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Title: The Influence of Houseplants in a Child Development Center on Young Children's Directed Attention.

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Marilyn A. Read

The near physical environment is believed to be an integral component in creating quality learning and classroom environments for young children. Free-choice play periods during preschool daily curriculums are a widesprea0d component of preschool early childhood education. Research has demonstrated that the presence of houseplants may be a contributor to human ability to self-regulate their attention. Behind their popularity as environmental enhancements seems to be a general belief that the emotional experience of viewing greenery will help foster a more restorative environment. Educational settings of almost every size employ houseplants in both formal and informal settings and spend reasonable financial and person-hour effort to maintain these elements. Despite their ubiquitous nature, the educational value of houseplants has not been well documented.

The problem of children experiencing stress and directed attention fatigue familiar to adults (e.g. irritability, difficulty concentrating and increased proneness for mistakes), may be compounded by over- or under-stimulating classroom designs and layouts. The mechanism behind directed attention is a fragile but vital means for

learning to occur. Maintaining focus to surrounding stimuli is one way directed attention becomes fatigued. Proponents of Attention Restoration Theory believe contact with nature or views of nature may allow the brain to rest and restore, thereby allowing renewed ability to focus.

This study addresses the interior design element, houseplants, popular in childcare facilities as a natural element, in relationship to preschool children's directed attention. In a quasi-experimental video observational pilot study, two groups of preschool children's attentional behaviors were compared within subject during a free-choice play period. Specifically length of attention, type of attentional state and type of adaptive behavior are analyzed over an 8-week period while 32 participants' self-select engagement at a sensory-activity table. Due to the small sample size, statistically significant results could not be revealed, however, there is indication via Cohen's *d* effect sizes that there may be a positive relationship between the presence of a group of houseplants and an improvement in young children's ability to direct attention.

Keywords: attention restoration, directed attention, directed attention fatigue, houseplants, greenery, free-choice learning, preschool children, nature, classroom design

The Influence of Houseplants in a Child Development Center on Young Children's Directed Attention

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APPROVED:

_____

Major Professor, representing Design and Human Environment

_____

Chair of the Department of Design and Human Environment

_____

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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J. Davis Harte, Author

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Chapter 1: Introduction

Children's near physical environments are thought to play a contributing role in both children's behavior (Docherty, Kendrick, Sloan & Lerpiniere, 2006; Evans, 2006; Gandini, 1998; Hunter, 2005; Kantrowitz & Evans, 2004; Maxwell, 2007; Read, 2003, 2007; Read, Sugawara & Brandt, 1999; Strong-Wilson & Ellis, 2007; Trancik & Evans, 1995; Weinstein, 1987) and their psychobiology of stress responses, typically exhibited by a rise in heartbeat, blood pressure, blood sugar, adrenaline and cortisol levels (Aldwin, 2007, Gunnar & Quevedo, 2007), which influences attentional states in an interrelated manner (Eldar, Ricon, & Bar-Haim, 2008). The focus of this study was to look at the interior design element of houseplants within a preschool classroom environment and whether the presence of houseplants influences children's attentional states.

The National Association for the Education of Young Children Standards (NAEYC, 1996), the accrediting organization for quality child development centers in the United States, identifies the physical environment as an important factor in quality care. The child's physical context creates the foundation for everything that occurs for the child. In general, the physical space of a childcare facility may include classrooms, playground, entry space or a multipurpose room, of which this study's focus is two preschool classrooms. The environment fulfills many daily routines incorporating teacher/child relationships, skill building, peer relationship formation,

fostering of abilities and lifelong attitudes towards education development.

> For all these things to happen well, program planners must carefully design the physical environment…[The physical environment]…conveys values and messages about who is welcomed, what is important, and what the beliefs are about how children learn. (Ritchie & Willer, 2005, p. 9)

There is a scarcity of major research evaluating the contributions of the physical environment on children's development (Moore & Sugiyama, 2007; Sussman & Gillman, 2007). However, there is evidence to support the proposition of child development being influenced by the near environment, as proposed by Sussman and Gillman (2007), "we know (that) well-designed facilities enhance child development and program quality (p. 1)". More specifically, they note "research indicates that well-designed physical space decreases behavior problems in the classroom, increases teacher-child interactions, promotes productive child-initiated play, supports curriculum goals, and raises staff morale (p. 3, para. 8)". The emphasis on the role of the physical environment in this project is meant to supplement the vast body of literature concerning the developmental psychology and socio-cultural environments of the child's experience outside of the home.

Inclusion of a variety of sensory materials inspired by nature, such as; sunlight dappled on plants, water and sand in sensory tables and breezes blowing curtains, is thought to support a sense of comfort. This sensory variation has been described as the concept, 'difference-within-sameness' (Fiske & Maddi, 1961). Lewis (1996) describes this natural beneficial effect as "'thoughts that lie too deep for tears'" which

can be triggered by "grains of beach sand, water-burnished pebbles, seeds, (or) tiny mosses" (p. 108). This sense of comfort is thought to be a common goal for early childhood educators programming and designing child care facilities (U.S. General Services Admin, 2003).

This sense of comfort may also be seen as a type of fascination, one of the four qualities of an attention restoration theory-based environment, or restorative environment (Kaplan, 1995). Numerous studies conducted within natural settings have demonstrated that restorative benefits are provided by natural elements, (Berto, 2005; Hartig, Mang & Evans, 1991; Herzog, Maguire & Nebel, 2003; Korpela, Hartig, Kaiser, & Fuhrer, 2001; Korpela, Kyttä, & Hartig, 2002; Wells & Evans, 2003). Recent literature suggests that not just natural settings, but also attractive urban settings can provide restorative benefits to directed attention (Karmonov & Hamel, 2008; Joye, Willems, Brengman, & Wolf, 2010). Conceivably, merging natural elements within the physical environment inhabited by children is an apropos method for creating restorative environments that benefit children's development. Perhaps something as simple as a group of houseplants can buffer stress for young children or increase directed attention.

As much as researchers and designers have been building a basic body of knowledge to assist the person-environment fit, in all its many forms, there appear to be some gaps in the existing literature. The researcher was unable to locate any existing studies examining either: the intersection of the attention restoration theory with educational theories, especially the constructivist educational approach; nor on

the influence of houseplants upon young children's attentional behavior.

Designers and environmental psychologists need more research to guide the design of the built environment for children in non-home environments, specifically addressing the need for home-like interior environmental elements to facilitate this process. Elements within the built environment may act as intermediaries by facilitating social coping techniques (e.g. ability to control privacy needs and self-regulation skills), via personalization of place (Maxwell & Chmielewski, 2008; Shin, Maxwell & Eshelman, 2004; Wells, 2000). Indeed, Korpela (2002) states that "the ideas from place preference studies might even now be applicable when, for example, psychologists try to diagnose children who are particularly vulnerable to forced relocation or try to support them through the period of change " (p. 371). Evidence points to a connection between a person's level of stress and the subsequent ability to focus attention (van den Berg, Hartig & Staats, 2007). Eldar, et al. (2008) specifically found that anxiety during stressful events contributes to the type of attention children pay to coping activities.

The problem of children experiencing stress as a result of poorly designed physical environments is noted in the literature (Davis, Donzella, Krueger & Gunnar, 1999; Evans, 2003, 2006; Zimmerman & Stansbury, 2004). Young children who are under stress may exhibit fearful or anxious behaviors or display exuberant and under-controlled behaviors (Adams, Klimes-Dougan & Gunnar, 2007). Other coping strategies used by children may include: aggressive activities, behavioral avoidance, cognitive distraction, cognitive problem solving, information seeking, isolating

activities or social support (Ryan-Wenger, 1992).

Directed attention fatigue is a common phenomenon occurring in both children and adults after a period of sustained and/or challenging focused attention. Children in childcare facilities typically experience an increase in cortisol throughout the day, indicating a subsequent increase in stress (Watamura, Donzella, Alwin, & Gunnar, 2003). A common symptom is increased irritability (Gulwadi, 2006; Hartig et al., 1991; Kaplan, 1995). As Lewis (1996) noted, an "inability to reduce distractions can lead to reduced competence…loss of judgment and antisocial behavior" (p. 118). Kaplan and others suggest an effective way to alleviate directed attention fatigue is through exposure to natural elements, either through a visit to a park, walk in the forest or other time spent in wilderness (Faber Taylor & Kuo, 2006; Kaplan, R., 1993; Kaplan, S., 1995; Lewis, 1996). However, in an attempt to substitute wilderness, studies have been conducted on the role of the natural element, houseplants, on such factors as occupant's mood, creativity and productivity (Biner, Butler, Lovegrove & Burns, 1993; Brethour, Watson, Sparling, Bucknell & Moore, 2007; Bringslimark, Hartig & Patil, 2007; Chang & Chen, 2005; Fjeld, Veiersted, Sandvik, Riise & Levy, 1998; Lohr & Pearson-Mims, 2008; Lohr, Pearson-Mims & Goodwin, 1996; Park, 2006; Shibata & Suzuki, 2001, 2004).

There is an ongoing debate in the literature regarding the specifics of the overall beneficial effects of natural environments. Some argue that interaction with or the presence of natural elements has an affective positive relationship on stress (Ulrich, 1981; Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991), while others

contend that this type of natural environment has a restorative effect on attention (Kaplan, 1995; Tennessen & Cimprich, 1995). Studies in children and adults show that directed attention fatigue tends to increase irritability, hence reducing the psychobiological ability to attend to the unfamiliar environment at hand. However, whether it is via the mechanism of emotion or that of cognition – driving attention restoration, if these can even be separated into distinct mechanisms, it seems clear that alleviating directed attention fatigue might be beneficial for children's attentional states. The outcome of using houseplants to either reduce children's stress or increase attention remains unresolved at this point (Berto, 2005; Evans, 2006; Faber Taylor & Kuo, 2006; Tennessen & Cimprich 2005).

Purpose of the Study

In this study, the goal was to determine the influence of houseplants on children's length of attention and type of attentional state, as well as their general adaptive behavior, while engaged in free-choice play. The goal was to build upon basic knowledge so as to inform, as Zeisel says (2006), specific performance criteria design guidelines. That is, does the interior design element of houseplants contribute to the meeting of such an objective as learning in a designed learning environment (i.e. classroom)? Zeisel further specifies, as an example of design criteria; "learning environments that reduce alternative attention distractors, and thus help people focus on learning tasks at the moment of learning (p. 366)." This study was an investigation into this process and the possibility of the influence of houseplants on preschool children's ability to focus attention.

Research Hypotheses

The primary research question for this study was: Is there a relationship between the element of houseplants in the design of interior environments and children's ability to focus their attention within a learning setting? This study was intended to provide a starting point for operationalization of the presence of houseplants on children's ability to pay attention, their attentional states and their behavioral adjustment.

- Hypothesis 1: the presence of indoor plants located near the sensory table activity area within a preschool setting will have a direct positive influence on the length of time children choose to be engaged in those learning centers during free-choice play time.
- Hypothesis 2: the quality of the participants' engagement with the activity while at these treated learning centers will be more focused when compared to those behaviors which occur at the control learning centers.
- Hypothesis 3: the presence of indoor plants located near the sensory table activity area within a preschool setting will have a direct positive relationship on the quality of the participants' adaptive behaviors.

A further aim of this study was to apply the findings from the existing literature on attention restoration theory and the presence of houseplants on a different population in a new context; the preschool classroom. An objective was also that the findings from this study would provide a foundation for further research and extend the knowledge base for design of early childhood educational facilities. Although

these hypotheses remained guideposts for the duration of this study, during the analysis phase the hypotheses were determined to be unable to be tested in the traditional null hypotheses testing manner, due to the relatively small sample size.

Research Approach

Given the evidence that exposure to nature in the near environment may be beneficial for adults (e.g. Dijkstra, Pieterse, & Pruyn, 2008; Fjeld, et al., 1998; Kaplan, S., 1995; Lohr & Pearson-Mims, 2008; Shibata & Suzuki, 2004) this study was proposed in order to explore if the same holds true for young children. It is certainly not considered appropriate to make the assumption that what is true for adult populations will also automatically be true for child populations, however the assumption that there may be similarities between the two populations is part of the fabric driving this research. This is due to the existing literature indicating a variety of benefits for children who have ADD who spend time in nature (Faber Taylor, & Kuo 2006, 2009; Faber Taylor, Kuo, & Sullivan, 2001), as well as for children in rural settings (Wells & Evans, 2003). These studies and other research edifying the connection between natural environments and human behavior are discussed more fully in the next chapter.

It is important to remember that the near environment, and specifically the interior environment in this case, has a multitude of interacting variables and therefore accurate evaluation of particular design elements are often difficult to discern (Silverstein, 1993). The approach deemed most suitable for assessing the relationship between the presence of houseplants and young children's attentional behaviors for

this study was a multi-measure, quasi-experimental, observational, deductive approach. By observing in a qualitative manner and then coding the participants' actions into both qualitative and quantitative measurements, the researcher was able to analyze the data in a more robust style than would have been possible with a singular approach. Based on the small sample size, the application of an inductive approach was also established so as to best understand the varied nuances of the experimental setting. However, the possible confounding variables that exist in a naturalistic setting, such as the preschool classrooms, were not dismissed nor where they intended to be, but rather were incorporated within the 'in situ' setting. The use of both deductive and inductive research can be considered a relatively common approach for social science research (Trochim, 2006). After the observational data was collected, statistical analysis was conducted, leading the researcher to suspend the initial research goal of testing the original hypotheses and instead provide a series of effect sizes that provide a framework for understanding the patterns and influences between the houseplants and the participants' behaviors.

Definition of Terms

In order for this review of existing literature to be as clear and concise as possible, it is first necessary to operationally define the relevant concepts involved in each of the following sections. The relevant concepts are:

Directed attention. Also known as executive attention or inhibitory attention, directed attention is a complex brain system that allows one to focus on difficult tasks or remain focused on pleasant tasks while facing distraction, as well as to return to a

focused state after interruption. This state takes effort and is more fragile and tends to fatigue easier than other mental systems (Beadle, 2006-2008).

Directed attention fatigue (DAF). A temporary neurological symptom that occurs when the inhibitory attention system, the system of the brain that permits us to concentrate while dealing with distractions becomes fatigued (Bio-medicine Webpage, 2009).

Facilities. "The physical places that house early care and education programs" (Sussman & Gillman, 2007, p. 2).

Learning centers. Learning centers are popular in early childhood education classrooms. Small to medium-sized areas are arranged, usually by the teacher, so that similarly used materials are placed together and delegated to a particular place in the classroom with the intention for independent child play. They are also known as "interest centers, learning stations, activity areas, free-choice areas, booths or enrichment centers" (Patillo & Vaughan, 1992, p. 13). This arrangement helps young children regulate and organize their daily activities and is supported by constructivist-based early childhood programs in both the United States and in other countries (Holmes & Cunningham, 1995).

Micro-restorative environment. Micro-restorative environments are "the smallest representation of wilderness that could offer restorative qualities" (Lewis, 1996, p. 111).

Near environment. Near environment can be defined as:

The environment is all factors that impinge upon or influence an

> individual. The near environment or the immediate or personal environment is that part of the environment which is close to the individual and with which the individual interacts; our clothing, building interiors, and housing are all components of the near environment. The near environment includes the specific places and things with which an individual engages daily or regularly. The near environment has both tangible and intangible components. (DHE webpage, 2008, para. 5).

