parent's survey on many points. She talked about how she watched flowers and observed ants digging holes in the ground. She talked about playing on slides and swings in the park. She talked about visiting her grandparents' house when she was asked about what she did on weekends and where she saw nature. She said that there were trees at grandma's place, but she could not climb them because they're dirty and it's dangerous. Grandma also told her things about trees--for instance, which trees she should not touch. She remembered instances of her mother telling her things about nature, too. The family influence on Ning-Chen was probably stronger than the father recognized. The time the family spent together in nature seems to be memorable to Ning-Chen.

Suan-Hui and Her Mother (4)

Suan-Hui's mother said she learned to relax and adjust the pace of her life pace through nature. She listed many natural places they visited on weekends. She said they often used different opportunities to teach the children the names of living things, about

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pollution, and to have an appreciation of nature. If the children asked questions, they searched for the answers together. In fact, Suan-Hui grew up in the countryside and did not move to the city until she was 3 years old. They try to let the children play freely and happily in nature as long as they can be seen by the parents.

Suan-Hui stated that in her drawing of nature, she is resting, smelling the flowers, and enjoying the breeze. She seemed to enjoy nature's beauty very much because in the photograph interpretation she talked a lot about nature having to be beautiful. She also seemed to be full of imagination when talking about what she did in nature. Nevertheless, she said her parents did not tell her much about nature when they went hiking or went to the mountains. When going to the mountains, the family just went to the hot springs. She said she "just knew" what nature was (no one taught her).

De-Lu and Her Mother (4)

Religion seemed to be an important element in their family's life. Nature was defined as made by God. They were the only family living in a single-family house. The mother believed the children learned ideas about nature from books and real experiences. She enjoys nature. It calms her and she can not help but praise it. She taught her children that when the earth was made by God, it was all good. But because of human beings' destruction, nature is striking back. She thought parents needed to explain things like flood disasters so that children would not be fearful.

De-Lu said that she had learned about nature because she had been into nature many times. She said, "Because my parents love me very much, they often took me out to play. And we saw nature." She also talked about nature as playing games with church friends, observing bees and butterflies around grandma's place, biking on the prairie, and

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fishing in the river close to their house. They also had parrots and cats as pets at home. Hiking with family and friends on weekends included all kinds of memories of eating and playing. She wanted to make friends and play with nature every day.

Chi-Z and His Mother (5)

The mother said she loved nature a lot and that nature is like home for her. She believes her child loves science and learns ideas about nature mostly from books and television because there was not much chance for them to really experience nature directly. They often went to libraries and visited science-related exhibits. There was a park close to their home, but they did not go very often. Her husband thought parks were not clean and her mother-in-law did not like them to go out, but she herself really likes her children to have contact with nature.

Chi-Z went to Taekwondo class five times a week. He said he thought about questions more complicated than what was nature. He thought about the origin of the earth, how to put computer chips in classmates' heads in order to control them, and how to maintain his speed when turning. His interview and drawing did not say much about his ideas of nature because he only knew how to draw planes and was busy telling me all about his science ideas (mentioned above). However, in the photograph differentiation task, he had a clear idea about his definition of nature: anything that was artificial, plants that were planted by human beings, and animals that were raised by human beings were not nature.

Yu-Ting and Her Mother (5)

The mother loves nature a lot. She grew up hiking with her parents and was a member of the hiking club at her work place. She said she purposely took her child out to

exercise and enjoy nature. She also believed that parents' influence on children was very profound. As long as it is safe and not harmful to the environment, she encourages her child to freely "crawl and jump" in nature.

Yu-Ting, the daughter of this single parent, seemed like a sensitive child who went out to talk with trees a lot at recess time and after school. On the weekends, she enjoyed going hiking with her mother so that they could chat about what happened during the week. In the interview, she talked about many of the details that her mother had told her about nature. She had not only knowledge of scientific facts but also an understanding of sustainability. Her progress through the photographs was very interesting, too. At first, her concept was relatively blurry. She began by saying that the desert was nature because sand was not "made." She gradually started to use this idea in all the photographs and concluded that anything that is not made is nature.

Ge-Jin and His Father (4)

The father believed that children learned their ideas about nature mainly from direct contact with nature. They often went biking in a riverside recreation park close to home. His responses to the survey questions were very short.

Ge-Jin talked about chatting when biking with his brother, playing at the playground facility in parks, playing with stones and sand, and looking at flowers with his family. He talked about watching "a nature" of the Amazon River on television and remembering a book at home about "all the nature," but he could not remember what was in the book or what his school had taught him about nature. He believed that those photographs with good weather represented nature.

Chen-Yu and His Mother (3)

The mother stated that the entire family enjoyed nature. She believes that parents'
and any close friends and family members' influences were very crucial to children. She
said that Chen-Yu showed an interest in nature from the age of 2 and that he loved to
observe insects with his older brother. She believes nature can broaden and strengthen
children's views and minds. They often read together and learn through hands-on
activities such as gardening. She believes her child's ideas about nature were mostly from
reading, because Chen-Yu likes to read. She does not recommend e-learning for children
at this age. She encourages children to explore and nourish their curiosity. She believes
nature makes children learn to be humble and cherish what they have.

Chen-Yu responded to the question of how do you know this (the drawing) is
nature, by saying, "I saw it outside" and "I can tell by looking--you know it by
watching." He knew ladybugs were having babies on plants and recognized a lotus
because he "watched." He stated that they go to play ball on the weekend, but stay home
if mom is not in a good mood. His mother did mention that one of his favorite outdoor
activities is kicking balls.

Jin-Ruei and Her Mother (4)

The mother said she liked nature a lot, but her child did not show a particular
interest in nature. Because the summer is Taiwan is hot and humid, it is not ideal to take
children outdoors. She believed children learned ideas about nature mainly from school
but that direct contact with nature made a stronger impression on children. They did not
often visit natural areas unless others invited them.

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An-Jhen said she grew up with her grandparents in the countryside. She said she kept playing on the computer "from [beginning on] Mondays" and got up early on weekends to play more on the computer. She also watched television with her mother after school. She did not start the drawing right after the prompts, but after looking at the photographs she got the idea and included many things like a pond, fields, and squirrels in her drawings. She said she knew her drawing was nature because of the photographs shown to her in the interview. She was aware that there were some books that told about nature, but she never read them. "There were some at mom's office. They teach nature there." Her mother's occupation is education-related.

Summary. Using the constant comparison method, I read through the transcripts, codes, and surveys of each parent and child pair and constantly compared them to find similarities, contrasts, or salient perspectives. Reading all the transcripts and surveys multiple times brought the data analysis to a proper close. This process and results were also interesting. Some parents valued nature highly, but their children did not seem to care much about nature. Some pairs were just the opposite. And some pairs matched so well that one could not mistake them even if their names were masked. Even though there is no one way of parent-child causality on the topic of children's ideas and experience of nature, there is almost no doubt that children remember many occasions with their family in nature. Those meaningful experiences may not directly link to their mature understanding of nature from a science perspective, but those memorable moments play an important part in children's daily life. As a result, I argue that parents have a profound influence on their children's experiences in nature and parents should capture those moments and make them meaningful moments. These results support with those in the

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section on the source of ideas. The parents' influence may convey more insight and be more unforgettable to children than the parents realize. Children remember their time with parents in nature and what their parents told them more than what books or schools have taught them.

Summary

The findings were organized according to the research questions. Five themes emerged from the children's definitions of nature. First, children use different elements to define nature. Second, plants create the space called nature. Third, nature sometimes contains different degrees of natural and artificial elements. Fourth, nature grows and moves. Fifth, human beings are not part of nature.

Most children expressed positive feelings about nature. They enjoyed nature because of its aesthetic and social value as well as the chance to interact with living things. Fears and dislikes of nature sometimes arose when they felt helpless or encountered insects they did not like. Children's definitions are developed mainly from what parents and grandparents have told them and their firsthand exposure to nature. This is very different from most literature that states contemporary children learn about nature mainly from media, although they learn the best by direct experience.

In terms of children's daily lifestyles, the study shows that weekdays are mostly for homework and after-school class; and visiting nature is often part of the weekend family activities. What activities children usually do in nature are reported as part of their daily life as well. They do physical and social activities, enjoy the beauty, and interact with living things in nature. Regarding the time factor in the model, it reveals that children remember many meaningful moments with their family in nature. However, it

was learned that often parents miss those teachable opportunities to make these experiences meaningful to children.

Parents' ideas and influences on children's experiences of nature are reported mostly from the parent's points of view. Coaxial comparison was performed to see how different factors may be associated with each other. It was found that most parents in this study are inspired by nature and are very willing to bring their children out to nature. The most visited natural places are parks and the mountains surrounding the city.

In comparing all the data, there is no one salient factor that can make children have a better understanding of nature. While the sample size is small, it shows that each personal learning route and the influential factors varied. Hence, I used the CML to visually frame all those influential factors learned from this study. My experience as a researcher in this study grappling with data analysis and interpretation shows that the model helped me to see a more holistic picture of what influenced children's experiences about nature.

Chapter Five: Discussion

The present study sought to investigate children's conceptions of nature and understand the factors that influenced them. Twelve children ages 5 and 6 were prompted to draw a picture of themselves in nature and interviewed about their thoughts of nature and their daily lifestyle. At the end of the interview, eleven photographs of scenery with different degree of naturalness were shown to them to see if they thought those photographs presented scenes of nature. These twelve children's parents participated in a survey, and their responses were matched with the children's to study the family influence. Parents wrote responses to questions about their ideas and attitudes toward nature, their observations of their children's interests in nature, and their family activities. Those questions were designed to cover aspects of the personal, sociocultural, and physical contexts that change over time in the Contextual Model of Learning (2000).

Research Questions and Summary of Findings

Results were organized in a way that could inform the five main research questions. The fifth question was intended to ask about the influences of children's interests in nature, but was broadened to include children's ideas and experiences of nature. The question was expanded for two reasons. First, children in this study did not have much to explain about their interests in nature. Second, parents and other physical contexts, such as surrounding environment, did not seem to directly influence children's interest, but did affect the kinds of activity and access to nature.