Restoration. Defined by Kopec (2006) as a process first of finding oneself in a state of "mental fatigue…caused by excessive directed attention and (then restoring) attentional capacity and mental balance … by engaging in effortless attention" (p. 345) – thus the process of restoring or regenerating one's directed attention.

Restorative environment. A place, either built or natural, that according to Berto (2005) assists in maintaining and restoring the capacity to direct attention.

Self-regulation. Self-regulation as defined by McClelland and Ponitz (2009) is "multidimensional and consists of controlling, directing, and planning cognitions, emotions, and behavior (Baumeister & Vohs, 2004; McClelland, Ponitz, Messersmith, & Tominey, in press; Schunk & Zimmerman, 1997)" (p. 4).

Sustained attention. The act of sustaining attention, "'involves the continuous maintenance over time of alertness and receptivity for a particular set of stimuli or stimuli changes' (e.g., Davies, Jones, & Taylor, 1984)" Groot, de Sonneville, Stins & Boomsma, 2004, p. 306).

Chapter 2: Literature Review

Conceptual Framework

This chapter will review the literature underlying the existing research underlying aspects of this specific research. First the author looks broadly at the Attention Restoration Theory and specific studies within that field, then reviews the Constructivist Education theory and plants in the near environment literature.

As disclaimer and as general informational claim the author holds a bachelor degree in Early Childhood Education and Child in Society. A broad sweep of literature was previously reviewed as well as explored through the course of the author's graduate career, but could not be included due to the limited scope of this work. However, the scope of this preexisting literature is very briefly outlined, as it forms the initial theoretical thinking that comprises this project. The previous literature reviewed encompasses the topics and fields of: interior design and human behavior in the near environment; child development and educational theories, including constructivism, Montessori and the Reggio Emilia approach; free-choice learning; developmental psychology; sociology; attention restoration theory and houseplants, wilderness and greenery's influences upon behavior; environmental psychology; sensory stimulation and synesthesia; creativity and the paradox of stress.

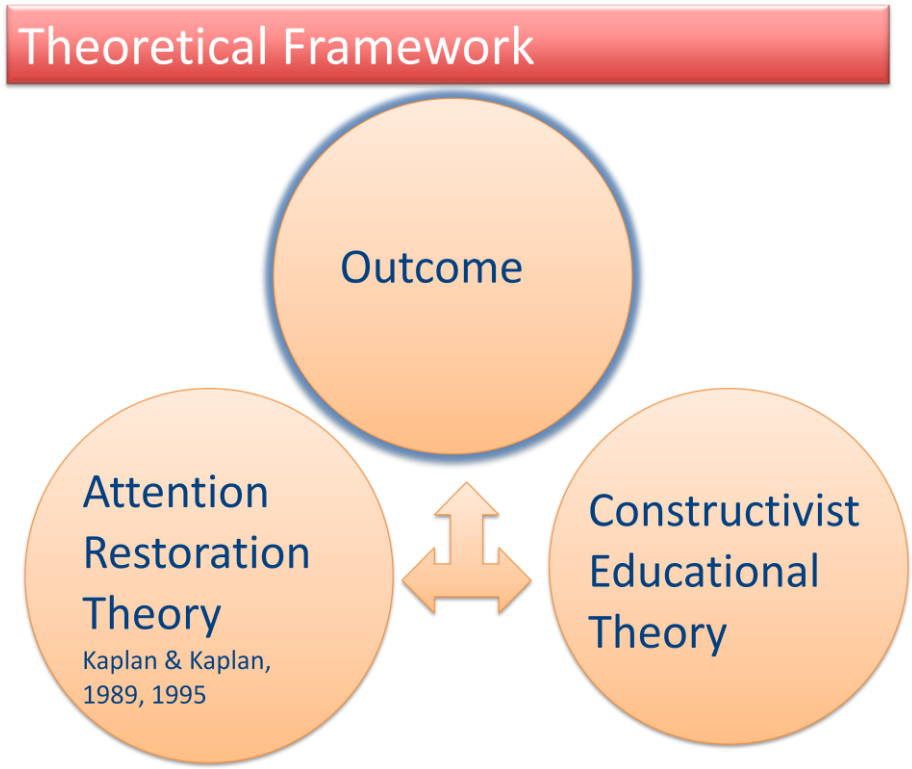
Attention restoration theory (ART).

The conceptual framework for this research project consists of attention restoration theory (ART), developed by Kaplan and Kaplan (1989, 1995), as well as an underpinning of constructivist educational approach. See Figure 1 for a visual

rendering (on page 14). The attention restoration theory is frequently used in environment-behavior and symbolic interaction studies as a tool to study relationships between green spaces, such as trees and parks, and the behavior of human participants (Faber Taylor, et al., 2002; Faber Taylor & Kuo, 2009; Tennessen & Cimprich, 1995; Wells, 2005). Typically the studies are grounded in the concept of directed attention fatigue and the use of restorative environments from which to recover from such states. Herzog, Black, Fountaine and Knotts (1997) provide evidence that directed attention fatigue is a widespread situation in modern times. This is a problem because symptoms of directed attention fatigue include: increased irritability, lowered ability to concentrate and to solve problems, greater proneness to mistakes or accidents (Kaplan & Kaplan, 1989; Kaplan, 1995; Lewis, 1996), impatience, a proclivity to take needless risks, and "typically an impaired capacity to reason and plan" (Kaplan, Bardwell & Slakter, 1993, p. 727).

Figure 1

Theoretical framework



Stemming from an environmental psychology perspective, Kaplan and Kaplan (1989, 1995) propose the four components that comprise a restorative environment as: fascination, being away, extent, and compatibility. Kaplan defines and differentiates these components between those that are stress-related and those that are attentionally derived. Taken together these common modern-day situations often lead people to

seek out restorative experiences. Each of the four ART components works to a certain degree of its' own accord, but all four must be present to bring about the benefits of a restorative environment; as Kaplan says (1995) all four components are integral to the attention restoration framework.

The basic premise of the Attention Restoration Theory (ART), as stated by Kopec (2006), is that "mental fatigue is caused by excessive directed attention and that attentional capacity and mental balance can be restored by engaging in effortless attention" (p. 345). Kaplan proposed that the form of attention called involuntary attention, needing no effort, is not likely to become fatigued. Furthermore, while in an involuntary attention mode, the directed attention should have a chance to recuperate (Kaplan, 1995). Although it is most often associated with natural settings, recent literature suggests that inclusion of built environments is relevant and appropriate (Scopelliti & Giuliani, 2004). Kaplan himself asserts, during a conversation with Gallagher (1993), that, "apart from natural aesthetics…'these conditions could be met in a basement workshop as well as on a mountain'" (p. 210). However, this assertion was followed with a study a decade and a half later providing further support for the role of nature, and not urban built environments, with facilitating attention restoration (Berman, Jonides, and Kaplan, 2008). As an extension of the existing literature, the reason for including the ART within the child-environment interconnect framework is the possible transfer of the restorative experience to non-home places. Of particular interest is the idea that built environments may facilitate restorative experiences with similar positive effects on humans, as do natural-setting restorative places.

Directed attention, as the focus of ART, is inspired by the work of William James' ideas of voluntary attention (1892). The processes underlying directed attention fatigue include: expending effort, having a goal of establishing focus, being partially under voluntary control, is prone to fatigue, and limits distraction through inhibition (Kaplan, 1995).

The first of the four ART components is 'fascination'. The soft type of fascination, as opposed to hard fascination found at accident scenes and sports events, is of special interest in the desire to create restorative environments (Kaplan, 1995). Soft fascination is characteristically found in natural settings, but may also be promoted by interior design elements that engage involuntary attention such as mobiles, kinetic sculptures, fish tanks or shadows dancing through a tracery shutter (Korpela & Hartig, 1996; Korpela, et al., 2001).

The second component of ART is 'being away' which is also thought of as 'getting away from it all'. Releasing the mental clutter is key and this may occur in the same environment, but seen from a different perspective or by an actual physical change in locations. Either way, it is the conceptual transformation of the feeling of 'being away' that must occur. This may or may not provide restorative benefits, depending on the context.

The third component is 'extent'. This occurs when there are enough fascinating stimuli provided in a coherent and lush manner to occupy a large portion of space in the mind. Extent is similar to being in a 'whole other world'. Examples of 'extent' in the built environment are miniaturization (i.e. bonsai, models or dollhouses) or a

historical context that brings us into the time period at hand (Kaplan, 1995; Kaplan & Kaplan, 1989).

The fourth and final component of ART is 'compatibility' between the environment and the purposes and inclinations of the person (Kaplan, 1995). The interplay between the individual's purposes or inclinations within the environment, the environmental patterns, and the actions required by the environment determine the degree of compatibility. As Kaplan says, the "importance of compatibility in human functioning is perhaps easier to see in its absence, that is, in terms of the costs of incompatibility" (Kaplan & Kaplan, 1989, p. 186).

The goal of including ART is that it may provide for a more tangible, pro-active stress-reduction mechanism, as well as potentially guiding interior designers within a formidable base of literature detailing specific restorative elements. It has been suggested that restorative environments utilize the application of beauty and aesthetics for the possible consequence of increased feelings of well being for children who experience non-home physical environments (Gulwadi, 2006; Hartig, et al., 1991). The goal, as Kaplan & Berman (2010) say, is to move toward a place of "synthesis of research and theory that draws upon a common resource to help explain cognitive patterns and adaptive approaches to self regulation" (p. 43).

Specific examples of ART.

The ART framework has been substantiated by many studies with adult participants. Herzog et al. (1997) specify two restorative benefits' categories stemming from restorative environments: "attentional recovery and reflection" (p.

169). In Hartig et al.'s (1991) seminal ART study the authors state, "carefully constructed therapeutic environments may facilitate recovery from mental fatigue" (p. 24) brought about by the demands of modern life.

Studies determining what type of environment can be considered restorative are numerous. The earliest and most prolific of these studies occur in natural, green, outdoor settings. For instance, Korpela, et al. (2001) establishes evidence for a relationship between restorative experiences, self-regulation, and favorite places. Both restoration and favorite places tended to be natural settings. In a study of participants' who seek restorative experiences Staats, Kieviet and Hartig (2003) determined that most benefits occurred in natural settings when compared to urban settings. A study employing the Perceived Restorativeness Scale (PRS) by Korpela et al. (2001) determine natural settings are overrepresented in mention of favorite places and underrepresented in mention of unpleasant places. These studies strongly imply that restoration is linked with natural settings.

Initially Kaplan (1995) suggested the concept of beneficial restorative environments as occurring in nearby nature and outdoor challenge programs, although after years of study he has extended these environments to include "anything that aids in the management of stress… At the same time, however, directed attention also plays a significant role." (p. 180). As an example, Tennessen and Cimprich (1995) extended the possible elements comprising restorative environments to views of nature from a window. They found a positive association between natural (trees, grass, bushes, and/or lakes) window views and dormitory residents performance on

attentional measures. They suggest that further studies be conducted on design elements (such as plants) that may have an influence on attentional responses. They call for "similar research on the attentional affects of environments in other populations" (p. 85). Kaplan (2001) conducted surveys to build on the work from Tennessen and Cimprich regarding views from windows. Kaplan's research on the view from home shows promising results that views of natural elements or settings tend to contribute substantially to residents' satisfaction with their neighborhood and their well-being as a type of microrestorative environment. Stone (1998) conducted a study of windows and posters on task performance finding that task-relevant posters decreased the number of computational errors, while it also increased positive mood and decreased fatigue perception. Windows did not contribute to task performance, although windows did increase perceptions of environmental motivation.

In addition to the previously mentioned benefits attributed to restorative environments; satisfaction with neighborhood and well-being (Kaplan, 2001) and increased environmental motivation (Stone, 1998); Gulwadi (2006) cites the benefits of microrestorative environments for teacher's inward or outward coping strategy during stress. Berto (2005) indicates that restorative environments improve the participants' performance on attentional performance measures. A study by van den Berg, Koole and van der Wulp (2003) provides a link explaining people's preferences for natural environments over built environments when seeking restorative experiences and the reason this restoration occurs. Participants prefer restorative environments with the "potential to provide restoration from stress or fatigue" (p.

135).

ART in the built environment.

Early attention restoration theory studies all show strong evidence that the ubiquitous natural settings are the most likely type of environment to provide restorative benefits. However, later studies have begun to explore the possibility that restorative environments can be a location other than an actual natural setting. In a study by Berto (2005) results suggest "it is possible to design urban and indoor environments (schools, hospitals, environments for old people, etc.) so they are more 'comfortable' from a cognitive point of view and to manage natural environments in ways to encourage recovery from mental fatigue" (p. 258). Museums as a context for restoration have also been proposed (Kaplan et al, 1993). Monasteries have also been shown to exhibit restorative qualities (Ouellette, Kaplan & Kaplan, 2005).

A study by Scopelliti and Giuliani (2004) expands the concept of restorative environments to include overall restorative potential of place experiences, especially within the built environment context. Specifically in terms of restorative meaning of experiences the "interaction of physical and social components" may better be "characterized by different affective dimensions" (p. 435). Karmanov and Hamel (2008) provide empirical evidence that the urban environments chosen for their study may have similar affective restoration and stress-reducing capacities as does attractive natural environments. Evans (2003) states that the ability to restore attention and diminish stress is indirectly associated with properties of the near environment. Joye, et al. (2010) adds to the body of literature in providing supporting evidence of the

restorative benefits of greenery on consumers in retail settings. Nordh, Hartig, Hagerhall, & Fry (2009) discuss the impact of small urban parks on the restoration of city dwellers.

ART and children.

Much of the literature using the attention restoration theoretical (ART) framework has focused on adult participants. There have been relatively few studies with children explicitly using ART. However there are closely related studies that use natural setting to develop relationships in outcomes for children. For instance, the inclusion of refuges or places to hide in outdoor spaces has been found to be "high on the list of environmental preferences in children" (Kirkby, 1989, p. 7) for sustained developmentally appropriate play. Kylin (2003) describes refuges or dens from both the physical environment and the child's perspective. Kylin found this type of natural setting to be meaningful and supportive for creative play. Sobel (1990) explains the importance for children in their middle childhood in creating special places for themselves, such as dens, dollhouses & snow-forts where they can discover themselves. Sobel says this about the act of creating a special place, either indoors or out; "children need the opportunity to create and manipulate, within prescribed limits, small worlds" (p. 5). This connects with the element of extent from the ART. Weinberger (2006) also emphasizes the importance of retreat spaces within family day care homes, stating "retreat use can be viewed as a potentially adaptive environmental strategy that children apply as their needs change in a given day and from one developmental period to the next" (p. 571).

Faber Taylor and Kuo (2006) examine the state of evidence about children's need for contact with nature. Their review of literature "suggests that this hypothesis may be correct: contact with nature is supportive of healthy child development in several domains – cognitive, social, and emotional" (p. 136). In addition Faber Taylor and Kuo (2006) call for more research into the true quantified value of the role of nature in the lives of children: especially what level and density of nature is beneficial and whether passive or active interaction with nature has greater impact.

Faber Taylor, et al. (2001) found evidence of children with Attentional Deficit Disorder showing marked improvements in their day-to-day attention-related functioning after an increase in exposure to natural environments. The implications of this research suggest that: "all children's attentional functioning may benefit from something as inexpensive and direct as incorporating vegetation into places where children live, learn, and play" (p. 75).

Maxwell (1996) states early childhood educational settings need to have certain physical environmental attributes to meet good childcare requirements, including providing restorative interior elements. Maxwell cites the use of plants in the classroom as an example of a natural element that supports restoration.

Although not specifically addressing the restorative factors of the built environment, Moore and Sugiyama (2007) are creating a shorthand design guide for children's built environment. The final evaluation of this scale is still in the process of being validated as of this writing. "Nevertheless, research has found that the quality of the *physical, designed environment* of early childhood centers…*is* related to

children's cognitive, social, and emotional development (see early summary in Moore 1987, and later in Evans 2006)" (p. 26)

Specific elements within ART measurement scales.

Measurement scales for assessing the restorative components of environments have been developed, for both adult and child participants. The rating scales are reviewed here because of their widespread usage in the ART literature. In addition, many of the components used as indications of ART environments include interior design features such as houseplants, supporting the hypotheses.

Hartig, Korpela, Evans, & Gärling (1996) developed a valid and reliable measure, the Perceived Restorativeness Scale (PRS), as a tool to assess the restorative ability of the four components of the attention restoration theory (ART). In their descriptions of the study sites they included plants ("exotic, potted, many or large planters" (p. 9). They indicate that plants play a substantial role in the design elements of restorative environments. Herzog et al. (2003) utilize ART in their scale by using a direct rating approach to rate each component proposed in the attention restoration environment, as well as considering four additional predictor variables (openness, visual access, movement ease, and setting care). Bagot (2004) developed a perceived restorative components scale for children (PRCS-C) in an attempt to fill a measurement gap in the restorative environments literature. Subsequent research by Bagot, Kuo, and Allen (2007) revealed some weaknesses in the original scale. They developed an amendment (PRCS-C II) to the original scale so as to "strengthen the Extent factor and conduct a factor analysis with a larger sample (p. 26)." The PRCS-C

II scale has been found to be valid and appropriate for use in assessing the perceived restorativeness of environments by children. The PRCS-C II scale is for use with children ages 8 to 11, so it may not be appropriate in this research.

Laumann, Gärling, and Stormark (2001) also designed a rating scale using the four components of the ART. The author's rating scales "provide(s) meaningful and reliable measures of the restorative components of nature and city environments posited by the theory of Kaplan and Kaplan (1989)" (p. 43).

Ulrich's recovery framework.

Similar in some ways to the Kaplan ART framework, yet coming from a different perspective, Ulrich has built a body of research investigating relationship between natural environments and human behavior. Pleasant, typically natural, settings are a major component in Ulrich's (1983) stress-recovery framework, because of exposure to the visual stimuli. The difference between Kaplan (ART) and Ulrich's recovery frameworks is that ART begins from a cognitive source, while Ulrich begins from an affective and physiological source (i.e. e. heart rate and brain electrical activity).

Ulrich suggests future research be conducted on young children and infants to increase the volume of cross-cultural studies that investigate this differential responsiveness to natural versus urban settings. Ulrich, et al. (1991) employed physiological measures to indicate that participants exposed to natural environments had a faster and more complete recovery after observing a stressful movie than did subjects exposed to an aesthetically-unappealing urban environment. Ulrich (1981)

determined that participants benefit from passive contact with plants, such as viewing a print of plants. Scenes of water and, to a lesser extent, vegetation were more effective than urban scenes at holding participant's attention and interest.

Hartig, Böök, Garvill, Olsson, and Gärling (1996), in an effort to differentiate between the restorative components of ART and the psycho-evolutionary framework derived by Ulrich, conducted two laboratory experiments and both studies utilized salivary cortisol measurements. They raise the issue of "whether a distinction can be made between stress and attentional fatigue" (p. 380). Even more relevant for this research is the "possibility that attentional restoration and stress reduction processes might run simultaneously in a restorative experience" (p. 390).

Constructivist educational approach.

The constructivist underpinning creates a sense of the human being, and specifically the child's ability to create meaning upon previous experiences, as scientists build on their prior knowledge. The study was conducted at a center with a constructivist approach, which integrates the variety of needs and stages of children into the curriculum (Strong-Wilson & Ellis, 2007). Several major concepts of the constructivist approach as demonstrated by an active, hands-on discovery approach are:

> (a) the view of the child as a learner; (b) the integrated, emergent curriculum and project work; (c) the teacher – child learning relationship; and (d) the documentation of children's thinking processes and products (Edwards, Gandini & Forman, 1998; Hendrick, 1997; Stegelin, 2001). (Stegelin, 2003, p. 163).

The design of space for children, whether it is their everyday play space, day care facility, healthcare situation or an unfamiliar environment that they are shuttled to in an emergency, should include what is needed for the child's development, safety and general well being. There appears to be a natural link between the constructivist approach and the Attention Restoration Theory. For the purpose of this research, the constructivist approach both represents the actual setting for the research project, as well as begins to tap the subtle element of the physical learning environment.

The young child's classroom is best designed and created as a 'home-like' environment; easy to care for, safe, large enough to provide the required space per child, containing novelty and variety, colors appropriate to the activity, engaging for the child and able to be controlled to a certain degree, have spaces for privacy and restoration, exploration, personalization and a sense of legibility (Maxwell, L. E. 2007; Trancik & Evans, 1995; Weinstein, 1987). Many early childhood classrooms tend to be either overly stimulating or under-stimulating. Children's senses are designed to notice changes in stimulation, rather than attend to a steady input of stimuli. The classroom environment, although static and unchangeable, must be able to support movement and change (Olds, 2001).

Although the researcher was unable to find academic studies directly linking the intersection of educational theories with that of the attention restoration theory, more must be discussed on their possible overlap. To illustrate the possible influence of the child's near environment on learning, one specific educational approach is highlighted. The Reggio Emilia approach was originally influenced by the work of

the seminal constructivists Piaget and Vygotsky (Gandini, Hill, Cadwell, & Schwall, 2005) and assists in demonstrating the influence of the constructivist-theoretical inclusion in this research. One of the guiding principles for the Reggio Emilia approach is that the classroom environment is the third teacher (of a team of two human teachers). In a few ways, this principle is displayed in the overall ease of navigation, access to quality materials to support the 'hundred languages of children', as well as the ability to display the works of the children and continue project-based work over the course of time. (Gandini, 1998). A well-resourced learning environment exemplified by the Reggio approach appears to support deeper and richer learning as the young 'scientist' is able to create his or her own learning based on the interaction with peers *within* a quality physical setting. See Figure 2 for a photo image exemplifying the care taken to ensure a quality interior design for preschooler's learning, within a Reggio Emilia approach classroom (Reggio Emilia Provocations NZ, 2006).

Figure 2

Autumn colors light box activity area in Reggio Emilia setting.

Children's stress, attention and self-regulation.

In a principle textbook on stress, coping and development, Aldwin (2007) states "emotion regulation is often based on attention regulation…" (p. 272). This statement lends supports to the inclusion of the attention restoration theory in the proposed child-environment interconnect framework. Attention restoration theory (ART) provides a buffer for children experiencing stress due to novel situations, such as non-home care facilities (Kaplan & Kaplan, 1989). Over and under-stimulation also are typical near environment situations potentially causing developmental harm to young children (Legendre, 1999). Recent literature supports the essential role of

directed attention on children's school success (Diamond, Barnett, Thomas, & Munro, 2007).

Literature suggests that there is a connection between the ability to regulate one's attention and the ability to regulate one's emotional state. According to Eisenberg and Zhou (2000), "emotion regulation often is accomplished through effortful management of attention (e.g., attention shifting and focusing, cognitive distraction) and cognitions that affect the interpretation of situations (e.g., positive cognitive restructuring)…" (Eisenberg & Zhou, 2000, p. 167). Kaplan in an interview with Gallagher (1993) plainly says, "Nature could play a terribly important, although as yet almost unrecognized, role in reducing some of their stress."

It has been suggested that children's natural tendency to sustain attention may be more accurately unveiled in free play settings (Alessandri, 1992). Sarid and Breznitz (1997) also find free choice settings to be a sensitive time to assess preschoolers' ability to sustain attention. Attention in young children has been widely studied in the developmental psychology literature in terms of a child's distractibility because of the importance placed on maintaining attention in early learning. "States of focused and casual attention are generally inferred through facial expression and motor activity, but the duration of engagement or looking may also be an indicant" (Kannass & Colombo, 2007, p. 64). In fact, Kannass & Colombo (2007) state that "infants and children are less distractible when they are engaged in long looks to the target than when they are engaged in short looks to the target" (p. 64).

Understanding the complexities of attention within a preschool learning environment is further informed by recent literature on children's self-regulation, as attention appears to be one component of self-regulation. Self-regulation, from a behavioral perspective, can be viewed as:

> deliberately applying attention, working memory, and inhibitory control to overt behavioral responses like remembering to raise your hand and waiting instead of shouting out an answer (McClelland, Cameron, Connor, et al., 2007; McClelland, Cameron, Wanless, & Murray, 2007; Morrison, et al., in press; Ponitz, et al., 2008)" (McClelland & Ponitz, 2010, p. 4).

Specifically, McClelland and Ponitz (2010) state "research … points to attention as an important mediator of children's early emotion regulation and their school success" (p. 6)

The realization that children experience everyday stress very similar in nature to the stress experienced by adults, although commonly manifested as psychosomatic symptoms such as headaches, is becoming common knowledge (Brobeck, Marklund, Haraldsson, & Berntsson, 2007). The social support role of parents, extended relatives, siblings and peers is an important contributor to the child's adjustment process. (Aldwin, 2007; Donate-Bartfield & Passman, 2000; Dubow & Tisak, 1989; Kliewer, Sandler, & Wolchik, 1994). Given that social buffering, peer support and family influences are shown to influence children's attentional and stress states, this study is an attempt to move beyond the human factors to assessing the

physical elements that have been suggested to influence children's well-being.

Children's place attachment.

There is a growing body of literature that explores children's self-regulation in conjunction with place attachment and restorative outcomes. An important assumption for this study is that the spaces these children spend time in outside of their own home should have a home-like feeling to them, although creating home-like conditions in child care facilities can be challenging (Whitehead & Ginsberg, 1999). In that vein, an attempt to understand children's place attachment is an important component to providing a stress buffering or restorative near environment.

Kaiser and Fuhrer (1996) explain that attachments are formed to places that fulfill people's emotional needs and make possible development and maintenance of their identities. Indeed favorite places are cited as affording emotional recovery and restorative experiences. Specifically, favorite place studies indicate numerous examples of self-reflection and solitary restoration opportunities (Korpela, 1996; Korpela & Hartig, 1996). Older adolescents and adults use private places or natural settings as indicators of group-membership and tools for self-identity development. (Korpela et al., 2001). There is a robust relationship between places (built or natural environments) and either cognitive or emotional regulation for children and young adults (Korpela et al., 2002). Choosing restorative places in both natural and built environments with the goal of experiencing emotional and/or cognitive restoration is seen to be relevant for all people through the lifespan (Scopelliti & Giuliani, 2004).

Plants in the Near Environment

Plants in the form of potted plants, flowers, gardens, trees outside of windows, and nearby nature have all played a role in the environment psychology and the near environment literature (Coley, Sullivan, & Kuo, 1997; Kaplan, 1973; Wells & Evans, 2003; Whitehouse, Varni, Seid, Cooper-Marcus, Ensberg, Jacobs, & Mehlenbeck, 2001). For the purpose of this study, the tangible component of interest in the near environment is the presence of commonly found green houseplants. This interior design element is present to varying degrees in places visited and inhabited by children, as well as adults. Here is a broad sweep of the literature regarding all plants in many types of near environments. Some seminal literature discusses indoor plant's psychological effects in the near environment approaching the relationship using gardening as a starting variable. Kaplan (1973) found that gardening emerged as a powerful source of the benefits provided by fascination, a component of ART.

In another early literature review of everyday environments, Kaplan (1983) asks: "What kind of nature and how much of it is necessary for enhancing a sense of tranquility, an inner peacefulness, that the rush and confusion of the urban environment so readily violate?" (p. 157). Rappe (2005) provides a clear example for the difference in 'kind of nature' by finding the impact of actively caring for plants versus passively experiencing plants in elder care situations. Alexander, Ishikawa, and Silverstein (1977) also attempt to describe human's desire for plants and nature. Although not empirically-based, they allude to plants' restorative potential on the human psyche:

> People need contact with trees and plants and water. In some way, which is hard to express, people are able to be more whole in the presence of nature…are able to go deeper into themselves, and are somehow able to draw sustaining energy from the life of plants and trees and water (p. 806).

Lohr (2007) synthesized the benefits of nature literature and offers suggestions as to why people tend to respond positively to nature. She states that embedded among other benefits, people's stress levels lower and their attention increases when they are exposed to trees and nature. Lohr continues, "research shows that plants also contribute positively to our mental health, improve our physical health, and make our communities safer. An understanding of the importance of plants and how and why people respond to them is becoming widely appreciated." (p. 84). The assumption is that if this statement is valid, that it will also apply to the population of children.

The existing literature strongly suggests that the presence of plants in the near environment has positive associations with adult populations, such as office workers. Office environment research has found relationships between the presence of plants on both productivity and stress levels (Bringslimark, et al. 2007; Lohr et al., 1996). Bringslimark, et al, (2007) suggest that "directed attention restoration might play a role in reducing stress" (p. 582) and that signs of associations suggests that plants feed into a general process common to all three outcomes (less sick leave, more productivity and lower stress). Lohr et al. (1996) also suggests that an increase in attentive feelings is directly related to a positive increase in productivity. Other

benefits emerged from the literature including positive psychophysiological influence for worker's who do not have a window view of nature (Kaplan, 1973, 1983; Chang & Chen, 2005) and the reduction in health symptoms of office workers as measured by cough, nasal irritation and neurological symptoms, such as drowsiness, nausea and headache. Two possible explanations for these office worker improvements are "an increase in general well being due to the perception of foliage plants or the effect of increased attention" (Fjeld, et al., 1998, p. 207). However, in this case, the authors consider the increased attention factor to contribute only slightly.

Shibata and Suzuki (2004) demonstrated an increase in positive mood and enhanced task performance for female participants in a study of the effects of either indoor plants or a magazine rack. Contrary to other findings of productivity of office workers in the presence of indoor plants, yet still building on the body of knowledge, are the findings that the presence of plants in an office environment reduces productivity, while increasing the comfort and attractiveness of office environments as well as the participant's well-being rating. The authors suggest, "plants may contribute to a setting's ability to promote human creativity and relaxation" (Larsen, Adams, Deal, Kweon, and Tyler, 1998, p. 280). Kyung-Ha Lee (2007) in a small sample of workplace stress participants found that indoor waterfalls and indoor plants were preferred interior elements.

Shibata and Suzuki (2001) investigated the effects of indoor plants on participants' task performance, fatigue, and mood. The study evidence "appears to suggest that the recovery from fatigue could have been accelerated by the plants" (p.

393). As well they "suggest the existence of the plants affected the restoration from fatigue rather than the reduction of fatigue" (p. 393). Furthermore, "the current study showed restorative effects by plants on task performance, without showing any effects on mood evaluation" (p. 393). This statement supports the use of the Kaplan's attention restoration theory for this research rather than the use of Ulrich's framework. Results from a study by Yamane, Kawashima, Fujishige, & Yoshida, (2004) suggest that active interaction with plants promoted physiological relaxation. Bringslimark et al. (2007) state the importance of future work "investigating factors that enhance coping, restoration, and performance in the work place" (p. 586). For children, their work place is most often their place of learning. However, there is a lack of supporting evidence demonstrating the influence of plants on children's well being.