1. *What are children's conceptions of nature?*

   a. *How they define nature*

The five themes that emerged from children's definition of nature were learned from their drawings, interviews, and photograph interpretations. First of all, children included different things in their definition of nature. Second, children thought plants are essential for nature. Third, children have a sense of different degrees of nature. Fourth, nature moves and grows. Finally, human beings are not nature.

b.   *What are their interests in nature*

As for children's interests in nature, most children expressed that they like nature, but did not elaborate on it. It was learned from parents' observations of their children that most children did show interest in nature. Most parents also responded that their children often expressed a desire to engage with nature. However, parents thought children started to show this tendency at different ages. No data confirmed that all children showed their interests in nature at a specific age.

c.   *How they feel about nature*

As for children's feelings toward nature, most children had a smiling face in their drawing and responded in a positive mood in the interview. They enjoyed nature for different reasons. Mainly they appreciated the beauty of nature, their social interaction and physical activities in nature, and the chance to observe living things. Parents also noticed that children enjoy nature, but for different reasons. They thought children liked nature because they can interact with living thing and enjoy the atmosphere of freedom that nature provides. There were also a few occasions that children mentioned those not-so-enjoyable insects. Nevertheless,

their tone when talking about these occasions was filled with excitement and confidence.

2. What are the sources of these ideas about nature?

There is a difference between the children's and parents' views on where children learned their ideas of nature. Most children mentioned things that they were told by parents or grandparents or that they learned from simply watching nature. On the other hand, parents thought children mostly learned ideas about nature from school and books and other audio and video media (Figure 4).

3. How do children's surrounding environment and lifestyle influence these ideas?

To study the possible physical contexts that might influence children's ideas and experience of nature, I investigated both the children's and parents' views about their surrounding natural environment and after-school activities. I found that most children did not spend time in nature on the weekdays. They are busy with homework and spend time in after-school class. On weekends, most parents were willing to take their children to nature, among many other items on the family agenda, necessary to meet everyone's needs. Families in this study often visited natural areas such as mountains, parks, and riverfront areas in or near the city. Children often remembered these occasions with their family in nature doing physical activities, enjoying the aesthetic scenes, and interacting with family. Some children told me about their nonstop walking when hiking, a popular activity among the families in the study.

4. How do parents think about nature and children's ideas of nature?

Following the results which mainly focused on children's personal and physical learning contexts (see the Contextual Model of Learning in Figure 1), this paragraph

reports the summary of results from the sociocultural aspects, which are mainly about family influences. Before discussing the parents' influence, it is necessary to first present what nature means to parents. Most parents in the study were inspired by nature. They wanted their children to benefit physically from exercise in nature and from contact with living things, but they personally also experienced nature as a mentally and spiritually comforting place. Most parents believed they influenced their children's interests in nature by taking them out into nature, providing them with materials about nature, and guiding them to appreciate nature. Further, I performed several coaxial comparisons with other survey responses to see any correlation among parents' ideas or with children's ideas. It was found that, first of all, parents' fondness for nature did not necessarily promise a more complex understanding of nature. Second, most of the parents who liked nature also thought their children liked nature. Third, those parents who believe in the benefit of direct contact with nature tended to be motivated to often take their children outdoors. Fourth, families whose children often expressed their desire to engage with nature often made the decision to go according to the children's needs or interests. But deciding which natural environment to visit might not be based on the children's favorite places. Finally, parks and mountain areas are the most often visited natural places by families in this study. No matter what kind of dwelling the families live in, hiking is a popular activity among them.

No clear patterns emerged in several items that were examined by application of coaxial comparisons. First, no consensus was found on whether parents thought children's interests in nature are innate or not. Second, that belief about innate fondness did not reflect how parents thought about the continuous school education on the topics

on nature either. Third, it is interesting that although some parents claimed they like nature intensely, it does not necessarily motivate their self-reported behaviors of taking their children out to nature. Fourth, there was no apparent difference among the families' surrounding environment and the frequency and activities in the natural environment. Finally, both parents' and children's gender did not seem to be a factor in parenting style in terms of nature-related issues.

5. What influences children's ideas and experiences in nature?

To inform the fifth research question, three methods were used to see how all these factors together influence children's experiences and ideas of nature. The first quantitative method used a scoring rubric to convert children's definition of nature, learned from drawings and interviews, into a numeric rating. The rating scores of the children were also compared in terms of their genders, grades, and school systems. It was found that girls, first graders, and the ones in public school showed a more complete understanding of nature than boys, kindergarteners, and the ones in independent schools. Since the sample size is small, the results only suggest implications as variables for future studies. The scores were also compared with parents' scores on their definition of nature and all the survey responses. The results suggest that no one practice in a family can solely contribute to a more complete understanding of nature.

Second, I used the Contextual Model of Learning to organize the themes that emerged from the study in order to conceptualize the interrelations and more fully depict these interacting factors. The model helps to view what nature personally and socioculturally means to children in their physical context (Figure 6). Personally, children's own innate interests draw them to nature. In nature, they are active physically,

use their imagination, develop intimacy with nature, satisfy their curiosity about living things, and, finally, enjoy the beauty. Socially, children interact with friends and families in nature. In terms of space, the city in this study offers its citizens access to mountains, parks, and riverfront recreation areas. Regarding the time factor, children told me about their memories of meaningful moments in nature either with family or friends. Another way to use the model is to organize the factors that influenced children' ideas and experiences in nature in the three different contexts (Figure 7). Again, personally, children's interests and desires to engage with nature affect their daily experiences in nature. Socioculturally, this society that highly values education shapes children's after-school time. Parents' attitudes and family agenda also affect how often and where the family visits nature. The results also indicate that parents sometimes miss their chance to use these family outdoor outings to make the children's experiences in nature meaningful. Sociocultural reasons that may limit families' visits to nature include parents' safety concerns or the more general idea of adults that children could get dirty playing in nature. In terms of the physical context, access to nature affects how often and where the families visit. Weather, traffic, or time constraints may stop parents from taking their children to nature.

      With the last method, each matching pair of child and parent transcriptions was constantly compared to look for insights. Whereas the first method showed no one family practice that contributed to a child's more complete understanding of nature, this method found that many children remembered moments of physical activities, social interaction, or encounters with animals when they visited nature with their families.

Theoretical Framework

Theoretical contribution of my study to the CML includes several perspectives. First, the study shows that the CML theoretical model can help to organize and understand a phenomenon in a more comprehensive and structured way. Many underlying assumptions about learning under the framework were revealed in this study. Second, the findings reveal that each learning experience is contextualized in personal, sociocultural, and physical influences. Although the model focuses on learning in museums, there are many similar characteristics between the learning in my study that educators can gain insights for. Vise versa, my study extends the vision of the model out of museums into nature. Third, there are also instances that the model does not fit to this study, since the nature of the settings is quite different from a museum setting. A few questions for the model are also raised from comparing the study with the CML.

The study shows that the CML is an appropriate framework to frame research questions and data analysis. To investigate factors that influence children's conceptions and relations to nature, the model was used to ask questions like: "What are the sources of these ideas about nature?" "How do children's surrounding environment and lifestyle influence these ideas?" and "What influences children's interest and experiences in nature?" It helps to cover layers of impacts and look at a problem thoroughly. The model also helps to structure the findings and to understand the phenomenon in a comprehensive ways (see Figure 6 and 7). Falk and Dierking (2000) argued "What [a learner] learned in one place was part of what [a learner] learned in some other places; all were intertwined—so intertwined that they challenge our ability to reliably extract from [a learner's] memories what was attribute to [a particular] experience and what was more

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appropriately attribute to some other, related experience. This is not a flaw of our approach but rather a reflection of the realities of learning (p. 147)." They further urged the ones that use the model that "the framework provided by the Contextual Model of Learning did not simplify the task of understanding what [a learner] learned, but it did provide a road map for our inquiry. The model permitted a thoughtful and reliable approach to considering the complexity and richness of the learning process without significantly compromising salient parts of the data. … By no means complete, the three contexts we have proposed provide a starting point from which to think about how to learn about free-choice learning."

They posited that often the traditional means to assess museum learning used the inefficient method and assumption of looking for evidence of learning of a few specific ideas or looking for generalizibility. The free-choice learning is usually unlike school education that intends to measure specific learning objectives, assuming learning follows a prescribed and predictable course. It is also true that sometimes the "learning outcomes" are hard to measure. My study stands on the same position. The framework helps to look at learning from a more comprehensive and holistic way, but at the same time, does not promise causality. For instance, my study tried to investigate what influences children's ideas and experiences in nature, but I do not argue all parents and teachers should follow the findings so that it will promise a child with better understanding and closer relationships with nature. The many factors developed in this study from the structure of CML provided focus for future studies for collecting more in-depth information for each influencing factor.

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Under the overarching assumptions about learning and the overall structure provided by the framework, many main elements in the framework are reinforced and extended by my findings. The findings reveal that each learning experience is contextualized in personal, sociocultural, and physical influences. Falk and Dierking (2000) summarized from numerous studies that museum learning has 8 important focuses that affect learning in these settings: A.) Personal Context: 1.) Motivations and expectations; 2.) Prior knowledge, interests, and beliefs; 3.) Choice and control; B.) Sociocultural Context: 4.) With-in group sociocultural mediation; 5.) Facilitated mediation by others—the role of museum staff as facilitators of learning. C.) Physical Context: 6.) Advance organizers and orientation; 7.) Design; and 8.) Reinforcing events and experiences outside the museum—the larger community society-wide context.

Every child in this study drew different pictures and had developed their own definition of nature, included different things in their drawings of nature, remembered varied experiences of nature with their families and friends, and talked about different places they played outdoors. They also linked nature (learning) with positive affections as the model proposed that learning is intrinsically emotional-rewarding. Parents also held their own beliefs, motivations, and interests in nature and education that influenced where and how often they brought their children outdoors, what they did together and talked about as a family in nature. Children's voices may also affect parents' decision-making, since children are also members of the family group. Parents may take their children out more often when their children show obvious interests in nature. The mutual effect mediated the learning within a family as the model proposed. Furthermore, the larger context of their living environment shapes these learning occasions. Children talked

about some novel and vivid experiences in nature as the model suggested an optimum amount of novelty of the environment triggering learning. Children also talked about the places they routinely played in nature. I believe this reflects the CML's point of view that humans like to have some familiarity and control to navigate in their learning environment, but not too much so that they get bored. How easy the access to nature or the public transportation and weather could decide if the parents want to go out. School testing schedule, homework load, and how parents prioritize these things also affect a family's visits to nature. How the society values and operates the education system also affects individuals, families and schools. With children's continued experiences in nature, their knowledge is added, reinforced and accumulated for them to remember and utilize in the future. Children also remember many occasions with their families and friends in nature. Those vivid moments can become the seed of knowledge, attitude, and behavior toward the environment. The ongoing learning never ends.