In addition to office environments, the effects of indoor plants on human behavior and well being have been studied in healthcare settings. Dijkstra, et al. (2008) investigated the role of indoor plants in healthcare environments. The study confirmed the stress-reducing properties of natural elements in the built healthcare environment with evidence to support the contributing factor of subject's perceived attractiveness of the environment.

Lohr and Pearson-Mims (2008) examined the relationship between plants and acute pain. The patients in a room with plants felt less discomfort than did patients in a room without plants when experiencing discomfort from a hand submerged in ice. The patient's perception of a room and cognitive wellbeing appeared to be enhanced with the presence of plants. A positive perception of a room was shown to foster a

positive outlook. Lohr and Pearson-Mims calls for more studies to "fully determine the potential benefits of using plants in interior environments to enhance human perceptions of well-being (Lohr & Pearson-Mims, 2000). This research confirmed previous studies documenting the stress-reducing benefits of passively viewing plants" (p. 176).

Plants in children's near environment.

Despite a growing body of literature on the effects of houseplants on adults, there is very little research on the effects of plants in the near environment on children. However, the literature has begun to develop on the importance of outdoor natural exposure for the health of children. In addition, there are a few literature examples mentioning the inclusion of houseplants in children's near environment (Harvey, 1989; Read, 2009). Experiences with plants in the outdoors during childhood seem to have a positive effect on the child's later attitude as adults towards trees in cities (Lohr & Pearson-Mims, 2004). Speaking from a general point of view in support of children's exposure to nature Louv (2005) asserts the role of plants in children's lives: "Nature as antidote. Stress reduction, greater physical health, a deeper sense of spirit, more creativity, a sense of play, even a safer life–these are the rewards that await a family when it invites more nature into children's lives" (p 161).

The use of plants in the design of childcare spaces has been touted by numerous texts, although most are not empirically based. In a guidebook for childcare design by Olds (2001), the use of harmonizing and "keenly felt" (p. 262) accessories is suggested, such as plants, as well as mobiles, knick knack, prisms and lamps. She also

specifies plants as a good tool for assisting interior circulation in childcare facilities by giving these spaces distinctiveness and beauty. Isbell and Exelby (2001) prescribe the use of plants and blooms to generate a feeling of home for creating beautiful spaces as well as for creating a "place to pause" or a restorative spot when designing meaningful environments for young children.

The use of gardens within a hospital context for children and adults alike is gaining popularity as this type of environment is seen to aid in restoration and healing (Brethour, et al., 2007; Cooper-Marcus, 1999; Whitehouse, et al., 2001). These healing gardens provide a place of quiet and respite for the patient and their families.

Despite these references to plants and nature in the lives of children, there does seem to be a lack of empirically based literature on the impact of plants on children's well-being. Lindemann-Matthies (2005) agrees, stating that barely any studies have even explored children's preference for green plants.

Object influence and interior design elements.

The impact of interior design of the built environment on a child's well being, constructed with a variety of determinants, is fairly well documented in current literature in a variety of settings. Specific design elements in the interior environment, such as wall color and ceiling height, have been shown to directly affect the preschool child's cooperative behavior (Read et al., 1999). Kantrowitz and Evans (2006) found that the number of play centers and the ratio of the children to these spaces contributed to the children's off-task behavior. Legendre (2003) also found a correlation with

toddlers between large numbers of children in a group; available play space; and cortisol levels.

Maxwell (2007) has developed a rating scale for assessing quality physical child care environments with this belief: "If the physical environment is an equal partner in children's learning experiences, then it is important to understand more about the quality and characteristics of an environment that promotes competence and learning" (p. 230). Maxwell (2008) indicates that a variety of materials and equipment be made available to allow the children to maintain some control over their learning. Maintaining the proper scale for children is important, as an example of reducing behavioral constraints. Personalization of the space and ability to seek out privacy are also indicated as important environmental features of the near environment. There must be an appropriate level of variety including texture, sensory materials and opportunities for cognitive restoration in the pursuit of young children's competency. Many of these design requirements may easily be satisfied with the inclusion of houseplants (i.e. texture, privacy screens, proper scale).

Other literature supports the inclusion of restorative spaces within childcare environments. Trancik and Evans (1995) describe the importance of the physical environment supporting opportunities for taking time out so as to alleviate physical or cognitive fatigue. They also cite the interior design elements that promote children's competency, complexity, exploration, place identity, legibility, and safety. McCoy and Evans (2002) found that a view of natural environment and the use of natural materials among other influences increased user's perceived level of creativity.

Anglin (2004) reports on children's residential programs in an effort to determine contributing factors in providing care that is in the best interest of the child within a complex system of care. It is the interior design elements that have been demonstrated to remove the institutional feel while providing a safe environment that allows for the personalization of space, aesthetics, including color schemes and plants, and functionality, including space planning and appropriateness of furniture, that in turn increase perceptions of a comfortable environment (Docherty et al. 2006). Adolescent's level of satisfaction with their alcohol and drug treatment residential facilities was higher for environments utilizing "quality furnishings and finishes of light colored woods, jeweled-toned upholstery, wall-to-wall carpeting, and framed prints and original art work" (Potthoff, 1995).

Within the pediatric healthcare environment similar findings have indicated that access to nature, reduced noise, and reduced crowding improve beneficial outcomes (Sherman, Shepley, & Varni, 2005). Shapiro, Melmed, Sgan-Cohen, Eli, & Parush (2007) provide evidence that a sensory adapted environment (partially dimmed room with lighting effects, vibroacoustic stimuli, and deep pressure) may be effective in reducing children's anxiety due to dental situations.

Chapter 3: Methods

The main objective of this study was to look for relationship(s) between the presence of a group of houseplants on preschool children's lengths of attention and types of attentional states while in a classroom environment during a free-choice time period. In order to test this objective, a quasi-experimental observational study was conducted on a convenience sample of preschool participants. Although the intention of the study was to look for possible influence(s) of plants on children, the goal was not to create a limited variable, controlled setting. Rather, studying the influence of plants on preschool children in a naturalistic, in-situ setting was desired. The following chapter discusses the sample population, research design, methods and analysis that were used for this study.

Research Design

One dichotomous independent variable, the presence of houseplants, was considered in this quasi-experimental research project. The experimental area was the vicinity near a sensory-table activity area in two regular preschool classrooms, treated with a group of houseplants arranged approximately 2-feet from the learning center. The control area was the same sensory-table activity area with no plants placed anywhere within the immediate vicinity (10-foot range). Therefore, the independent variables were either: control, no plants (NP) or treatment, plants (P). The study used a quasi-experimental observational design with all participants experiencing each of the two conditions. There were 3 dependent variables measured:

- The observed length of time participants spent at the activity area, in

second increments, recorded and coded while reviewing the video recording.

- The observed type of attention exhibited by participants as measured by type of an attentional states checklist (See Table 1 on page 42), recorded by the researcher and verified by the participants' teacher.
- The type of adaptive behavior exhibited by participants as evaluated by the Social Competence and Behavior Evaluation, Preschool Edition, shortened version (SCBE-30) (LaFreniere & Dumas, 1996), recorded by the researcher and verified by the participants' teachers.

Table 1

Types of attentional states

Category	Definition
Inattentive (I)	The child displays random, fleeting, visual checking of the environment, does not respond to the overtures of peers, and does not sustain the activity.
Alert (A)	The child stops activity, responds voluntarily to surrounding stimuli for up to 3 seconds then resumes the activity.
Sustained (S)	The child stops activity, responds voluntarily to surrounding stimuli for more than 3 seconds then resumes the activity.
Focused (F)	The child stops activity, responds voluntarily to surrounding stimuli for more than 3 seconds and moves closer to observe a peer's activity; there may also be interaction with the peer about the activity.
Divided (D)	The child displays a balance of engagement between their current activity and that of another, such as talking with a peer while still maintaining attention to a task.

From: Brown, Bortoli, Remine, & Othman (2008).

The intention for the study was to create a multi-measure research method utilizing video recorded observations, measurement of concrete attentional behaviors and adaptive evaluations recorded by the researcher and validated by the participants' regular teachers to begin to assess for relationships between the presence of houseplants and preschool children's attentional behaviors. Neuman (2006) says the triangulation technique of taking multiple measures is an effective way to ensure the researchers captures many angles of the variables in order to optimally focus on influences. The results were analyzed using both quantitative statistical analysis and qualitative descriptive narrative and video observation.

Data Collection

Sample population.

The participants in this study were purposively selected from among the enrolled attendees at the year-round program, at the OSU Beaver Beginnings facility during the summer of 2009. All children who attended the center, spent time on at least two occasions at the sensory-table activity during free-choice time and whose parents gave permission via signed consent forms for their participation were included in the study. The sample size was 32 preschool children, 18 girls and 14 boys, see Table 2 for demographic information.

Table 2

Sample population demographics (N=32)

Variable	Item/#	
Class	Rm 117	Rm 127
	21	11
Gender	Male	Female
	14	18
Age (range = 34 months, 23 days to 69 months, 21 days old)	<53.5 months	>53.5 months
	16	16
Number of visits	<6	6-11
	21	10

These participants were present on at least two occasions in both treatment settings. See Table 3 (on page 44) for observational frequencies by room and condition. The participants were comprised of children in two different classes at the facility. Two demographic variables, age and gender, were recorded. The range of ages for the children attending the preschool classrooms at the start of the study was 34 months, 23 days to 69 months, 21 days. The individual birthdays of the participants were obtained from the center director, Chris Riggan, at the beginning of the data collection period. This information gathering technique is important so as to maintain the confidentiality of the participants. Typically, the center as a whole serves a diverse population of children, ranging in age from infants to Kindergarten. The aim was to attain a research sample of participants from diverse backgrounds. However, no racial or ethnic information was collected.

Table 3

Observational Frequencies by Class and Condition.

Condition		# of observations	
Rm. 117 July		12	
Rm. 117 Aug		20	
Rm. 117 Sept		3	
	Total	35	
Rm. 127 July		10	
Rm. 127 Aug		17	
Rm. 127 Sept		0	
	Total	27	
	Total obs both rooms	62	
Rm. 117 treatment (P)		16	
Rm. 117 control (NP)		18	
Rm. 127 treatment (P)		15	
Rm. 127 control (NP)		13	
	Total obs P		31
	Total obs NP		31

Treatment.

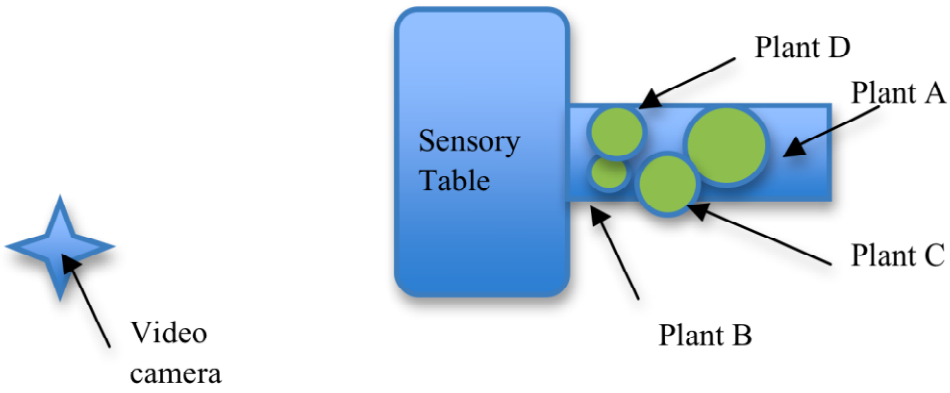
Each day's treatment (presence of houseplants) or control (no houseplants present) of the environment was determined a priori using a random selection process, specifically a random number generator in the Excel program. The randomization of conditions was established at the beginning of the study before any observations were recorded. The process of randomizing the condition settings met the goal of equalizing the number of treatment days with the number of control days. The randomization of plant placement was intended to account for possible confounding variables such as; weather, teacher material selection, peer influence, and child motivations. It is appropriate to consider the randomization of the plants in the condition area as a necessary component to creating a quasi-experimental study (Neuman, 2006). See Figure 3 for a simulated layout of conditions.

During treatment conditions, the plants were arranged on a low shelf within 2-3 feet of the sensory table while the children were otherwise engaged, either out of the classroom or occupied during teacher-directed circle time. See Figure 4 (on page 46) to view actual photographic representation of both the treatment and control conditions. The plants were intended to be a background interior design element, as opposed to a central interactive activity.

The classroom rules for room 117 allowed only 2 students to play at the table at a time, while for room 127 up to 4 students were allowed. The sensory table activity area was selected as the condition setting due to its regular student participation rate.

Figure 3

Simulated layout of treatment conditions.



KEY:
Plant A = dracaena plant
Plant B = polka dot plant
Plant C = Roosevelt fern
Plant D = spider plant

Figure 4:

Photo images of control and treatment conditions, Rooms 117 & 127

Control conditions:

Room 117 control condition

Room 127 control condition

Treatment conditions:

Room 117 treatment condition

Room 127 treatment condition

However, room 127 often only opened one of the two sensory table sections because, in general the sensory table turned out to be a less frequented activity for this group of students. See Figure 10 (in Appendix A, page 104) for renderings of the classroom floor plans. The arrangement consisted of the same 4 plants of various sizes grouped at children's eye-level in the selected free-choice learning areas. The plants were selected based on their non-toxicity and their generally ease of availability. The researcher tended all care for the plants' placement, relocation between classrooms and the regular caretaking maintenance of the foliage and overall plant health.

The investigation took place at the OSU Beaver Beginnings located on the Oregon State University campus in Corvallis Oregon. OSU Beaver Beginnings is a facility operated by Children's Creative Learning Centers in accordance with the NAEYC guidelines. The study took place during the existing period of free-choice playtime each day that is part of the daily curriculum. This time varied between the two classrooms. Typically this period occurs from 10:15 am to 11:00 am for Classroom 117 and from 3:00 pm to 3:45 pm for Classroom 127. The center was closed for a holiday (Independence Day).

There were two occasions when the classroom teachers requested non-experimental days. This occurred because the researcher requested that only non-liquid materials be made available in the sensory table, so as to provide a control for the experiment. Although no literature was found on this supposition, teachers generally believe that liquid-based materials in the sensory table are more appealing to the children than dry materials, so it was logical to provide a uniform draw to the

sensory table, throughout the 8-week period. The days the participants did not engage in free-choice time, data were not collected. See Table 7 (in the Appendix, page 106) for the research timeframe.

The researcher met with the center director, Chris Riggan, prior to contact with teachers, parents, or children. An orientation meeting with the four preschool teachers was held on June 17th, 2009, to describe the project, answer questions and to begin discussing obtaining teacher and director consent for the research.

Directed attention fatigue is a form of stress experienced when the brain has been focused on one task for a period of time with the consequence being fatigued attentional capacities (Kaplan & Kaplan, 1989; Kaplan 1995). This may naturally occur mid-morning in all childcare facilities, regardless of assessment (Gunnar & Quevedo, 2007; Legendre, 2003). All parents of the subjects were asked to sign a consent form permitting their child to participate in the study. See Form 1 (Appendix C, p. 107) for Internal Review Board documents.

Inclusion criteria were:

- The child attended OSU Beaver Beginnings during the summer 2009 research period.
- Parents and teachers consented to allow the child to participate.

Exclusion criteria were:

- The child did not visit the experimental under both conditions.
- The parents or teacher did not consent to the child's participation.

- The child displayed extreme interest in the video cameras in such a way as to interfere with the study.

The treatment, or independent variable, was the commonly found interior design element of houseplants, dichotomously measured as either present or not present. The plant species were all non-toxic and deemed safe for use in rooms occupied by young children. The species and their sizes (all pictured in Figure 4) are:

- Medium-sized spider plant (Chlorophytum comosum);
- Medium-sized Roosevelt fern (Nephrolepis exaltata cv. 'Rooseveltii');
- Large-sized dracaena plant (Dracaena marginata);
- Small-sized polka dot plant (Hypoestes phyllostachya)

Videotaping.

Videotaping of the treatment and control areas occurred for at least forty-five minutes only during the regular free-choice play period, five days a week for an eight-week period. Once consent from the parents and IRB approval was obtained, a digital video camera, with audio capabilities, was positioned on a tripod in a spot that allowed it to remain unobtrusive while still retaining the ability to capture the children's actions while at the sensory table during the free-choice time period. A trial run was recorded so as to ensure the range of the video camera was sufficient to capture all of the movements and behaviors of the participants in the condition areas. The primary investigator assessed the clarity of the video capture. The camera was turned on prior to the beginning of the children's free-choice period and left running until the free-choice period ended or the camera ran out of one-hour recording space. The children

proceeded to the activity as they would during a typical day in the classroom.

The use of video recording allowed a more detailed analysis of the participants' length of attention at the condition area than would have been feasible with an in-person observational strategy. Video recording is commonly used as a "sole observational strategy to examine...sequencing of minute behaviors, concurrent behaviors, and nonverbal behaviors that are difficult to observe in real time" (Paterson, Bottorff & Hewat, 2003, p.31). It was intended for the selected measurement scales to assess the participants' primary types of attentional states (Brown, Bortoli, Remine, & Othman, 2008) and overall adaption to the environment, (e.g. the shortened form of the Social Competence and Behavior Evaluation (SCBE-30). One set of randomly selected video recordings were viewed and rated by the regular classroom teachers, then cross-referenced with the researcher's results to test for reliability. The assumption was that the teachers would provide reliable and valid evaluations of the participants.

There were a total of 62 videotaped observation sessions. The total number of observations for room 117 was 35, while the number of observations for room 127 was 27. Total number of videotaped observation sessions for treatment (P) conditions was 31 and for control (NP) conditions was 31. The final sample size for participants who visited both treatment and control settings was 32. There were 7 children who were excluded because although they were occasionally present during observational periods, they either did not visit both condition settings or their parent's did not turn in the consent form. The video editing software program Final Cut Pro was used to blur

these 7 children's faces to prevent identification.

The Instrument.

The behavioral checklist utilized was the Social Competence and Behavior Evaluation, Preschool Edition, shortened version (SCBE-30) (LaFreniere & Dumas, 1996). This 10-item scale is designed to measure social aptitude, affective manifestation, and adjustment in children ages 2 ½ to 6 years of age. It was chosen because it is a scale that has been cited numerous times for use of assessing young children's adjustment to their environment in a descriptive rather than diagnostic manner (Anthony, B. J. Anthony, L. G., Morrel, & Acosta, 2005; Kotler & McMahon, 2002; Shortt, Barrett, Dadds, & Fox, 2001; U.S. Dept of Health & Human Services, 2009). The 10-point SCBE-30 scale was adapted for this study as a dichotomous measure of absence/presence for each of the behaviors.

While viewing the video recordings, the researcher marked the length of time participants spent at the treatment area in 1-second increments. While viewing the video recordings, the participants' teachers evaluated each participant for a randomly selected observation period on both the SCBE-30 scoring sheet and the type of attention checklist. These tallies were then compared with the researchers tallies to check for consistency.

During the observation and coding process children were identified by an assigned participant code, so as to maintain the participants' anonymity. No identifying characteristics are believed to be discernable. Confidentiality was maintained to the highest degree possible by the researcher.

Data collection occurred for a period of 45 minutes, of which the first half an hour's data was coded. Data was collected in two classrooms one time each day, during the usual free-choice playtime. This occurred in the morning in one classroom (rm 117) and in the afternoon in the other classroom (rm 127). These periods of data collection occurred over an eight-week period, with randomization of plant's presence accounting for approximately half of the observation time. There were 39 possible total days from which to sample. Coding of the length of attention, type-of-attentional state checklist, and type of adaptive behavior checklist were quantified and tallied from the video recordings onto blank copies of the tracking form (See Figure 11, Appendix A, page 105). The participants' length of attention, as assessed by their arrival and departure at the sensory table, was coded every 1-second. The participants' exact location was also marked by pre-existing masking tape on the floor surrounding the sensory-table environment, however, this location information was not analyzed due to limitations in the research project.

Statistical analysis.

Three types of dependent variables (length of attention, type of attentional state, type of adaptive behavior) were analyzed using the independent variable of either treatment (P) versus control (NP) settings, using both paired-sample t-tests for the mean difference between conditions for each participant, as well as the Wilcoxon Signed Rank, the nonparametric version of the paired-sample t-test. However, as discussed by Neill (2008) and Gliner, Vaske and Morgan (2001), due to the small sample size and the intent to not generalize the findings beyond the sample population, stand-alone p-values generated from the t-tests were considered to be a misleading measure of the influence of the houseplants on the dependent variables as they are dependent on the size of the sample and may not accurately convey the actual extent of the relationship between the independent variable and the dependent variables. With this consideration in mind, the effect sizes were deemed a more accurate measure of the relationship between the presence of houseplants on the length of attention, type of attentional state and type of adaptive behavior of the participants. Abbreviations are used to represent the variables (P, plants; NP, no plants; I, inattentive, A, alert; S, sustained; F, focused; D, divided; A-A, anger-aggressive; S-C, social competence; A-W, anxiety-withdrawal).

In order to generate the effect sizes, further analysis of the possible influence of houseplants on the participants, the Cohen's *d* effect size was calculated for each matching pair (individual participants in both the treatment and control settings) by using the means, pooling the standard deviation from each and using the calculated

correlation from the paired samples t-test. See Table 4 (on page 57) for the complete statistical results.

The focus for this study's analysis was to look at the participants' behaviors while they were in both the treatment condition and the control condition in order to compare the participants' lengths of attention and note any discernable differences, such as: a high positive correlation or high effect between the participants' length of attention while in the treatment area as compared to the lengths of attention exhibit in the control area. A secondary area of focus was to look for any high positive correlations or high effects for the influence of the houseplants on the participants' type of attention exhibited (i.e. focused, alert, divided) as well as on the participants' exhibited adaptive behavior, as measured by the SCBE-30.

Table 4

Mean Differences in Participants' Attention and Behavior at Control (NP) and Treatment (P) Settings (N=32)

		Control –NP			Treatment – P						
	df	Min	Max	*M* (SD)	Min	Max	*M* (SD)	Correlation	95% CI [ll, ul]	Cohen's *d*	Interpretation
Total avg length of visit(s)	31	00:03	16:43	5.15 (3.30)	00:43	15:37	5.40 (3.34)	.434	[–01:36, 00:57]	0.12	trivial effect
Avg length of visit(s) - Rm 117	20	01:36	11:15	5.52 (2.31)	00:50	14:54	6.03 (3.16)	0.098	[–01:58, 01:36]	0.2	small effect
Avg length of visit(s) - Rm 127	10	00:03	16:43	4.04 (4.48)	00:43	15:37	4.55 (4.08)	0.689	[–03:14, 01:29]	0.33	small effect
Avg length of visit(s) - boys	13	01:36	08:20	5.07 (2.18)	02:42	10:11	5.25 (2.16)	0.094	[–02:04, 01:29]	0.09	trivial effect
Avg length of visit(s) - girls	17	00:03	16:43	5.21 (4.16)	00:43	15:37	5.51 (4.22)	0.505	[–02:38, 01:39]	0.1	trivial effect
Avg length of visit(s) - <age	15	01:36	08:49	5.10 (2.04)	00:50	10:11	5.20 (2.26)	-0.025	[–01:53, 01:34]	0.05	trivial effect
Avg length of visit(s) - >age	15	00:03	16:43	5.20 (4.35)	00:43	15:37	5.59 (4.29)	0.547	[–02:57, 01:39]	0.13	trivial effect
Avg length of visit(s) - <6 visits	18	00:03	16:43	4.49 (3.47)	00:43	15:37	5.28 (4.18)	0.466	[–07:33, –03:24]	0.28	small effect

table continues

Avg length of visit(s) - 6-11 visits	6	01:36	11:15	5.47 (.002)	03:19	11:11	6.45 (2.22)	0.746	[–08:56, –04:34]	0.73	medium effect
Inattentive	31	0	3	.31 (.644)	0	2	.34 (.653)	.35	[–.298, .235]	.06	trivial effect
Alert	31	0	12	2.31 (3.032)	0	9	1.66 (2.585)	.072	[–.728, 2.041]	.24	small effect
Sustained	31	0	13	2.72 (3.165)	0	8	1.66 (2.164)	.263	[–.138, 2.263]	.46	small effect
Focused	31	0	2	.22 (.491)	0	4	.53 (1.016)	.018	[–.716, .091]	.42	small effect
Divided	31	0	10	2.97 (3.307)	0	9	2.19 (2.693)	.439	[–.380, 1.942]	.35	small effect

Note. NP denotes No Plant or control setting. P denotes Plant or treatment setting.

Chapter 4: Results

This chapter is divided into three main sections reporting on the results of the study. The results compare the participants' behaviors while in the treatment setting (presence of houseplants, referred to throughout as P) as compared to the participants' behaviors while in the control setting (no plants present, referred to throughout as NP). Recruitment of the sample population is explained and then the first results section addresses the results of the length of participants' attention.

The second section reports on the results of the participants' types of attentional states displayed, and the third section reports the results for the participants' types of adaptive behavior displayed. Within the first section, results are reported in five sections for length of attention (time in minutes and seconds) for: individual participants, individual participants' means by classroom (117/127), individual participants' means by gender (boy/girl), individual participants' means by age (younger/older) and individual participants' means by frequency of visits (<6 visits/6-11 visits). The second section reports on the results for each of the five types of attentional states: inattentive, alert, sustained, focused, and divided.

The third section reports on the results for the three main categories covered by the Social Competence and Behavior Evaluation, version 30 (SCBE-30): anger-aggressive (A-A), social competence (S-C) and anxiety-withdrawal (A-W). Narrative descriptions are included to provide a qualitative perspective for these behaviors.

The results for lengths of attention, as well as those reported for all of the dependent variables, including participants' type of attention and type of adaptive

behavior, are to be applied only to the population sample. There is not sufficient evidence to indicate that the results would be valid or reliable if applied to the generalized population due to the small sample size. Therefore, the findings focus on the effect sizes for this particular sample population, deemed to be more valid and reliable for a study of this nature (Neill, 2008; Gliner, Vaske, & Morgan, 2001). The measurement of lengths of attention were tracked and coded in 1-second increments while viewing the video footage.

Lengths of Attention

The analysis of the possible influence of houseplants on participants was divided into subcategories so as to get a closer look at the possible effects. The grouping are formed naturally into the two separate classrooms (room 117 and room 127), by gender (boys and girls), by ages with "<ages" referring to the younger half of the participants (< 53.5 months) and ">ages" referring to participants ages >53.5 months; and by frequency of the participants' visits (<6 visits or 6-11 visits).

There appears to be a consistent pattern of larger means for length of attention in the treatment (P) settings verses the means for the control (NP) settings, as seen in Table 5.

Table 5

Means for Length of Attention Based on Variables.

Variable	NP (min, sec)	P (min, sec)
total avgs	05:15	05:40
avg 117	05:52	06:03
avg 127	04:04	04:55
boys	05:07	05:25
girls	05:21	05:51
<age	05:10	05:20
>age	05:20	05:59
visits <6	05:00	05:26
visits 6-11	06:02	06:19

Despite this apparent trend, no statistically significant differences were found in any of the groups, utilizing either a paired-samples t-test or a Wilcoxon Signed Rank test, except for: total average time in minutes for the P setting versus the NP setting after running a paired-samples t-test ($t = -.614$, $p = .013$, $d = .12$). All other *p*-values do not fall within the statistically significant range. As previously mentioned, due to the small sample size and the objective of keeping the results valid and reliable for the sample population only, the Cohen's *d* effect size was considered to be a more valid and reliable indicator of relationships between the treatment and control groups (Cohen, 1992; Neill, 2008). Therefore, the Cohen's *d* effect size was the primary result reported for the interactions between the presence of houseplants and the independent variables (see Table 4).

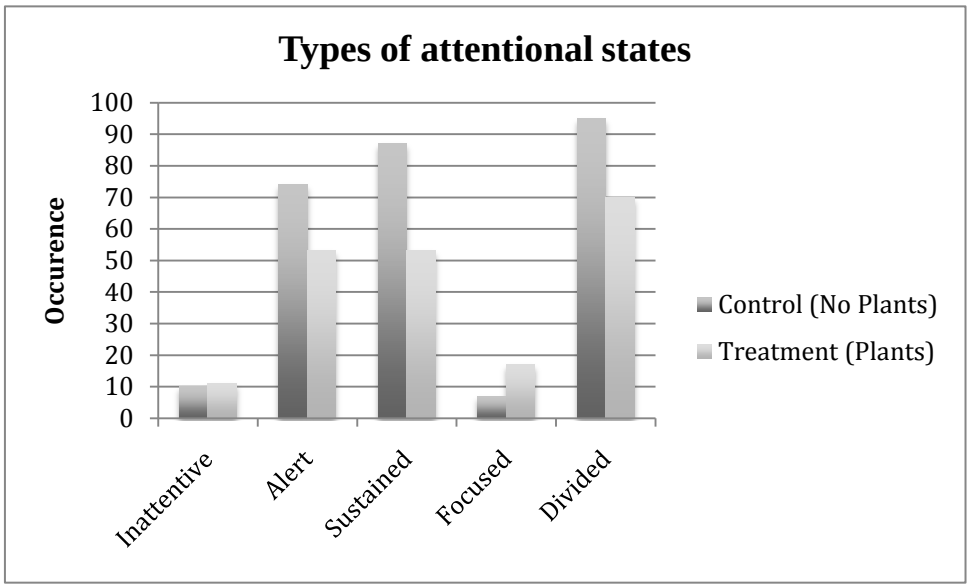
The rule of thumb for the measurement of effect sizes for this study was based on the guidelines proposed by Cohen (1988): < .2 = no/trivial effect; .2 = small or weak; .5 = medium or typical and .8 = large or substantial. The lengths of time (in minutes and seconds) spent at the activity table were compared between the treatment (P) and control (NP) settings using their mean and standard deviation values to calculate the Cohen's *d*. Either no effect or trivial effects were found for the effect of houseplants on four of the variable groups: gender ("avg length(s) of visit – boys", *d* = .09; "avg length(s) of visit – girls", *d* = .1) and age ("avg length of visit(s) - <age", *d* = .05; "avg length of visit(s) - >age", *d* = .13. Small effects were found for the influence of houseplants on: the average length of time participants' spent at the activity in room 117, *d* = .2; the average length of time at the activity in room 127. *d* = .33; as well as for those participants who visited the area less than 6 times, *d* = .28. Medium effect sizes are reported for the effect of houseplants on the average length of time at the activity for those participants who visited the area between six and 11 times, *d* = .78.