Moreover, there are many similar characteristics between the two where the details in the model help educators keep in mind that learning in nature is often about where children make their personal meaning out of the sociocultural mediation. The model supports my arguments in the implications discussed later in this chapter. Children need to feel confident and in control of their choices of learning and their learning environments. Adults need to support free-play opportunities and facilitate meaningful moments in the learning environment. Schools need to design a curriculum that gets students familiar with their environment so that they know what is happening in their world, what to expect, and what is novel to learn. Teachers also need to be aware that

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each child brings their personal prior knowledge, motivations, and beliefs about nature to the classroom.

Falk and Dierking (2000) recognized "Learning in museums is different from learning in any other setting by virtue of the unique nature of the museum context. Although the overall framework we provide should work equally well across a wide range if learning situations, compulsory as well as free-choice, the specifics apply only to museums (p. 136)." Since museum learning and children's learning about nature are both unique in many ways, apparently not all elements are applicable to my study. Although museums are situated in the large society and education system, the biggest different between museum learning and nature learning is that most museums are still bounded in a construction. It is designed by human beings with specific agenda behind the design. However, if we include *some* degree of humanmade things, adding the idea learned from this study, we can argue that many educational signages, trail facilities, and educational programs are important in supporting children and families to learn in nature, such as parks and mountain trails.

Very few questions are raised after comparing the study's results and the CML model. It is unclear, whether the ever-changing nature of learning is considered as the time factor or under the physical context: Reinforcing events and experiences outside the museum (outside nature) (the 8th focus of the model). Or, it should be under the prior knowledge that children bring to a certain setting (the 2nd focus of the model). In some sense the 8th focus of the model could also be considered as the larger education system constructed under the society's belief and value. That can be the sociocultural context. These questions are not to controvert with the model, but to challenge other researchers

when taking the model as a theoretical framework. After all, the model emphasizes that these aspects intertwine as time goes.

<p style="text-align:center">*Children's Conception of and Relation to Nature*</p>

An Already Developed Understanding of Nature

Children aged 5 to 6 in this study showed they already have a basic conception of what nature is as well as an understanding of the word itself. In Littledyke's study in 2004, only five out of 46 children were able to provide an answer to the question, "What do people mean when they talk about the environment?" Louv (2005) also discussed in his book the nature-deficit disorder phenomenon of children in the United States, where children in modern society are severely lacking in outdoor free-play time. Because of these concerns, I had prepared the photographs so the children would get an idea of what we were talking about in this study. Surprisingly, only one child needed those photographs to start the interview. The concern that children might not be familiar with the Chinese term nature 大自然 was unwarranted with children who were 5 and 6 years old. Children did not look blank when asked questions about nature. Some ideas might not have been developed enough to provide me with a consistent definition of nature, but none of the children were so far afield that they could not respond to all of the questions on the topic.

In addition, the study showed that children at this age had varied complexity of understanding nature in terms of their definitions of nature learned from their drawings and photograph interpretations. This leads to another discussion of item C in my coding of children's drawings. C was meant to score those children with an overarching correct and consistent idea of nature. However, the *correct* definition was based on my personal

definition of nature as anything except humanmade things and their interrelationships with the whole. My intention was not to judge if the child had correct *science-based knowledge* (Hart, 2007, p. 700) or how knowledgeable he or she was. Rather, I tried to use the rating to determine the complexity of the children's ideas of nature and how solid was their belief in their definition. One child in the study consistently told me the photographs were nature because it is beautiful. Is that incorrect? My rationale is that this definition cannot exclusively describe nature. Thus, I did not give her a point for item C: an overarching correct and consistent idea of nature.

> *Suan-Hui: [This is nature because] It is beautiful. Because there is a deer. And*
>
> *here are flowers. Deer can eat flowers. And the scenery is beautiful.*
>
> *Amy: Is your mom beautiful?*
>
> *Suan-Hui: [She is] beautiful too.*
>
> *Amy: Is your mom nature?*
>
> *Suan-Hui: No.*
>
> *Amy: So nature must be beautiful?*
>
> *Suan-Hui: Yes.*
>
> *Amy: So what is beautiful is not necessarily nature?*
>
> *Suan-Hui: Yes.*

Daily Life Reflected in Conception of Nature

None of the children in this study drew wild animals (e.g., tigers) or landscapes (e.g., rainforests) that are not often seen in their living environment. Littledyke (2004) found that many primary school children talked about animals in their definition of the environment. She argues that their definition is influenced by their frequent contact with

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pets and anthropomorphic representations of animals in children's books and television programs. Rickinson (2001) summarized relevant empirical studies of children's conceptions of nature in his thorough review of learning in environmental education and Walker and Loughland (2003) drew their conclusions from interviewing more than 2,000 elementary and secondary students in Australia. The authors of the two articles found evidence of the vital impact of the media on children's ideas of nature. It is not just books and television programs that shape their ideas. Imagine how many animal characters children have been exposed to on clothes, toys, and on decor from the time they were born! Also, informal educational institutions such as zoos provide the chance for children to see animals outside their own daily context. Yet all the children in this study drew small animals that are often seen in the city where they live.

The drawings honestly reflect children's contact with nature in daily life. Their daily life and immediate environment also reflect on other elements of their drawings. The coding system for the children's drawings was modified from the Kalvaitis study conducted in the United States. In addition to the fact that no children's drawings in this study showed any sign of symbolic style or time period, many other elements in the original coding system were absent in this study. For instance, I removed elements such as evergreen plants, cactus, pets, snow, sports, and work (academic and chores). Lack of evergreen plants, cactus, and snow reflects the climate of Taipei City. Things that are often connected with nature in the United States, such as a tree house or backyards, probably would not appear in Taiwanese children's drawings. Sports like ball games are probably still not popular among children at such a young age.

What children are doing in the drawings of nature is also very similar to what they told me they did in nature in the interviews. In their drawings, they were biking with mom, posing for pictures, watching the sky, playing Frisbee with friends, watching flowers and observing ants, resting, and spacing out. In the interviews, they also mentioned doing physical activities, enjoying the beauty of nature, observing with living things, and interacting with other people in nature. I believe the similarity indicated that their drawings of nature truly reflected their daily life.

Children's responses in the interviews also accurately reflect a phenomenon of modern Taiwan society. In the interviews, I noticed that when I asked children where they had seen nature, several told me "at my grandparents' home." Or, when I asked them what they usually did on weekends, they told me that they regularly visited grandparents in southern Taiwan. While many young people (the children's parents) move to big cities for more job opportunities, the older generations stay behind in smaller cities or the countryside. Considering the geographic scale of Taiwan, families are able to frequently visit grandparents during the weekends. Grandparents in the same city (probably like those in countries everywhere) help the busy working generation in the middle raise the youngest generation. Consequently, half of the children voluntarily mentioned their grandparents in the interview. It was either the grandparents who told them something about nature or they saw nature at their grandparents' place. This is another example of the sociocultural and physical contexts that influence children's lifestyle and possible access to nature.

Nature and Living Things

The literature review indicated that most children thought of nature as a place where animals and plants live (Bonnett & Williams, 1998; Littledyke, 2004; Shepardson et al., 2007). In this study, children thought plants more often than animals represent nature. Plants were a must-have. Or the space created by plants might be called nature. As mentioned in Chapter 4, plants not just *live* in nature (Littledyke, 2004; Shepardson et al., 2007), but they themselves *are* nature. Similar results from other study is that Phenice & Griffore (2003) found 74% and 66%, respectively, of studied children under 6 years old answered "Yes" to the questions Are trees part of nature? and Are plants part of nature? Bonnett & Williams (1998) found also that some children thought nature was only plants. The statement is close to the idea that children clearly thought "nature is where the plants are" in this study. Animals--mostly insects--were often in their drawings. But in the interviews, some children were not sure if animals were nature. Maybe they thought animals just live in nature, but do not represent nature. Regardless of whether animals are nature, nature is a place where children encounter animals and can interact with or observe them.

De-Lu: And this is a little deer (pointing to the photograph).

Amy: Is deer [nature]? Is a deer nature?

De-Lu: No!

Amy: Why?

De-Lu: Because it has no grass, no flowers, and no trees. It is nature's animals.

In this study, children talked about nature as it moves and grows things. During the interviews, I was pretty sure that they must have mixed up the definition of nature

with that of living things. It is unfortunate that I did not have a chance to check with the school teachers to see if they had been teaching about living things around that time. However, as I analyzed the data, I started to realize maybe the children linked nature with living things for a reason. Maybe they think nature is alive. Maybe they think living things are the most important thing in nature. Although they might have mixed up the definitions, the definition that nature moves and grows makes sense. My instant judgment during the interviews might have mirrored my thinking, shaped by my past school science learning which was sometimes about memorizing precise definitions of scientific terms. Cobern (1999) compared ninth graders' ideas of nature with science teachers' and science professors', who went right into their "science talk" whereas the ninth graders talked about nature from diverse perspectives: aesthetic, religious, conservationist, and sometimes scientific. Future research may want to investigate this: How young children see a difference between living things and nature. The finding might tell us more about how children see nature.

Interrelation of Humans and Nature

The literature indicated that children were able to see the interrelation of humans and nature (Shepardson et al., 2007; Loughland et al., 2002; Bonnett & Williams, 1998). In the interviews of my study, some children mentioned the relationship as human beings in need of fresh airs from trees, but they made rare references to the interrelations of nature in their definitions. In the drawings, it is hard to observe the relationships between themselves and nature, especially when most children did not draw themselves moving or add much description to their drawings. They did later tell me they were biking with mom, posing for pictures, watching the sky, playing Frisbee with friends, watching

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flowers and observing ants, resting, and spacing out. I interpret these as the personal relations that children in this study had with nature. However, the drawings and interview did not show how ecologically humans are related to nature or how living and abiotic things are interdependent. After conducting the interviews in Lu-Dye elementary school, I had a chance to see an entire classroom wall of students' drawings. I proposed my question to the teacher: "Do children at this age mostly draw human figures standing upright without moving as I had observed in all the drawings on the wall?" She responded that it was so. I believe it could be hard to understand the relationships between children and nature from drawings without much action drawn or description written (Shepardson et al., 2007). From this aspect, interview data might be a better means in this aspect.