Types of Attentional States

The types of attentional states exhibited by the participants were analyzed using observational coding while viewing the video footage. See Figure 5 for the range of occurrences for the types of attentional states during the course of the observation period.

Figure 5

Frequencies of Attentional States



The five types of attentional states seemed to fall on a natural spectrum of linear continuity, however, the researcher was unable to verify whether or not the types of attention are related in a linear way. The 5 attentional states were inattentive (I), alert (A), sustained (S), focused (F) and divided (D) as described in detail in Table 1 (on page 42). These attentional states were categorized and labeled for previous research by Brown, et al. (2008). This table was selected due to the operational clarity of the description defining each type of attentional behavior. Video stills capturing the specific movements, known as multimodal discourse analysis (MDA) (O'Halloran, in press 2011), are included in Figures 6-9 to more clearly demonstrate how the four 'active' attentional states are displayed within the research context. The attentional

state, ‘inattentive’ is not displayed in this format.

The attention scores were compared between the control (no plant) and treatment (plant) settings using their mean and standard deviation values to calculate the Cohen’s *d*. The results were: trivial effect for “inattentive” (*d* = .06), small effect for “alert” (*d* = .24) and “divided” (*d* = .35) and very close to medium, yet still in the small range for “sustained” (*d* = .46) and “focused” (*d* = .48).

Types of Adaptive Behaviors (SCBE-30)

As with the findings for the presence of houseplants on the participants’ type of attention states, the findings for the types of adaptive behavior also appears to be a small but valid starting point for future research. The 30 behaviors listed in the SCBE-30 as a whole were seldom exhibited during the observational videos. Of a possible 1920 cell frequencies (possible occurrences of the display of any of the 30 behaviors) there were only 30 occurrences, or 0.016% frequency. The researcher was unable to obtain copyright permission to reproduce the SCBE-30 table. The nature of the SCBE-30 was intended to provide a solid and reliable guideline for assessing participants’ ability to adjust to new settings. However, the settings were not considered ‘new’ for many of the participants, as they attended the same classroom for a number of months previous to the observation period. There were three main subgroups of behaviors that could have been displayed: anger-aggressive (A-A), social competence (S-C) and anxiety-withdrawal (A-W).

Figure 6

'Alert' video MDA example

Less than 3 second glance at surroundings

Figure 7
'Sustained' video MDA example

Figure 8

'Divided' video MDA example

Raises shoulder, shakes head at teacher in the neighboring area, keeps scooping and pouring material

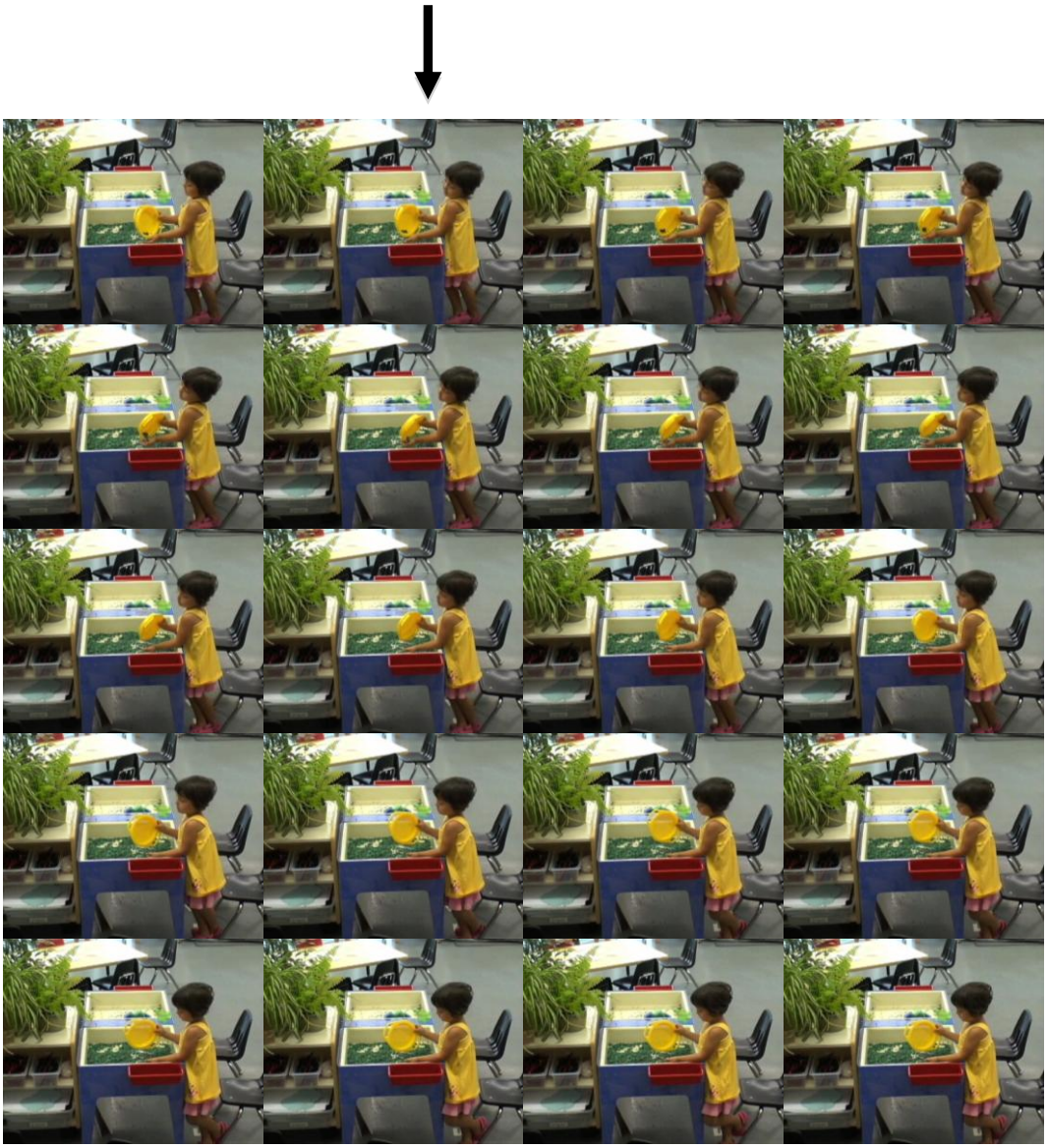
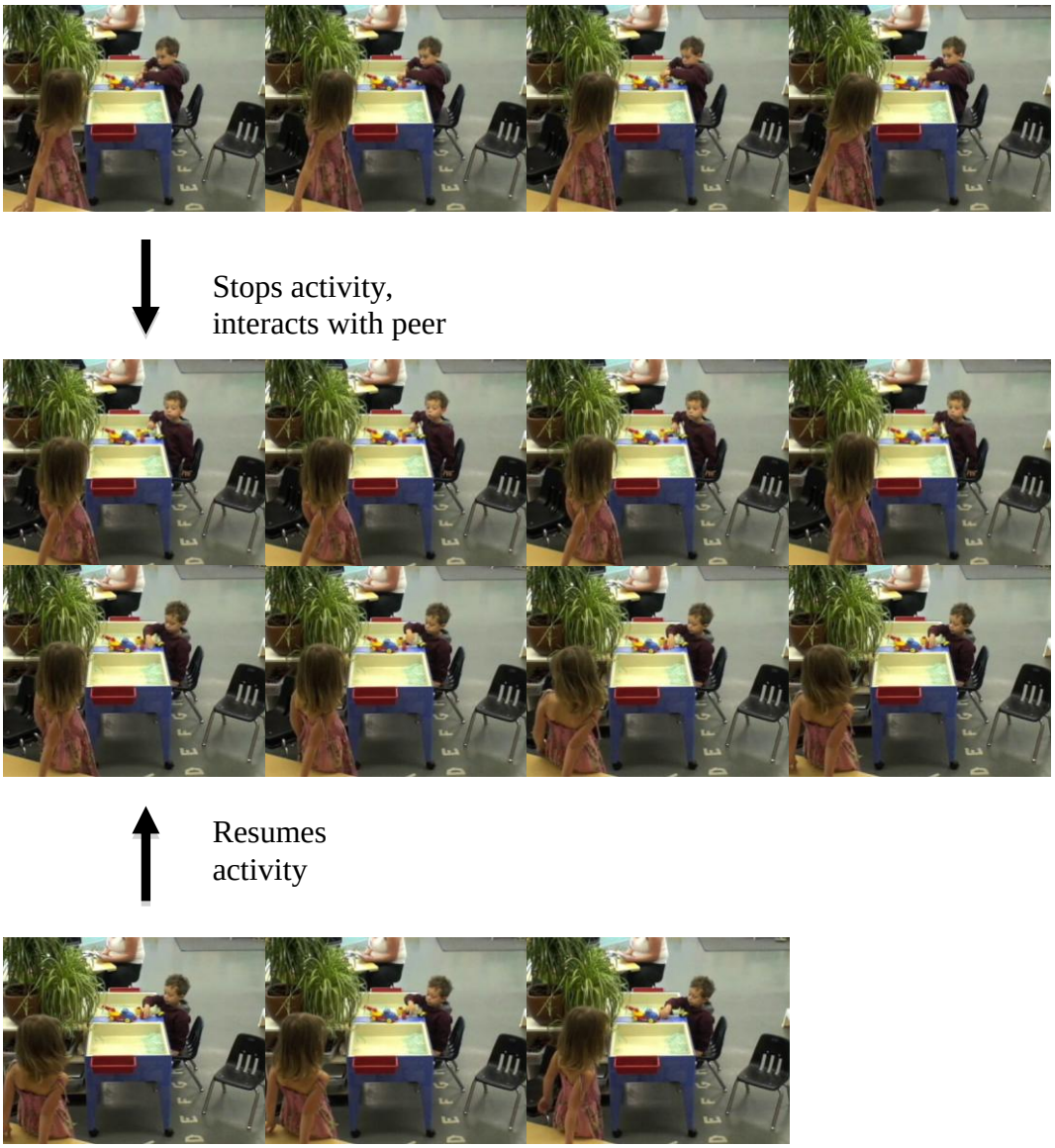


Figure 9

'Focused' video MDA example



The absence or presence of any of these behaviors allotted a dichotomous value of 0 or 1 for not present/present. These SCBE-30 scores were compared between the treatment (plant) and control (no plant) settings using their mean and standard deviation values to calculate the Cohen's *d:* small effect sizes were present for all three groups: anger-aggressive (A-A) had the highest effect size of the group (*d* = .48), followed by anxiety-withdrawal (A-W) (*d* = .33) with the lowest effect size being social competence (S-C) (*d* = .28). Refer to Table 6 for the means, standard deviations, minimum and maximum values, correlations and Cohen's *d* for all of the three main categories for the SCBE-30 rating measure for both the treatment and control settings. Written observation narrative is included to provide some more detailed descriptors for each of the three main categories included in the SCBE-30 rating system.

Here is a description of an interaction that took place in the younger morning classroom (rm 117). A boy who often plays at the sensory table (between 6 and 11 visits for both settings) is seated and has been playing at his area for about 7 minutes, using building-type materials. A younger girl who has either just returned from a long break or is new in the classroom (researcher was not able to ascertain); approaches the sensory table, circling in until she is directly opposite the boy. As she passes by the boy, she reaches into the table and picks up some of his building blocks. He reaches out toward her hands and the items while saying quietly 'no'. She steps away to the near shelf (which do not have plants this day) with the items and then turns back

Table 6

Mean Differences in Participants' Adaptive Behavior at Control (NP) and Treatment (P) Settings (N=32)

		Control –NP			Treatment – P							
	df	Min	Max	*M* (SD)	Min	Max	*M* (SD)	Correlation	95% CI [ll, ul]	Wilcoxon Signed Rank	Cohen's *d*	Interpretation
A-A	31	0	1	.03(.177)	0	3	.19(.592)	.25	[–.363, .051]	.102	.48	small effect
S-C	31	0	2	.16(.515)	0	2	.31(.592)	.046	[–.433, .120]	.313	.28	small effect
A-W	31	0	1	.03(.177)	0	2	.13(.421)	–.054	[–.262, .074]	.257	.33	small effect

Note. NP denotes No Plant or control setting. P denotes Plant or treatment setting. A-A denotes Anger-Aggressive. S-C denotes Social Competence. A-W denotes Anxiety-Withdrawal

towards the sensory table. The boy then stands and grabs hold of the items, while again saying 'no' in a louder voice, while pulling the items towards his chest. At the same time, he is looking to his right, where a teacher is seated at a neighboring table. He pulls the items from the girl, who then begins to reach into his bin to pull out another item. He begins to quickly scoop all of his materials in toward himself, leaning over and covering them with his torso. He says nothing. The peer who is using different building materials next to him also begins to scoop her items closer to her area to keep them out of reach from the younger girl. However, she also begins to speak quickly and quietly to the younger girl, explaining that it's "not allowed". Although this was simply a matter of protecting the items that the boy was involved with – his pulling and tussling with the younger girl demonstrates one of the SCBE items that falls into the 'anger-aggressive' category.

Another scene is observed demonstrating one of the indicators for the 'social-competence' category: Two boys who both visit the sensory table frequently (between 6 and 11 visits for both settings), have been playing next to each other for more than five minutes scooping and pouring beans with small green scoops, sifters and sand-mills. It is a control condition day, so there are no plants present. They have a potential disagreement about sharing the materials when one boy fills his sifter with beans and sets it on the middle shelf between the two sensory table bins. The second boy empties this sifter of beans into his own bin. The first boy quickly begins to scoop beans out of his peers' bin and put them back into his own, saying "hey, you got all of it". Then he quickly tells the teacher, who is sitting near him, "he got all of it,

every bit of it". She intercedes to help redistribute the beans and both continue playing with no further discussion or behavioral displays. They worked out this misunderstanding with no issue.

The last example demonstrates what could be considered an anxiety-withdrawal behavior – while also showing what an 'outlier' participant may be going through while playing at the sensory table. One of two sections of sensory table is open. The material is cornmeal, tools are a few shovels, funnels, empty containers with narrow openings, (e.g. a soda bottle) and a sand-mill. After one and a half minutes of solitary play, participant asks in a loud voice, "Does anybody want to play with me? Does anybody want to play with me?" 10 seconds later a peer asks, "Where are you" and the participant waves his hand at the peer. The participant stands at the narrow end of the table, with a clear view of the rest of the room. The plants are next to him on the right, less than a foot away. He then says to his friend "_____, I am going to dump this...I'm going to dump this, and you're out of time!" He continues, "you're going to run out of time, running out of time. ____ you're running out of time. Are you going to play with me or not?" Then the participant pours the cornmeal. He says the name of two other peers and motions to them, inviting them to play, by pointing down at the table. They either say or indicate "no". He continues to scoop, pour and fill his empty container while he actively invites his peers for a total of 2 minutes. No one comes to play with him. He continues to scoop and fill the container with cornmeal then pours the material through the mill on his own for 15

minutes. He no longer invites anyone to play with him. After 15 minutes, a girl joins the table and the participant finishes and leaves within 15 seconds of her arrival.

The statistical findings, couched in the objective descriptions, indicate that the presence of houseplants in these particular settings, although not statistically significant, did reveal a pattern of differences as assessed by the use of Cohen's *d* effect size, between the means of length of attention, type of attentional behavior and type of adaptive behavior between the treatment setting (plants present) and the control setting (no plants present).

Observing the participants directly as they engaged with the sensory table materials and had interactions with their peers and teachers further reveals how the subtle influence of houseplants may contribute to the dynamics of the preschool learning environment. The previous example of the participant who invited his friends to play demonstrates that he was socially competent to such a degree that he was able to invite his friends, accept their rejections and continue to play on his own for a full 15 minutes. However, because he is unsuccessful in inviting any peers, of which this is only one of many such instances, it can be considered that he displays behaviors congruent with anxiety-withdrawal. When compared with examples of his play behaviors under the control conditions, he spends an average of four minutes longer at the sensory table when the plants are present (mean np time = 2:38; mean p time = 6:38).

Chapter 5: Discussion and Conclusion

In this chapter, the results of the study are summarized and interpreted, both overall and for the specific variable categories; length of attention displayed by the participants, type of attentional behaviors displayed and type of adaptive behaviors displayed, in order to address the research questions and subsequent hypotheses proposed. The limitations, implications and recommendations for possible future research are also presented. This study primarily used a quantitative method, with the intention of creating a replicable method that may be applicable to similar free-choice learning settings.

The aim of this study was to investigate the following broad research question: *Is there a relationship between the element of houseplants in the design of interior environments and children's ability to focus their attention within a learning setting?* The answer to this question was guided by 3 research hypotheses:

- Hypothesis 1: the presence of indoor plants located near the sensory table activity area within a preschool setting will have a direct positive relationship on the length of time children choose to be engaged in those learning centers during free-choice play time.
- Hypothesis 2: the quality of the participants' engagement with the activity while at these treated learning centers will be more focused when compared to those behaviors which occur at the control learning centers.
- Hypothesis 3: the presence of indoor plants located near the sensory table activity area within a preschool setting will have a direct positive

relationship on the quality of the participants' adaptive behaviors.

As mentioned in the previous chapter, the size of the sample for this study appeared to be too small to indicate statistical significance or carry enough statistical power to carry out effective hypotheses testing. This problem of inability to detect subtle effects appears to be relatively common in the literature on the effects of nature and houseplants on human behaviors. As Bringslimark, Hartig, & Patil (2009) reiterate in a recent critical review of experimental literature on the psychological benefits of interior plants, the benefits derived from plants "might have only small effects on some outcomes, and the detection of such effects requires large samples" (p. 428). Therefore, it is expected that results from this study, if they are indeed apparent, may be subtle and quite difficult to discern.

It should come as no surprise then, that this study changed course from the original plan of hypotheses testing in order to pursue a more plausible conceptual framework and course of action to seek out effects and positive influence on participants' attentional behaviors while in the plant setting as opposed to the control setting.

Discussion

As previously mentioned, due to the small sample size, it is not surprising that the majority of interactions between the participants' attentional and adaptive behaviors and the presence of houseplants were not statistical significant. An indication of the effect the small sample size had on the statistical analysis can be seen with overall average length of time spent in the treatment as opposed to in the control

area (t= –.614 , p = .013). This was the only statistically significant finding at a .10 significance level. The sample size for this particular test was 32, while the majority of the other participant groupings (i.e. by younger and older children) were much smaller in number (7 – 20), suggesting that the larger sample size of 32 for this test played a role in creating a misleading statistical significance. Supporting the belief that the small sample size contributed to the lack of statistical significance is the presence of statistical power, as indicated by the frequency of both small and medium levels of Cohen's *d* effect sizes.

However, it is encouraging that, based on Cohen's *d* effect sizes the presence of houseplants in this particular setting does seem to play a role on this particular group of preschooler's attentional and adaptive behaviors. In general, the findings for the dependent variable of length of attention while at the condition setting indicate that there appears to be a relationship between the presence of houseplants and young children's attentional and adaptive behaviors. For this study, the typical statistical assessment of null-hypothesis significance testing was not deemed appropriate, although for the sake of providing delineated and clear connections between the effect sizes and how these relate to the hypotheses, the discussion will compare the effect size to the hypotheses using the terms: rejecting, non-consistent, neutral, consistent, and supporting, so as to assist the reader in standardizing the results. However, due to the fact that the sample size was too small to allow actual significance testing, none of the results in this study fall into the rejecting or supporting categories.

The medium (.73) effect size for participants who visited the condition setting more than 5 times during the study appears to be consistent of hypothesis 1. The presence of the houseplants appears to play a neutral role in the participants' attentional states for the variable categories of boys/girls and younger/older ages, as indicated by the appearance of trivial effect sizes. This neither supports nor denies hypothesis 1. This lack of observed effect on age differences is not entirely surprising, as the development of attentional behaviors typically coincides with a child's increasing maturity (Sarid & Breznitz, 1997; Levy, 1980). This can be seen in the smaller effect size (.05) for the younger age bracket and larger effect size, albeit still not quite a 'small effect size' (.13) for the older age bracket. In addition, the age span from youngest was quite wide, but the youngest participants only spent 2 or 3 days total at the condition setting during visits. There may have been too much inconsistency amongst the participant's attendance to pick up effects based on the age-differences. In a future study a larger sample population with regular attendance may help reveal more or less of an effect.

There were also no observed differences of effects on participants' lengths of attention when analyzed on a gender partition. With a trivial effect, the houseplants had a neutral role on hypothesis 1 for gender. One possible explanation for this may be the variety of sensory materials that classroom teachers selected for the sensory table. For instance many times the material in the table appeared to be geared specifically towards boy-preferred type play (i.e. rock salt and trucks, Lego® building blocks) or slightly less often for girl-preferred type play (i.e. animal figures and

bedding/caretaking materials). An analysis of the materials selected for the sensory tables may have wielded a larger influence on the participants' choice to engage in the activity, however it is beyond the scope of this study to draw any conclusions on this or other possibly confounding variables.

In summary all of the results for the first dependent variable, length of attention, for this study investigating the relationship between the presence of houseplants on the preschool participants' length of attention while at the condition setting appear to be either neutral or consistent with hypothesis 1. The variables measured did not appear to indicate any inconsistent roles between the houseplants and the participants' lengths of attention. However, further analysis or larger sample sizes may provide more insight into the specific nuances driving the subtle differences that were observed during the course of the study.

This current study is one of only a few known studies on the direct influence of houseplants on young children's attentional behaviors. Although this study was unable to provide conclusive evidence for statistical significance, the results are encouraging and indicate a strong argument for future studies due to the number of small effect and small/medium effect size findings. Regardless of the possible role of intermediating variables (e.g. peer-influence, other activity center's draw, child temperament), it can be said that there may be a positive, if subtle, relationship between the presences of houseplants in a free-choice learning center on this group of preschool children's length of attention while at the condition setting.

Certainly for those participants who selected engagement with the sensory table on a regular basis, and had the opportunity to do so by being at the center and being able to communicate their selection and right to be there (i.e. asking for a turn if the table was currently occupied, not being summoned by the teacher for another activity), the presence of the houseplants seemed to increase their length of attention to the task at hand.

In addition, by viewing the data from a qualitative perspective, it becomes clearer that the presence of houseplants does have a subtle yet persistent influence on individual participants in this study. Due to limited resources on this study, all of the myriad interactions between participants, participant-teacher and so forth, were not objectively coded in a qualitative manner. However, those that were assessed demonstrate that depending on the individual child, the presence of houseplants appeared to facilitate a micro-restorative setting within these preschool classrooms. Either the participant appeared to feel drawn to spend more time at the activity on the days the plants were present, or participants felt more able to address possibly underlying issues with their peers while the plants were present.

Existing literature for the influence of houseplants on adults' perceptions and behaviors often indicates a relationship on a variety of variables (e.g. perceptions of creativity, frequency or lack of sick days) but findings have also been mixed (Bringslimark, Hartig, & Patil, 2009). In addition only one study in Bringslimark, et al.'s (2009) review of 21 articles, was found that specifically investigated the role of houseplants on adult's attentional behaviors in an experimental study design. These

inconsistencies in the studying the relationship between houseplants and human behavior is not surprising considering the wide variety of testing and experimental procedures (Bringslimark et al., 2009). The work of parceling out the influence of a subtle design element such as houseplants on a complex human phenomenon such as attention is an area of great opportunity and potential. This study appears to have been able to add another small but effective layer of understanding for this dynamic process.

The types of attentional states that were exhibited by the participants in this study ranged from that of 'inattentive', when the child did not engage with the activity, to 'divided' which on the surface may appear to be a type of attentional state that is not very focused or directed – but which in reality may be the most complex of the types of attentional states present on Table 1 (page 42). It was not possible to verify this assumption. However, based on the frequency of the directed attentional state as compared to the divided attentional states during the observation period, as well as the operational description of the two types of attentional states, it does seem that the focused attentional state is a more sophisticated type of attentional state. The more simple types of attentional states, 'alert' and 'sustained' involve the child being distracted from their activity and then being able to re-engage their attention on their own activity after the distraction.

There is evidence consistent with Hypothesis 2 in the 'alert', 'sustained' and 'divided' attentional states effect sizes. The results for 'inattentive' and 'focused' attentional states may be either neutral or inconsistent with Hypothesis 2. It was not

possible in this study to parcel out the relationship between the presence of houseplants and these two types of attentional states.

It is interesting to note that the findings for differences in means for four of the five attentional states result in small effect sizes, indicating some sort of dynamic going on between the presence of the houseplants and the participants' type of attentional state. However, the means for three of the four of these types of attentional states indicate that the participant is better able to focus while engaged in the presence of the plants verses while engaged in the activity with no plants present. That is, there was a greater frequency of exhibiting the attentions 'alert', 'sustained' and 'divided' under the treatment setting (P) than there was under the control setting (NP). The inverse is true for the 'focused' type of attention. This is not easily explained and would be an interesting area for future study.

The phenomenon of human attention is an area of research that has been examined from many perspectives, fields and methods (e.g. Sarid & Breznitz, 1997; Eldar, et al., 2008) – in fact, the keyword search for 'attention' located within the title, just since 2000 in Google scholar, raised 25,200 possible articles. In the case of this study, the underlying conceptual framework of attention restoration theory supports the natural human tendency to try to alleviate directed attention fatigue by seeking a means to tap into nature, or some type of restorative environment, in order to recharge the directed attentional brain region and thereby regain an ability to focus on the task at hand.

In the case of the varying effects the presence of houseplants may have had on the attentional states – (three attentional states showed decreases, while one attentional state showed an increase in the treatment setting) – the question arises, is the goal to prevent a young child from getting distracted in the first place or is it more beneficial for the child to be adept at shifting attention? Perhaps the reduction in surrounding stimuli, via the plants acting as a visual screen, may have contributed to the outcomes. Zeisel (2006) does state that environments that are able to "reduce alternative attention distracters…(are) thus (able to) help people focus on learning tasks at the moment of learning, (to) support brain learning" (p. 366) is a design criteria goal for helping children maintain attention.

It is worth considering that the children who were already experiencing directed attention fatigue were more likely to engage in an activity near the houseplants and were thus able to recharge while they played, thereby reducing their distractibility. Or perhaps the criteria for the types of attentional states were such that the frequency of observation of the type of attention 'focused' was less likely to occur. This is certainly one aspect of the study that could benefit from further analysis and research. Due to the constraints on the study, it is not possible at this time to draw conclusive findings on the role of houseplants on the participants' display of attentional states. However, as a pilot study, the findings do suggest neutrality or consistency for Hypothesis 2. The presence of houseplants did seem to play a role on the types of attentional states exhibited by the participants during the study. The

directionality and mechanisms behind these possible findings are an area for future research.

The increase in displays of angry-aggressive behaviors with the plants present is inconsistent with Hypothesis 2, at an effect size of .48. It is likely that influence and interactions between peers on the participants' may have played a transactional role in the display of behaviors, perhaps due in part one of the SCBE variables regarding negative social interactions requiring a peer dyad. Social competence behaviors, with an effect size of .28, are consistent with Hypothesis 2, suggesting houseplants may contribute to positive social interactions. The effect size for anxiety-withdrawal was .33, also possibly inconsistent with Hypothesis 2, as it was believed the presence of houseplants would decrease the observations of anxiety-withdrawal behaviors. Again, though, this study was not able to conclusively parcel out the mechanisms driving these particular findings.

However the general findings from this study seem to only hint at the many levels of influences possibly affecting the participants' types of adaptive behaviors. It is encouraging that there does appear to be some relationship between the presence of houseplants and the participants' adaptive behaviors. This is an area that would benefit from further study.

Limitations.

A limitation that was beyond the control of the researcher was the consistency of children's attendance at the center, which was limited by participants' families' use of the summer sessions as a convenience for their child's care rather than as a daily

routine. Because the study took place during the summer months, the sporadic drop-in nature of the preschool program seemed to hinder the regularity of some children's attendance, thereby reducing the frequency of participants' presence at both the control and treatment conditions. A related limitation was the lack of resources available to pursue a larger or more diverse sample size. This could be accomplished by inviting more children from different classrooms or from different childcare settings to participate.

Working within the naturalistic setting of the classrooms added a layer of richness and depth that would have been difficult to attain in a more sterile experimental setting. However, it is worth noting that the teacher's influence on the participants' behavior may have limited the participants' ability to freely make choices during the research period. For instance, the classroom 'culture' was that a child was encouraged to ask their peer for a turn if they were interested in being at an activity. The first child was taught to say how many minutes longer they would play and then the teacher would help the children to enforce the 'turn-taking'. The teachers also would sometimes need the participant who was at the sensory table to join them in another activity (e.g. alphabet collage art activity the entire class would participate in). Therefore, these regular classroom and teacher-driven occurrences may have hindered or shortened participants desired time at the sensory table.

Possible limitations of the study that were within the control of the researcher included the data collection method, although no evidence of data collection issues was noted. Video recordings were the primary method of observation, so the

researcher validated that the recordings captured the movements and behaviors of the participants within the treatment and control areas before data collection began. It was important to ensure the accuracy of the video recordings so as to have reliable observations from which to work. A comparison between the researcher's coding and the participants' teachers coding was conducted. No researcher bias was discerned upon initial investigation, however a statistical analysis was not conducted, as the teacher's understanding of the various measures and instruments appeared to be a limitation. With further resources, a more comprehensive explanation of the measures would have permitted a better understanding of the research design on the part of the participants' regular classroom teachers. The researcher attempted to compensate for this and alleviate any potential researcher bias by using only discrete, concretely operationalized measures, such as; exact time of entrance to the activity based on the video recording's timer, pausing and rewinding the video to track multiple participants' behaviors and other objective techniques.

Due to limited resources, the research design did not include the use of parental or teacher survey's or participant input, which could be accomplished with interview, pictograph or other visual communication methods. These measures could have provided a richer qualitative picture of the effects of the houseplants on the participants' behaviors. The research design was naturalistic by utilizing an unobtrusive video camera in the classrooms; however, this may have increased the numbers of confounding variables that were present. Bringslimark et al. (2009) state "plants in a setting filled with visual stimuli might have weaker effects than plants in a

sterile setting" (p. 429).

Recommendations and implications for future research.

It could be argued that nature is the most authentic type of restorative environment. However, the question arises, is there a way to replicate the cognitive and attention evoking processes of nature in the interior spaces occupied by preschool children? If a grouping of houseplants does indeed play a role on the directed attentional behaviors for young children, this may be due, in part, to the processes involved in defining and recreating restorative environments. With future studies, larger sample sizes and a more refined quasi-experimental design, the possible implications for this design precedence could be far-reaching across a variety of fields including early childhood education, interior design and free choice learning.