Past studies showed that children at this age have not developed mature concepts of the interrelations of nature. Loughland et al. (2002) found that primary school children in the United Kingdom more often used objects than relationships to define the environment than secondary school children did. Littledyke (2004) also found that children learn from their local environment first and gradually move to an understating of the complex relationships in the environment. It could be that children at this age still do not see nature from the perspective of relationships. Or they just have not matured enough to develop those complex ideas about nature.

It is worth noting that researchers may stress different attributes of nature itself. Cobern and his colleagues (1999) sought to find if ninth graders viewed nature from its attribute of order and pattern, which is an important element in elementary school science objectives according to the American Association for the Advancement of Science

(AAAS, 1993). They found that ninth graders in the United Stated did not talk much about ideas learned from school after 9 years of schooling. Rather, they linked nature with personal life experience that was not related to school science knowledge. For example, students talked about finding peace and pleasure in nature.

The literature review in Chapter 2 also indicated nature could mean different things to children when their standpoints change. Bonnett and Williams (1998) found that children thought of themselves in some sense as part of a natural process and interdependent with it. They knew that humans need nature for life. On the other hand, children also thought that nature was separate from their everyday life. Payne (1998) also found most sixth graders in his class believed that nature is the same as the environment, and that nature does not include humanmade objects. However, when the context was narrowed to their local environment, about half the children began listing some humanmade objects but left out others, and the rest of the children continued to exclude humans and humanmade objects in their drawings. Similar results were discovered in my study even though I did not purposefully include such investigation in my research question. I found, in most children's drawings, they seldom showed humanmade things as the main element in the drawing. Only one child had a high-rise building in her drawing and the other drew only a plane because he only knew how to draw planes. Others drew humanmade things, such as Frisbees for playing, bikes for biking, and planters for flowers (Figure 8), as a relatively small proportion of the picture of their activities in nature.

Figure 8. Children's drawings with humanmade things

However, when I showed them photographs that they might or might not be familiar with, their tolerance for humanmade things increased greatly. Future studies might want to compare the proportion of humanmade things in children's drawings of nature in order to learn their ideas of humanmade things in the definition of nature and the human-nature relationships.

My study aimed to investigate children's understanding of nature as it is the fundamental basis for environmental education. Adding the human factor to nature, it becomes the core of environmental education learning: the human and nature relationship. Therefore, understanding human–nature interrelation is important for children at this age in order to be competent in environmental literacy as it is designed in the curriculum guidelines. Pozarnik (1995) also argued that the human-nature relationship as the basis for children's future development of environmental ethics. Some of the themes derived from this study may be the leverage points for teaching this relationship. First, many children do not think humans are nature. Second, most children do not think humans are related to nature. Third, children seemed unsure if nature should include humanmade things even though they have a sense of the different degrees of naturalness.

This uncertainty about the extent of human beings involvement in the definition of nature does not only occur among young children (Bonnett & Williams, 1998;

Shepardson et al., 2007). A study of Chinese secondary teachers (Ma, 2009) also found

that they struggled with the degree of human involvement when they defined nature. I

argue that children's sense of the different degrees of nature found in this study can be a

discussion point to start the conversation about the human role in the environment.

School teachers and curriculum developers need to be aware of children's uncertainty

about including human society in the environment and to emphasize human beings

possible roles in the environment, as the guidelines suggest.

Comparing Curriculum Guidelines with Students Existing Ideas

Finally, the current environmental education curriculum standard in Taiwan is

compared with the results from this study. It is shown that children's existing ideas of

nature might align well with the existing school environmental education. However,

based on my findings I argue that more emphasis on human's involvement in the

environment is needed. The national Grade 1-9 Curriculum Guidelines include

recommendations for environmental education, which is the targeted subject of this study.

The science guidelines of course also include the topic of nature, but are not as focused as

the environmental education guidelines. Thus, the environmental education guidelines,

especially the competence indicators, were compared with the results from this study. The

purpose is to understand what children know around the time they start school and what

children need to learn from the curriculum. Furthermore, the intention is to study if the

curriculum standard design is based on and expand from children's existing concepts.

Competence indicators for environmental education are listed under five

categories of learning goals: Be perceptive and sensitive to the environment,

environmental concepts and knowledge, environmental value and attitudes, environmental

action skills, and environmental action experience. Examples of competence indicators are as follows: To use the five senses to experience and explore things in the environment (1a); To know the surrounding natural and humanmade environment around animals, plants, and microorganisms, and their interrelations (2a); To understand what role human beings play in the ecosystem and the relationship between the natural environment and human beings (3b); and To participate in community environment protection activities with families or teachers (4a). See the full list in Table 1.

Environmental education includes the roles of human beings, the society, and the environment (as defined in the Environmental Education Law). However, it is worth noting that this study does not directly investigate children's ideas about *the environment*. It focuses instead on children's ideas of *nature*. When making any comparison or implications from what children know in this study to what they need to know in environmental education, we have to bear in mind that this study was not meant to include children's ideas of human involvement in the environment. In another word, children's lack of concepts about humanmade materials and human society could be due to the nature of this study.

It is shown that children's existing ideas might be well transited into the school environmental education. Children in this study already showed some degree of understanding of the competence indicators listed in Table 1. They used their eyes and noses to explore nature. They learned to understand nature from their surrounding environment. They have curiosity about living things. They can use language and drawings to express their ideas. Yet, there could be greater achievement for first and second graders as they begin their nine years of compulsory education. None in this study

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had mentioned ideas about microorganisms. The interrelations of nature and the roles of human beings still need to be learned. Many children in the study were not sure whether human beings are part of nature. Yet, their ideas of different degrees of nature may be a good start for including humanmade things in the idea of environment that focuses on the interdependency of humans and nature. In addition, the ideas of conservation and participating in conservation action need to be learned. However, because the study did not touch on these issues may be the reason the children did not include these ideas and actions.

Possible Influential Factors

Rickinson (2001) summarized from a group of studies that many factors may affect children's perception of nature: socioeconomic setting, gender, experiences of nature, age/cognitive development, and the media. He argued, however, that many of these influences are "speculative rather than conclusive" (p. 277) in this group of studies. I compared children's rating scores of their definition of nature in terms of their age, gender, and school systems. As I discussed earlier in Chapter 4, these variables that I tried could become in-depth interview items for a future study, not the basis for conclusion about any trends among these children. Moreover, the results from parent surveys did not shed light on these variables either. Most responded that they treated boys and girls in the same way when they are in nature. In the early stage of designing my study, the school system variable was also used for selecting participants across different backgrounds. However, none of the parents mentioned any sort of philosophy of education or attitude toward nature learning that would apparently relate to their choice of school for their children and consequently influence children's conceptions and relations to nature.

Human Bond With Nature: Innate or Learned?

One of the themes that emerged from the literature review in Chapter 2 is that children connect nature with feelings. In this study, most children showed a positive affection for nature in their drawings and interviews. Yet the affection mentioned in the interviews is subtle. A few showed a deep connection to nature, but most did not. Unlike some cases in the documentary *Where do the children play?* (White, 2007), no children in my study felt that nature was a sacred place to him. Nor was evidence of children's innate love of nature found in this study. Some parents claimed their children started to show interest in nature from a very young age. However, I did not see these children's enthusiasm for nature in the interviews. Could it be that children show curiosity about everything when they are very young? Their bonding with Mother Nature or motivation to pursue nature was not so strong that I could claim children in this study are biophilia (Wilson, 1984). I also did not observe that every young child in this study has a unique way of seeing and interpreting nature (Hyun, 2005). Even though they have no problem expressing their understanding of nature, most children in this study did not describe nature as a place of any significance. It might be that even though children in Taiwan have easy access to experience nature, they did not spend much time there or have much free-play time or that the biodiversity in the city (Turner, Nakamura, & Dinetti, 2004) was not rich enough for them to develop that kind of deep emotional and spiritual connection. Nature sometimes became the background for them to bike, chat with friends, or play swings in the park. Wals (1994) studied middle school students' perceptions and experiences of nature in the city Detroit, United Stated, and also described one of the themes emerged as nature as a background to activities. These urban adolescents' thought

many activities were more enjoyable in nature, but not required being in nature. In Sebba's (1991) study about 20 years ago, she found that many fewer children thought of nature as a significant place for them than did their parents. Gardner (1999) theorized that some people possess more of a naturalistic intelligence than others. Some children show the ability to recognize patterns in nature, distinguish species from species, and care and interact with nature and difference organisms. This ability was reflected by some of the children in my study. Some seemed to care more about nature or to have developed a greater sense of nature than others.

Kalvaitis (2007) studied elementary school children's ideas of nature and found most children like and love nature because it provides them places for play, work, beauty, freedom, learning, relaxation and as home. It is interesting that when Kalvaitis discussed this aspect of what children get and what nature provides, he also used the word "meet" to describe that nature has "met" many of these children and shares these things with everyone it "meets" (p.157). The same concept is used in my Figure 6 to show where children "meet" nature. It is more of a conceptual space where children and nature come across each other. In studying young children, Kalvaitis and I both have a similar observation about this children-nature relation. As I discussed earlier, these "meetings points" are more physical than biological or spiritual.

Children in my study often referred to nature as beautiful, an observation that echoes the results from the Kalvaitis study (p. 129). He found that children throughout elementary schools expressed the idea that nature is beautiful. This contradicts what Stoecklin and White (2008) concluded from other studies--children do not judge nature by aesthetics. As previously mentioned, parents in this study also did not believe that

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children liked to engage in or appreciate nature from an aesthetic point of view. I argue that children at this age have already developed a sense of beauty and enjoy nature because it is beautiful. A sense of appreciation the beauty of nature could be innate for human beings as well as the fear and respect to nature.

Some children also talked about their negative feeling toward some insects, and adults showed their dislike of nature because it is dirty outdoors or is dangerous. The fear resonates with Louv's finding (2005) about American parents. Worldwide, parents have genuine safety concerns. Parents in my survey also mentioned that as long as it was safe, they would let their children play freely in nature. I argue that if this fear comes from the powerful and unpredictable attributes of nature, then educating children about those characteristics would be reasonable and positive. Children can learn to respect and be humble in the face of nature's power. Parents and school teachers could then guide children's and their own negative feelings in the light of this consideration.

The results from the parent surveys indicated that many parents deeply value nature. They claimed that nature was a mental and spiritual retreat where they could calm their minds and find ways to solve problems in life. Families visited nature more often than I expected. Of course their self-reported frequency of visiting nature could be doubted, but I believe it is a fact that the parents cherish nature and are willing to take their children to enjoy nature as they reported. The fact that the parents were willing to use *some* weekend time to visit nature makes a difference and allows children to have some contact with nature. On the other hand, children did not articulate how they bond with nature in the same way. Take Yu-Ting as an example. She talked about how she likes to hug trees and talk to them, but she did not express this as, "Oh, nature is very

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important to me. It comforts me. I appreciate nature very much." Kalvaitis (2007) argued that children, especially young children like first and second graders, are not able to distinguish if nature benefits them emotionally, physically, cognitively, or spiritually. They are, however, able to see the reality that nature is satisfying and supporting their many needs at this point in their life.

So, if innate bonds between children and nature were not found in this study, what about learning from school education? Very few children mentioned that school education influenced their conceptions of nature. One mentioned that in the Living class the day before, they had watched a video: "The demolition day of Earth. Because we don't really cherish the earth. The Earth is going to be demolished. Also, however, it depends on the atmospheric layer. Some atmospheric layer has disappeared. Some are still there. Actually there is a layer of carbon dioxide inside the atmospheric layer." The other example is Yu-Ting. She told me she often goes to hug trees and talks to them after school. I asked her in detail how she found that particular tree on campus. She said they did a rubbing of the tree bark and she found this particular tree. Leafing through the Living textbook they used, I found the unit "It is Getting Cold." One of the activities is to learn about different trees species from rubbing its trunk surface. The unit includes four topics: The Winter Scene, Warm Winter, Preparing for Chinese New Year, and Happy Chinese New Year. Examples of activities in the first topic include asking children to observe the environment around them to see what is different in winter and what people do in different seasons. Second, finding a home for the falling leaves asks children to identify the falling leaves caused by the cold weather. Third, making friends with trees encourages children to hug trees and identify the trunk patterns. This last one maybe encouraged

Yu-Ting's interests in hugging trees. It is worth noting that the same activity did not prompt other children to tell me about hugging trees or making friends with them. Hence, even though one can claim that Yu-Ting's love of nature was merely because of her school class, her learning from school has influenced her after-school time. I conclude that some children showed a greater inclination and tendency toward nature than others.

Chinese Culture

My study also did not show clear impact from the Chinese culture to children's conceptions and relations to nature. Human activity on multiple scales forms its specific use of language, belief systems, value systems, and practices (Lemke, 2001). Culture, such as family culture and classroom culture, can affect what children value, how children think, and what children learn in environmental education (Barraza, 2001; Chenhansa & Schleppegrell, 1998). To extend the cultural context to a large-scale influence such as the cultural values in Chinese society, I compared two studies that targeted science teachers in China and Taiwan. In the study of Chinese high school teachers' views of nature and their understanding of the nature of science (Ma, 2009), it was found that teachers' ideas of nature were influenced by both traditional Chinese philosophy and modern science. Ma stated that while those traditional views are diverse, the concept of humans and nature as one integrated whole was well accepted among ancient scholars. Lin (2006, p. 80) also discussed the notion of a well-balanced and harmonious universe derived from eastern wisdom and its implications for environmental education. However, in my study, no children showed any tendency toward this kind of thinking or indicated any ideas that had obviously been influenced by traditional Chinese culture. Culture is ever changing. Today's young children live in a society that does not

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closely or directly rely on land and natural phenomena as in an agrarian society. The wisdom from the ancestors may not have been recognized or experienced in their daily life.

Liu and Lederman (2007) interviewed prospective Taiwanese elementary science teachers about their views on nature and the nature of science. They found that prospective teachers expressed views on a continuum from the one extreme that humans are dominant in nature to the other that humans live in harmony with nature. The latter is believed to align with the traditional Chinese conception. Yet more than half (61%) of the prospective teachers tended to hold the so-called western anthropocentric view of nature (Singer, 2003). But there is no clear trend showing a strong impact from ancient philosophies.

In Taiwan, older students will learn more about the ancient Chinese scholars and be more familiar with the many proverbs and idioms that implicitly talk about the relation between humans and nature. (A lot of times, the word *sky* is used to refer to nature, the universe, the supernatural, or the law of nature.) In future research, it will be interesting to learn how older students think of these old saying and if they voluntarily bring up these saying in interviews.

Parents' Beliefs and Concerns

This study did not show evidence that spending time outdoors promised a better understanding of nature. However, understanding how children spend time in nature provides us with insights about children's daily life learning. How children spend their after-school time is a complicated product of the parents' and children's choices within sociocultural values and practices. Many factors, such as the children's age (their

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independence and mobility) (Kalvaitis, 2007; Hofferth & Sandberg, 2001) and the time the mothers spend in the workforce (Hofferth & Sandberg, 2001), affect children's everyday schedule in the United States.

In Taiwan, education in general is usually highly valued by parents. Parents strive for children to get a better education from an early age in order to get into a handful of "star" public high schools and those top-ranked public universities and, finally, into a higher socioeconomic lifestyle. These widely recognized values in that society make the pressure and competition start from as early as kindergarten. The independent kindergarten, Pu-Lin, in this study is a bilingual (Chinese and English) school. Bilingual schools have become popular because they promise a greater competitive advantage in the children's future. In addition, Pu-Lin is located in a high-rise building so that the children have very limited outdoor play space. The independent elementary school, Gu-Shin, has a full-day schedule for children in first grade while most public elementary schools have only a half-day schedule. The public kindergarten, Ge-Chen, has homework for children to do after school. Si-Chen's mother stated, "I think they are doing a good job in Europe. They emphasize letting children explore what they want. Children in Taiwan spend too much time in school. Adding in the general belief in credentials, children need to practice skills for exams….They also have to spend time practicing skills for other talents [such as instruments].… These deprive the children of the chance to understand themselves and to have contact with nature (children need to feel from doing and learn from doing)." It goes without saying even longer hours are expected in middle and high schools, with many students going to cram schools after school both on

weekdays and on weekends. The time spent on schoolwork of course limits free play time after school.

Limited green space and parents' safety concerns for their children also constrain children's exploration and experiences of nature on the weekdays when most parents work late. People in Taiwan once reported the longest working hours in the world in the World Competitiveness Yearbook 2003. In the book *Last Child in the Woods— Saving our Children from Nature-deficit Disorder*, Louv (2005) discussed the reasons why children in the United States do not spend as much time in nature. The modern lifestyle of longer working hours, more study time, more time in front of a computer screen, and more time spent on other organized activities has made weekends no longer a time for leisure but rather for doing chores that piled up during the week. The other important factor is parents' fear, "fear of traffic, of crime, of stranger-danger—and of nature itself" (p. 123). This study resonates with Louv's conclusions in many ways. However, only one or two children talked about spending their after-school time on a computer in this study. One talked about the computer's educational programs such as Little Newton as opposed to games. I suspect it is because children at this age might not stay in front of the computer screens as much as older children. Or, it just did not come to their mind when I asked them what they do after school.

Within the context of modern life in Taiwan, I do not argue to change the current lifestyle of each family culture or claim that nature learning is more important than other aspects of young children's lives, such as language or arts. Because it is almost impossible for children to play freely in nature on the weekdays after school, weekend family activities become vital for children to have contact with nature. Of course, the

assumption is that good quality and quantity of contact with nature brings good learning opportunity.

Other Physical Context

In terms of the physical context in the Contextual Model of Learning, parents mentioned limited transportation and the convenience of pubic transportation in the city. Some also mentioned that those rainy days or the humid and hot weather made them not want to go to nature. In an essay comparing American 6- to 12-year- olds' leisure time in 1997 and in 2003, Hofferth (2007) found that children in the warmer states spent more time outdoors playing and participating in sports. Weather also influences learning about nature as one example of the larger scale of physical environment.

The direct evidence that their living environments influence children's ideas of nature is relatively weak in this study. However, it was concluded from the study that many families did use those public green space in the city as an important way to experience nature. Future researchers may want to study other factors that can better depict children's living environment as it relates to learning about nature. For instance, a study interviewing parents (Veitch et al., 2006) in Australia found that the yard size at home affected children's free play. Having a yard is rare in Taipei City. Therefore public space becomes important.

Some past studies (White, 2007; Lindemann-Matthies, 2005) talked about walking between school and home as a way to daily experience some nature, compared with riding on a bus or in a car. Since Taipei City is a very competitive region for getting into high-academic-performance schools, parents choose school districts for their children at an early age. Sometimes children go to schools, often the independent ones, in

other school districts (as shown in Table 4) so it is impossible for them to walk home, to say nothing of the fact that parents are still at work when children leave school and the safety concerns the parents would have about children walking alone. Otherwise, the walk from school to home might offer a daily chance to connect with nature in urban settings.

Implications

Based on the results from this study, the implications are constructed within four main points. First, from what was learned from the physical contextual factors, I suggest that urban designers add more easily accessed green space in the city, since children often utilize these spaces as a way to experience nature. The idea arises because many of the children thought green areas were essential in nature, that plants create the space called nature. In fact, connected green spaces in a city attract more animals and allow them to move from habitat to habitat. This way, the natural interrelations among living things and nonliving things grow from these green spaces and provide chances for children to learn about nature. Second, schools should develop a school-based and community-based curriculum that includes learning about children's immediate environment. The children's drawings revealed that their understandings of nature at this age are constructed from their surrounding environment. The national curriculum guidelines also expect children of about this age to learn about the organisms around them. Third, many parents appeared to deeply cherish nature and were very willing to take their children to nature while many children have only their weekends to go out to nature. Thus, I suggest parents not miss the chance to create meaningful moments in those weekend outings to nature. Finally, I discuss some characteristics I observed among the children in my study, especially in

regard to methodology, so that readers and future investigators may be aware of these issues.

To Municipal Governor—Creation of More Green Space in the City

In the study, it was found that children and parents talked a lot about the parks and riverfront parks in the city and mountains surrounding the city. Those serve as important natural places in Taipei City, despite the fact that those places may not be completely "natural." Schools and parents could design and arrange half-day near-the-city activities that have both easy access and are full of educational opportunities. The results showed that children believed plants are essential to nature. In some sense, the children are right. Green space attracts animals and the interrelations of nature can begin there. If the concept of habitat corridors in the city becomes a reality, they could provide children easy access to nature and, at the same time, access for animals to their habitats (Stein, 1993).

In Taipei City, the size of parks varies from less than 1,000 square meters to hundreds of thousand square meters. The small ones are scattered throughout the city, with the space comprised of trees and bushes, chairs, often a Chinese-style gazebo, and sometimes a few pieces of playground equipment. The big ones can also have lakes, stages, and the like. Riverside parks are mostly bushes and grasslands with bike paths. Urban designers should consider providing access to green spaces so that both children and animals can benefit.

Children's access to and safety in these public green spaces are things for urban designers and parents to consider. Veitch and her colleague (2006) also found that facilities in these open space areas may or may not satisfy certain age groups' interests. That is something for urban designer to consider as well.

To Educators—Development of Community-based Curriculum

In this study, only one parent mentioned school education when talking about what influenced their children's ideas about nature. Some parents believed that real experiences with nature have a bigger impact on children's ideas. Since children at the age of 5 and 6 have not or have only just started formal education, one might suspect that school education plays a minimum role in their understanding of nature. This is one of the reasons I chose children of these ages. I wanted to know what ideas children had before entering school and what ideas of nature they bring to school. I also wanted to find out how schools can be aware of these different ideas and incorporate them into school curriculum.

Cobern et al. (1999) suggested that schools create a science classroom and invite children to bring their important ideas to the dialogue. Schools should not just have children put aside their everyday sense-making about science and construct their understanding following one standard idea. Those who could not integrate their concepts about their own world tended to become left out of the school mainstream, which is often preparation for future scientists. Ideas about nature could be applied in both environmental and science education (Cobern et al., 1999; Ma, 2009). In order to understand what cultural beliefs children bring to class, Cobern (1994) urged teachers to often ask themselves how their students understand their own place in the world, especially their relationship to their physical world.

The *Excellence in Environmental Education Guidelines for Learning (K-12)* (NAAEE, 2010b), published in the United States, lists six essential underpinnings of environmental education: systems, interdependence, the importance of where one lives,

integration and infusion, roots in the real world, and lifelong learning. The guidelines also conclude that children expand their understanding from the base of direct experience in local connection with the environment and environmental issues. The reformed curriculum guidelines in Taiwan manifest the fact that school-based curriculum is already advocated by the government. Young children learn from their immediate surrounding environment first and then broaden their views. Stoecklin and White (2008) also argued that environmental education programs that are beyond children's cognitive ability and understanding, such as teaching rainforest destruction in the classroom, are not appropriate for young children. Rather, learning about their local natural environment that is part of their regular experience is more likely to produce environmental protection in the future (Chawla, 2006). Lindemann-Matthies' (2005) investigation of children's perception of biodiversity also found that children can get interested in creatures other than pets or exotic species as long as they get to learn something about those local species.

In this study, children's understandings of nature were mostly from their direct contact with nature, so it is important to maximize the use of children's surrounding environment for nature learning. Moreover, in a recent review of sustainable education (Wals & Kieft, 2010), the report pointed out that one of the sustainable education challenges for the Asia-Pacific region is the lack of a coordinated political leadership on key issues. Many time implementing new programs require political support. As the environmental education law in Taiwan just recently enacted, schools are empowered with and supported by the government. The guidelines in Taiwan also encourage integration of environmental education into other main subject areas: Language, Health

and Physical Education, Social Studies, Arts and Humanities, Science and Technology, Math, and Integrative Activities. The results from this study show that nature provides children with a sense of beauty and imagination (personal context), access to living things and curiosity (personal context), spaces for physical activities (personal context), and social interaction (social context) (see Figure 6). Schools can use these elements to integrate environmental education into other subjects that make the most sense for children. In addition, the education reform in Taiwan also added Homeland Education, which requires students beginning in third grade to learn about the natural and humanistic aspects of their immediate environment as well as Taiwan's history and natural resources. This stand-alone subject has historical meaning in the context of Taiwan's unique relationship with mainland China. The majority of history and geology textbooks used to be about mainland China with limited pages devoted to Taiwan's own lands. Homeland Education provides students with more opportunity to learn from their surrounding environment.

As the Ministry of Education in Taiwan plans to add kindergarten education of 5-year-olds into the compulsory education, it is urged that the government develop environmental education and science curriculum guidelines that meet kindergartners' prior knowledge of nature. Children at this age also need to learn about the role of human beings in nature and the interrelations of nature in order to develop environmental education ideas from the foundation of what is nature. Both pre-and in-service teachers need to learn about local environment to get students engaged in learning about nature around them. Community professionals and informal science and environmental

education institutes such as parks or environmental centers can provide classes for teacher development.

Home is also the most important place for children at this age. It would be even better if the school curriculum would include family practice for sustainability. Parents also expected schools to include family practice in environmental actions. "School should encourage families to work with them for ecology education. Maybe teachers can use their creativity to link their teaching with family practices," wrote the parent of Chen-Yu. The parent of Ning-Chen said, "It is good that children can learn more about ecology education. It is also helpful for parents. We left school a long time ago and have forgotten many commonsense facts and knowledge about nature. So I hope besides those normal subjects, school can teach more about nature ecology education."

To Parents—Use Opportunities for Meaningful Experiences

The results indicate four main findings about parents. First, in their minds, many parents have a strong connection with nature. They saw nature as a mental and spiritual retreat that comforts them and as a place to exercise and have contact with living things. Second, parents' impacts on children's ideas of nature may be greater than the parents believe. Children often recall those moments and activities they had with their family in nature. Third, overall, many parents are willing to visit nature as a family activity on weekends. Those that believing in the benefits of direct contact with nature also tends to often bring their children outdoors. It is interesting that although some parents claimed they like nature a lot, it does not necessarily motivate their self-reported behaviors of taking their children out to nature as often as others. Finally, parents may sometimes lose the chance to have meaningful moments with children when they are focused on just one

aspect of these outings. Say, when they go hiking, they just "walked and walked" and "did nothing." "Take hiking as an example; if it is too tiring, children will lose their interest in these kinds of quiet activities." I personally have the same kinds of memories of some of those hiking experiences. Since the altitude difference in Taiwan is great (as mentioned in Chapter 1), there are many waterfalls in the mountains. In my memory, there were lots of hikes that were just endless climbing to reach a waterfall destination.

Kalvaitis (2007, p.128) also discovered from elementary school children's drawings of nature that they often referred to specific remembered experiences that the child had had in outdoor settings. Chawla (2006) interviewed people to find what motivated them to put a tremendous effort into environmental protection in both the United States and Norway. He found that the two most frequently mentioned motivations were their positive childhood experiences in nature and a person in the family who had inspired them.

Children have curiosity about nature. Taking into account the fact that so many families in the study went hiking on weekends, I use it as an example. If parents can use those moments to slow down their steps and let children explore, maybe nature will teach the children something (Grade 1-9 Curriculum Guidelines 1.a: To use the five senses to experience and explore things in the environment). In their study of everyday parent-child science activity, Crowley et al. (2001) also found parents sometimes appeared to have the role of regulating the learning experiences of young children in museums and tended to lead children through the exhibits, offering only one-way direction instead of mutual interaction with children. I argue that parents do not necessarily need to *teach* their children nature-related knowledge, which they may not feel confident doing. Studies

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show that children learn best from interactive play, self-discovery, and direct sensory experience rather than from adults trying to impart knowledge (Stoecklin & White, 2008). The *Early Childhood Environmental Education Programs: Guidelines for Excellence* (NAAEE, 2010 a) in the United States also suggests that sometimes parents just need to follow their children's leads and support their curiosity. In my study, some parents did use those opportunities to chat with their children. Some told them a little bit about conservation and the interrelationships in the ecosystem or discussed how to face their fears of nature (Grade 1-9 Curriculum Guidelines 3: Environmental value and 4: Attitude and environmental action skills). Some just let their children observe living things (Grade 1-9 Curriculum Guidelines 2.a: To know the surrounding natural and humanmade environment, and animals, plants, microorganisms, and their interrelations). Parents could also use resources such as interpretative signage, booklets, or docents if they need assistance on these subjects.

Since environmental education stresses the interaction between the environment and human society, parents can bring up topics such as children's dislike of mosquitoes and ants. These discussions that stress the interrelation of humans and nature and human impacts on nature may not need parents to actually "teach" children knowledge as much as share thoughts and inspire critical thinking. As the parent of Si-Chen said, "Because the time he stays in school is quite long, most of the teaching is done in school. As for myself, I just let my feelings naturally come out. Children do sense that. They follow the mother's eyes to see 'what is mommy watching' and 'why is mom in such a good mood'."

Schools and nature-related informal educational institutions could develop family programs or informative materials to assist parents in these outings. Since the mountains, parks, and waterfront areas are very accessible to Taipei citizens, a half day is appropriate so that families can use the rest of the time for other family needs like shopping or dining out. In the curriculum guidelines, children are expected to participate in environmental conservation under parents' and teachers' guidance. There are also many parents who hope to have support from and connection with the school environmental education curriculum and practices, as discussed earlier.

To Researchers—Methodology Issues With Children at This Age

In thus study, both drawing and use of photographs were shown to be appropriate for learning ideas from children at this age. I wanted children to include themselves in the drawing of nature, because I wanted to know their real relation with nature and their definition of nature from daily experiences. I was concerned that children in the interview would just give me a textbook answer that did not reflect their own views. The results did not indicate any textbook answers. All the children's drawings seemed to reflect their direct contact with nature. None of the elements included in the drawings were things that children in Taipei did not have contact with on a daily basis.

Drawing is a unique way for children at this age to express their ideas. Most children in my study started the drawing right away without much shyness or hesitation. Only a few added writing to their drawings, mostly to identify family members and elements in the drawing. That only a few added labels is understandable because children at this age have not learned to write many Chinese characters. Nor have they yet learned

to read very much. A few children told me they were aware of books about nature at home, but they did not read them due to their limited reading ability.

The photograph method was also revealed to be an efficient way to understand children's ideas. It helped one child who had no idea what is nature or what to draw get the sense of what I was talking about. The task also helped another child to express his ideas about nature when he did not draw nature (he only knew how to draw planes) and in his interview when he did not provide answers directly related to my questions. In the photograph interpretation, however, he clearly defined nature as anything that is not artificial and not man-planted. If there had not been photographs, I would not have been able to learn much from him on the topic of nature. This again confirms the fact that different methods can elicit different children's ideas.

It was also shown that different methods helped to clarify children's thoughts. A few children included humanmade things or human beings in their drawing. However, in the interviews, the ones who included people clearly told me they do not think human beings are nature. If one interpreted only the drawing coding, that reader would probably miss much of the children's interpretation of nature. As I mentioned previously, only a few children included a small proportion of humanmade things in their drawings (Figure 8). In the interview they explained what these things are. One included a high-rise building and later told me it was her home. The others drew humanmade things for their activities in nature such as bikes, Frisbees, and planters. The interview helped to clarify children's thoughts.

It was also found from the drawings and photographs that children's inclusion of humanmade things in nature varied the most compared with inclusion of living things and

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abiotic natural elements. While they seldom used human-developed things in their drawings of nature, they were not so certain about the humanmade things in the photographs, such as a small town that included many houses and trees. One possible explanation is that children believed those outdoor photographs, such as a downtown city or an elementary school campus, represented nature (see Table 7). Phenice and Griffore (2003) also found that young children more often thought of nature as outdoors rather than indoors. This is not surprising. In the United States, environmental education was once covered in three domains: outdoor education, nature study, and conservation (Carter & Simmons, 2010; Hart, 2007). Outdoors and nature in some way are used mutually when people talk about going outdoors as going to nature. For future studies, researchers can start with this notion that outdoors *is* nature to investigate children's tolerance of varied degree of human involvement from different perspectives. For instance, do their drawings with a minimum of humanmade things represent the ideal picture of nature? Nevertheless, those outdoor spaces such as the city downtown and school campus also can bring them the open-space feeling with some degree of contact with living things and fresh air.

These different methods not only allowed children to express their ideas of nature (Grade 1-9 Curriculum Guidelines 4.a: To be able to use language, writing, drawings, etc., to communicate one's experience or ideas about environmental conservation), but also helped one child evolve her definition of nature as the interview went on. Yu-Ting first explained her ideas of nature in terms of "here and there." "[This is nature] because it is city. Many houses. But there are trees here. Less over here (pointing to the other corner of the photograph) and there are no leaves." Later she said, "The sky is nature. Clouds are too.

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Trees are too... Cars…should be. Houses, are [nature]." And then, "Sands are nature. Ocean is nature too... because ocean is salty." For another photograph, she determined, "This is nature too. But the leaves have all fallen. Falling leaves is also a natural…phenomenon!" To the photograph of the living room, she started to use the word *made*. She said, "This is not. Because chairs and sofa were *made*. And houses were built. So they are not nature. Only those flowers behind are." She was still inconsistent about whether houses are nature or not, but she started to say "desert is [nature], because sands are not made." I asked her again if cars and houses are nature. She asserted they are not because they were *made*. I was inspired by this evolution that a child can immediately grasp new ideas and reconstruct meanings in the interview process, and hope what she took away is an overarching concept about how to make definition rather than detailed facts about what is made and what is not.

This study also found some interesting characteristics of children at this age. I am not stating that these are things that apply to every child, but want the reader and future researcher to bear in mind these possibilities. First, sometimes children talked about an experience as if they did it regularly. But when asked again, they told me that they did it only once last week--or never did it. It could be that some memories stood out from other experience so that when answering the questions, those memories came out. The child's imagination could also possibly account for those that never actually took place. For instance, Suan-Hui said that she played with the ducky in the pond and climbed on trees to make leaves whistle. When I asked for more details, she stated that these things never took place.

Amy: Like where [do you go on the weekends]?

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Suan-Hui: Yang-Ming Mountain and Ho-Huan Mountain in Nan-To (county).

Amy: What do you do at Ho-Huan Mountain, going so far?

Suan-Hui: Actually I only went to Nan-To (county) *with my dad and mom. Never been to Ho-Huan Mountain. That's what I thought up* (imagined).

Sometimes children are aware of their imagination; oftentimes their imagination is anthropomorphic.

Amy: What's this [in your drawing]?

Ge-Jin: Sun.

Amy: What's this?

Ge-Jin: Eyes and mouth.

Amy: Why does the Sun have eyes and mouth, but trees don't?

Ge-Jin: I imagined it.

Amy: So WHY does the Sun have eyes and mouth?

Ge-Jin: It's also my imagination.

Nevers & Gebhard's (2001) analyzed the environmental ethics of children and adolescents (ages 6-16) by discussing interest conflicts between humans and other living things. They found that children under the age of 10 or 11 relied heavily upon anthropomorphic explanations that were sometimes contrary to learned scientific facts. For example, children with a basic knowledge of plant physiology, such as photosynthesis, might also say that trees can feel and bleed. It is interesting and important to double-check their ideas for the purpose of studying their thoughts. Sometimes children got confused when I challenged their own words from earlier in the interview. Of course the purpose was not to embarrass or confuse them, but to reconfirm my

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understanding of their thoughts and see how they constructed meaning. It happened

several times in my study that children talked about their ideas of nature with

contradictory concepts. A short conversation with child Huan-Mong showed a typical

inconsistency found in this study:

Huan-Mong: The Sun is half [nature]. Clouds don't count.

Amy: Why? Clouds don't count. Why?

Huan-Mong: Because… the Sun occupies half of the earth area. Shining sunlight

on the plants. Clouds can only…can't do anything.

Amy: So [the ones that] can do everything is nature?

Huan-Mong: Clouds can move.

Second, it seems at this age, bringing up the inconsistency of their ideas did not

help them clarify their ideas during the moment of the interview. They usually insisted on

or ignored their conflicting ideas.

Amy: So are you nature?

Chen-Yu: No.

Amy: Why?

Chen-Yu: Human beings don't grow grass.

Amy: Did you just say that a ladybug is or isn't [nature]?

Chen-Yu: Ladybug. It is.

Amy: Does a ladybug grow grass?

Chen-Yu: No.

Amy: So what's happening here?

Chen-Yu: …Hmmm… I don't know.

The conversation about an inconsistency with Yu-Ting ended up with her saying, "I don't know."

Amy: Is this [nature] (pointing to the photograph of a living room)?

Yu-Ting: This is not. Because chairs and sofa were made. And houses were built. So they are not nature. Only those flowers behind are.

Amy: Are houses[nature] or not? You just said that houses are. And now you say houses are not because they are built.

Yu-Ting: Hmm…then I don't know.

Ning-Chen talked about the difference between a butterfly and human beings as her way to distinguish if things are nature.

Ning-Chen: Flowers and trees [are nature]…hmm…the people in [the photograph are nature].

Amy: Human beings are [nature]?

Ning-Chen: Human beings move. They're half [nature].

Amy: Why is another half not?

Ning-Chen: Because human beings are not like plants that kind…they are also not things that grow things.

Amy: How about butterflies?

Ning-Chen: They are.

Amy: Why are they [nature]? Do butterflies grow things?

Ning-Chen: Butterflies don't. But they can move.

Amy: Humans move too.

Ning-Chen: But they don't grow things from them.

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Amy: So butterflies grow things?

Ning-Chen: No. But butterflies can move.

Amy: What are the things that grow things? Can you give me an example?

Ning-Chen: Just like those things that grow things. Also those flowers and grass grow more flowers.

Third, another interesting thing about the children at this age is that they will not change the subject if they are not ready. They often continued their previous conversation when I started to ask the next question. I always waited until they finished their answer even when I wanted to move on to the next question. However, sometimes when I asked the next question, they started to talk about the previous question again. I found it interesting, because at the beginning, I couldn't understand their unrelated answers. As the data collection process went on, I learned about this phenomenon and was able to understand they were still talking about the last topic. It was hard to avoid interrupting them, because they often seemed to have finished their answers. Maybe interviewers can add questions like "Is that your answer?" or "Do you have any more to say?" Yet, it is often difficult for them to sense that they have finished expressing their ideas.

Finally, group interviews did not seem as successful as in other previous studies among those children in my study as shown in Appendix D. In group interviews, the children surprisingly repeated the same answers as in the individual interviews. I suspect that both their age and the culture made it so. The opportunity to have fun with classmates and be away from the authority of the teachers caused the children to act very differently in group interviews than they had in individual interviews. Children in Taiwan usually obey authority and are not familiar with the form of group discussion.

Summary

To begin this chapter, I first reported the summary of findings of this study. Next, theoretical contribution of my study to the CML was discussed from several perspectives. First, the study shows that the CML helps to organize and understand a phenomenon is a more comprehensive and structured way. It is also an appropriate framework to frame research questions and data analysis. Second, the findings reveal that each learning experience is contextualized in personal, sociocultual, and physical influence. My study also extended the vision of the model out of museums into nature. Third, there are also instances that the model does not fit to this study, since the nature of the settings is quite different from a museum setting

Children's conception of and relation to nature learned from this study were also compared with previous studies. This study showed that children at this age already developed some understanding of nature. Their conception of nature also reflected their daily lives and access to nature. In this study, children thought plants more often than animals represent nature while other studies showed children often thought nature is where animals *and* plants live. Children were uncertain about the extent of human beings involvement in the definition of nature. After I compared the current environmental education curriculum standard in Taiwan with the results from this study, I argue that children's existing ideas of nature might align well with the existing school environmental education. However, more emphasis on human's involvement in the environment is needed.

Other possible influential factors of children's conceptions and experiences about nature followed the discussion. Gender, age, children's school system, Chinese culture,

children's innate bonding to nature, and other physical factors were discussed. It seems that no one factor particularly made a strong impact. I concluded that some children showed a greater inclination and tendency toward nature than others. Parents' belief and concerns were discussed under the large society's lifestyle and belief system. Limited time and green space did constrain children's time in nature.

Finally, based on the results from this study, the implications are constructed within four points. First, from what was learned from the physical contextual factors, I suggest that urban designers add more easily accessed green space in the city, since children often utilize these spaces as a way to experience nature. Second, schools should develop a school-based and community-based curriculum that includes learning about children's immediate environment. Third, I suggest parents not miss the chance to create meaningful moments in those weekend outings to nature. Finally, I discuss some characteristics I observed among the children in my study, especially in regard to methodology, so that readers and future investigators may be aware of these issues. It is shown that both drawing and use of photographs were appropriate for learning ideas from children at this age. It was also shown that different methods helped to clarify children's thoughts and sometimes helped children evolve their definition of nature in the interview process. Children at this age sometimes talked about an experience as if they did it regularly. But when asked again, they told me that they did it only once last week--or never did it. I also found that bringing up the inconsistency of their ideas did not help them clarify their ideas during the moment of the interview. They usually insisted on or ignored their conflicting ideas. Another interesting thing about the children at this age is

that they will not change the subject in the interview if they are not ready. Finally, the

unsuccessful group interviews were discussed for possible reasons.

Appendices

Appendix A: Maps of Study Location
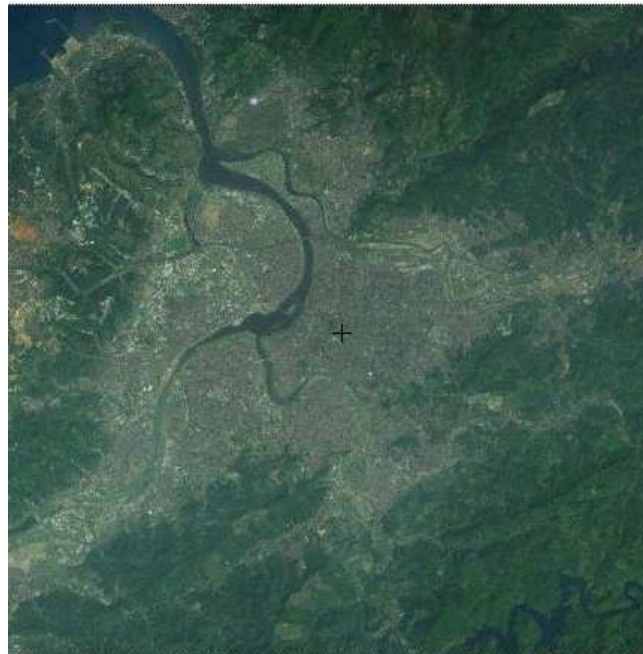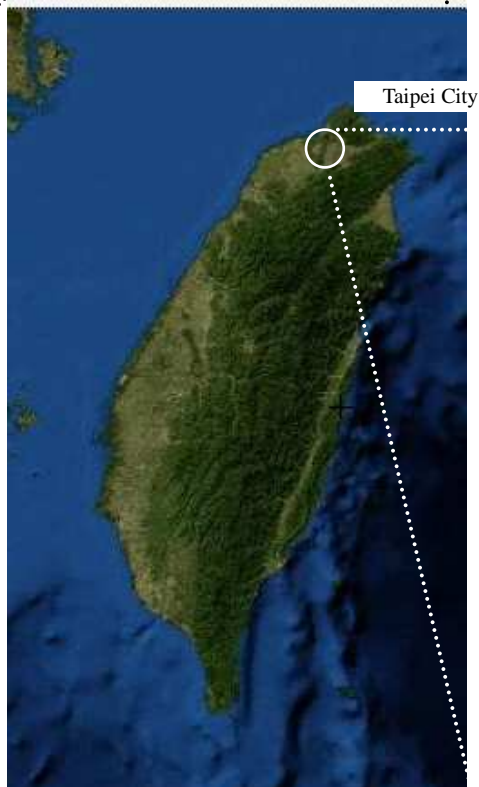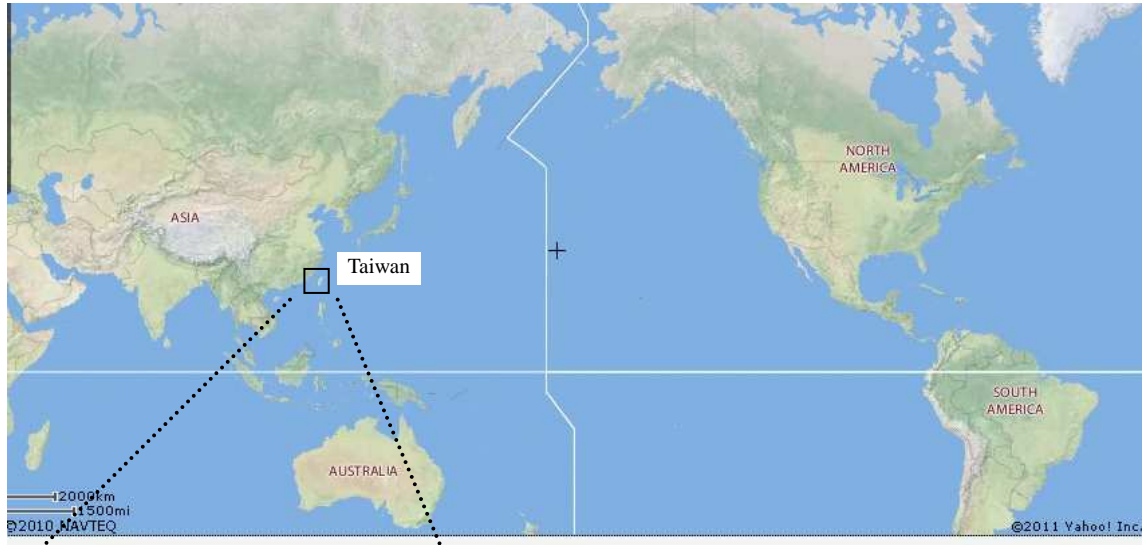
Drawing and writing prompts to children:

1. Drawing is another way of expressing/explaining your thinking. How well you draw is not as important as the details you provide

    Drawing One: Please draw a picture of you with your family.

    Drawing Two: Please draw a picture with you in nature.

2. Please write down on the sheet with the drawing with you in nature anything you cannot include in the drawing or what you especially want to explain is in your drawing.

Individual interview items for the children:

1. (1a) Let's talk about your drawing [show it to the interview] "You in nature".   Please describe your drawings.   Probes: What is this? Why do you include that? What is happening in the drawing?)

2. (1a) What is nature?

3. (1b, 2a) Do you like nature? Why?

4. (1c) How do you feel about nature?

5. (2b) Where do you get any of those ideas about nature (ex: schools, textbooks, parents, .etc..)?

6. (2b) Did anyone outside of school teach you about nature? Who? When?

7. (2b) How do books, TV, or other media talk about nature?   Are they the same with your drawing?

8. (2b, 2c) What do you usually do after school and during weekends? Probe: Where do you usually play?

1. What is nature?
2. What does nature mean to you personally and your child? (sociocultural context)
3. Do you find that your child particularly likes or dislikes nature? (personal context) What makes you think so? From when did you start to observe he or she likes or dislikes nature? (time)
4. What do you think may contribute to your child's interest in nature? (sociocultural, physical context)
5. Do you think you influence your child's interests in nature? How so?
6. Where do you live? (physical context) Please describe the surrounding environment and if any natural environment nearby.
7. What do you think you or your family does to influence your child's ideas of nature? (sociocultural, physical context)   Do you believe anything your child learns from home affects their learning about nature at school? How so?
8. How does your family spend the weekends? (sociocultural, physical context) (sociocultural, physical context) Does your child ever express a desire to engage with nature outside of school? (personal context) How often does you family go to nature? How do you usually react when you see your child play in nature (for example, with the physical or living environment?
9. What makes you not want to take your child to nature?
10. How does your child's gender affect the way you raise your child, especially the way they approach or play in nature?

Appendix D: Group Interview

I decided to drop the group interview part of the study after conducting three group interviews in Gu-Shin elementary school, Ge-Chen kindergarten, and Pu-Lin kindergarten. The conversation did not provide any more rich data than did the individual interviews. First of all, the children surprisingly repeated the same answers in the group interviews as in the individual interviews. Some children even stated, "I told you last time."

In the individual interview, Yen-Pin told me that she was watching the sky because the sky is beautiful. In the group interview, she repeated the same answer exactly:

Amy (Interviewer): Do you like nature?

Yen-Pin: (Nod)

Amy (Interviewer): Why?

Yen-Pin: Because you can watch the sky. The sky is beautiful.

When talking about An-Jhen's drawing in the group interview, he told me that he had said the same thing to me.

Amy (Interviewer): Who taught you this is nature?

An-Jhen: Um…from the books.

Amy (Interviewer): What kind of books?

An-Jhen: I told you last time. Noddy *and* Mr. Men & Little Miss. (Both are British children's books.)

Second, the opportunity to have fun with classmates and be away from the authority of the teachers caused the children to act very differently in group interviews

than they had in individual interviews. They ran around the interview room without paying attention to what others had to say, including the researcher's questions. The group from Gu-Shin elementary school fought about who would sit next to whom even before the interview. During the interview, three of the four children mocked the fourth child whenever he had something to say. They even covered their ears when he talked. The shy girl (data removed) who did not talk much in the individual interview was not so uptight in the group, but she did not provide much information when she was asked to talk with the researcher rather than her classmates. The boy who was laughed at had a lot to say in the individual interview, since he was very interested in science and was very expressive. However, he got pretty upset in the group interview because no one listened to him. The researcher reported the situation to their class teacher afterward to make sure everything was all right. The teacher apologized for the fights and explained the boy's social status in the class.

The group in Ge-Chen kindergarten was better about not fighting, but two of them, Suan-Hui and Yen-Jhao, ran around the room and lay on the floor playing, which made the conversation hard to continue. The children also played with each other. At Pu-Lin kindergarten, the situation was not any better. The researcher decided to end the discussion in the middle since the interview had almost reached its appointed time limit.

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