Restorative environments have only been researched explicitly since the early 1990's. Although the evidence continues to mount as to the benefits derived from human contact with nature, both indoors and out, there continues to be methodological issues that appear to contribute to the mixed results (Bringslimark et al., 2009). This study intended to address some of these research design issues while also working to include an underrepresented population; that of preschool children in a classroom setting.

Kaplan and Berman (2010) said about restorative environments that it "helps if…(it [the restorative component] is) large enough to permit one to explore it or at least imagine exploring it. Thus, a single potted plant would fail the requirement for extent" (p. 49). Yet the question still remains, does a grouping of potted plants have

an influence on children? The specific design components of restorative environments are still in the process of being understood, especially in terms of children's restorative environments. As an example, during one of the early days of data collection, before the teacher imposed 'rules of behavior with the plants', at least one child was observed spending time using the animal toy provided to explore the leaves and branches of the plants, appearing to create a world of extent. This example is one that supports future inclusion of participant driven open-ended qualitative feedback for the assessment of houseplants on children's attentional behaviors.

Suggestions for future research have been inserted throughout this chapter; however, many other recommendations for future studies can be made. In refining a similar study, it would benefit the research to include larger numbers of participants as well as increase the number of classrooms and centers from which the observations are conducted. Secondly, it would be beneficial to conduct such a quasi-experimental study during a more consistent attendance period, allowing for more opportunity for the participants' to engage in the condition setting. This current study was not able to utilize almost a quarter of the possible participants due to these children's infrequent attendance during the summer months.

Thirdly, a more clear and concise description of types of materials to be included in the sensory table would help reduce some of the possibly confounding variables. Although it was a priority to allow the classroom teachers to conduct their curriculum as they might normally, the appearance of building materials, for instance, in the sensory tables seemed to contradict the expectations for a sensory table. Related

to this would be to conduct a similar study in a variety of different classroom circumstances, such as not during free-choice time period or at another activity area. A third research design idea would be to conduct an out-of-classroom controlled experimental design so as to alleviate even more of the possible confounding variables. The possibilities for expanding on this study seem to be quite endless.

Concluding Remarks

Free-choice play periods during preschool daily curriculums are a widespread component of preschool early childhood education. Research has demonstrated that the presence of houseplants may be a contributor to human ability to self-regulate attention (Lohr & Pearson-Mims, 2008; Lohr, et al., 1996). Behind their popularity as environmental enhancements seems to be a general belief that the emotional experience of viewing greenery may help foster a more restorative environment. Educational settings of almost every size employ houseplants in both formal and informal settings and spend reasonable financial and person-hour effort to maintain these elements. Despite their ubiquitous nature, the educational value of houseplants has not been well documented.

Although research suggests that houseplants, as natural interior design elements, engage people emotionally, few studies have attempted to understand the specifics of this engagement with young children or examine what types of attentional influences houseplants may have on young children. While there is a growing body of research on learning and engagement in relationship with the built environment, we lack the basic information about how young children interact with and learn from

classroom free-choice play areas that include houseplants. It is believed that examining how children interact with free-choice play areas that include houseplants will fill a gap in the growing body of knowledge related to the influence of the physical environment on children's behavior, as well as on free-choice learning and more importantly serve as a basis for creating tools or activities to deepen engagement at these preschool activities. Establishing rigorous baseline data on the influence of houseplants in a free-choice learning area was therefore an important first step in mediating and improving the interactions that occur at these and related activities.

It is believed that the findings from this research will provide research-supported ideas to shape both of these areas – best practices in free-choice preschool physical environment design and interpretation and the educational value of interaction with activities while in the presence of houseplants. The results of this project may also inform researchers and evaluators within the fields of preschool education and free-choice learning as they will provide new evidence (and methods) that may be used to assess this popular curriculum decision and other activities and physical environments involving houseplants. The findings are believed to add to our understanding of how free-choice experiences with houseplants present can mediate preschool learning. The possible ripple effect of teachers' and designers' inclusion of the simple, cost-effective and popular interior design element of houseplants in their classroom may be cumulatively important for the benefit of children's development.

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Appendices

Appendix A: Figures

Figure 10

Child care facility classroom floor plans, Rms 117 & 127

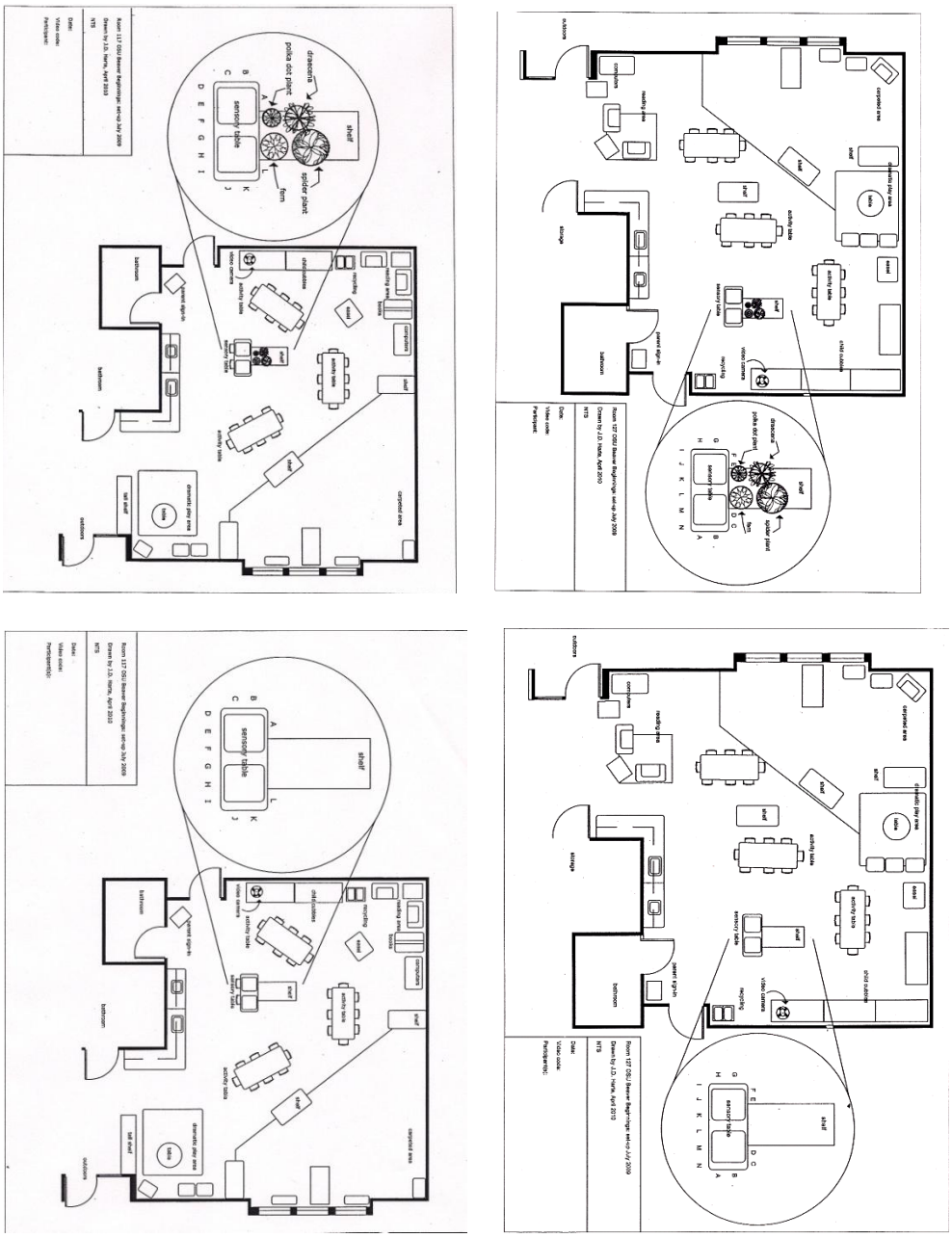

Figure 11: **Date:** **Notes:**

Tracking form

Participant	Location/ Time in	Location/ Time out	Location/ Time in	Location/ Time out	Location/ Time in	Location/ Time out	Location/ Time in	Location/ Time out
	Type of attention	Type of adaption	Type of attention	Type of adaption	Type of attention	Type of adaption	Type of attention	Type of adaption

Appendix B: Tables

Table 7:

Research timeline

Task	**Spring 2009**	**Summer 2009**	**Fall 2009** (maternity leave)	**Winter 2009/10** (teach)	**Spring 2010**	**Summer 2010**	**Fall /Winter 2010**
Propose to graduate committee	May 11th, 2009						
Make arrangements with child care facility	June	continue					
Gain IRB acceptance	applied June	approval received July 9th 2009					
Gather participants & conduct parental permission		upon IRB approval					
Obtain supplies, prepare spaces & materials		begin preparing materials	continue as needed i.e. care for plants				
Conduct observations		July, Aug, Sept					
Convert videos to digital & blur faces		July	continue until complete	→	→	→	
Code data		August	continue until complete	→	→	→	
Analyze, synthesize & write up results					March	continue until complete	→
Thesis Defense							12/ 01/10
Submit for publication							Jan.& on

Appendix C: IRB Forms
Form 1:

INTERNAL REVIEW BOARD PAPERWORK

INFORMED CONSENT DOCUMENT FOR PARTICIPANTS

Project Title:	The impact of houseplants on preschool children's attention & play behavior.
Principal Investigator:	Marilyn Read, PhD
Student Researcher:	J. Davis Harte, MS student in Design & Human Environment

WHAT IS THE PURPOSE OF THIS STUDY?

Your child is being invited to take part in a research study designed to investigate the impact of houseplants in the environment on preschool children's attention and play behavior. It is believed that the presence of houseplants may contribute to young children's attention and play behavior in a beneficial manner. We will be looking to see if the children play for longer periods of time when they are in an area that contains houseplants. We will also be watching the level and type of attention being displayed. The results will be used in a Master's thesis, as well as for possible publication in academic journals and presentations at professional conferences. We are studying this because previous research indicates that children's behavior may benefit from exposure to natural elements.

WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide whether you agree that your child may participate, or not. Please read this form carefully. You may ask any questions about the research, the possible risks and benefits, your child's rights as a participant, and anything else that is not clear. When all of your questions have been answered, you can decide if you want your child to participate or not.

WHY IS MY CHILD BEING INVITED TO TAKE PART IN THIS STUDY?

Your child is being invited to take part in this study because he or she attends Beaver Beginnings on the campus of Oregon State University during the summer of 2009.

WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

If you agree to allow your child to take part in this study, your child will simply play as normal in their usual classroom during the usual free-choice time. Your child will continue to be under the supervision of the preschool classroom teachers at all times. The study will take place each regular classroom day for a total of eight weeks. The data (how children behave as recorded by digital video/audio recording) will be collected for a 45–minute period once each day, only during the scheduled free-choice time periods.

If your child takes part in this project, he or she will have his or her identity kept private and no identifying information about your child will be used in the data collection process or in the written sections. Each child will be given a 'code' number based on their initials to help the researcher identify the different children while analyzing the data. All data will be stored confidentially in a locked cabinet in Milam Hall. You and your child's full name will only appear on this consent form, and these forms will be stored separately from the coded list.

If you choose not to have your child participate, the classroom teachers will guide your child to a similar but alternate activity out of the view of the video camera. If they do inadvertently go into the eye of the camera, their image will be digitally concealed (made blurry) and no information about them will be available.

WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks to the participant in this study. The only risk is that you may feel uncomfortable allowing your child to be recorded. The plants that will be present are non-toxic and considered safe for use around children.

WHAT ARE THE BENEFITS OF THIS STUDY?

We do not know if your child will benefit from being in this study. However, we hope that, in the future, other children might benefit from this study because their attention to activities may be improved due to the impact of houseplants in their environment.

WILL I BE PAID FOR PARTICIPATING?

Participants will not be paid for being in this research study.

WHO WILL SEE THE INFORMATION I GIVE?

Only the researchers directly involved with the study will have access to the digitally altered (non-participants de-identified) tapes and they will be destroyed 3 years from the end of the project. Transcripts may be used in professional reports, but your child will not be identified in them in any way. Identifying features of participants (including names) will be removed from the written transcripts prior to use in presentations of research findings. We may use clips from these digitally altered (non-participants de-identified) videotapes to show to other researchers to explain our

results and to students and other researchers for training.

The information you provide during this research study (video/audio tapes) will be kept confidential to the extent permitted by law. To help protect your child's anonymity, we are not asking you for your name or your child's name, except on this consent form, or any other identifying information. We will be told your child's age at the beginning of the study from the center director, Chris Riggan.

If the results of this project are published your identity will not be made public.

DO I HAVE A CHOICE TO ALLOW MY CHILD TO BE IN THE STUDY?

You can choose if you want your child to participate in this project. Your child will not lose any benefits or rights he or she would normally have if you choose not to allow them to participate. If your child does participate and later elect to have your child stop participating, you may ask to have your child stop at any time during the study and still keep the benefits and rights your child had before participating. You may ask to have your child's data (video/audio-recorded observations) withdrawn from the study after the research has been conducted or anytime doing the study. If you decide not to allow your child to take part in this study, your decision will have no effect on the quality of care your child receives.

WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact:

J. Davis Harte at (541) 520-6244 or j.davisharte@gmail.com, or

Marilyn Read at (541) 737-0982 or Marilyn.Read@oregonstate.edu.

If you have questions about your child's rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Thank you for your consideration.

Participants' signature required on following pages.

INFORMED CONSENT SIGNATURE PAGE

Project Title:	The impact of houseplants on preschool children's attention & play behavior.
Principal Investigator:	Marilyn Read, PhD
Student Researcher:	J. Davis Harte, MS student in Design & Human Environment

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to allow your child to take part in this study. You will receive a copy of this form.

_____

(Printed name of child and parent/guardian or legally authorized representative)

_____

(Signature of Parent/Guardian or Legally Authorized Representative) (Date)

VIDEOTAPE CONSENT ADDITION:

One aspect of this study involves making video/audio recordings of your child. These recording are being made so as to accurately record the length of time each participant spends at the treatment area, as well as to record the types of behavior the children are exhibiting. The recordings will only be made available to J. Davis Harte, Marilyn Read and the participants' teachers. Raw data, including all video/audio tapes and transcriptions will be destroyed 3 years from the end of the research project. At that

time, the raw data, transcripts and consent forms will be destroyed in a secure manner. The digitally altered (non-participants de-identified) tapes or copies may be used for:

___√___ THIS RESEARCH PROJECT ___√___ TEACHER EDUCATION

___√___ presentation at professional meetings

My signature indicates that I agree to video/audio taping of my child at the Beaver Beginnings Child Care Center during these days: July 6th – August 28th, 2009.

_____

(Printed name of child and parent/guardian or legally authorized representative)

_____

(Signature of Parent/Guardian or (Date)

LEGALLY AUTHORIZED REPRESENTATIVE)

Institutional Review Board • Office of Sponsored Programs and Research Compliance
Oregon State University, 312 Kerr Administration Building, Corvallis, Oregon 97331-2140
Tel 541-737-4933 | **Fax** 541-737-3093 | http://oregonstate.edu/research/osprc/rc/humansubjects.htm
IRB@oregonstate.edu

NOTIFICATION OF APPROVAL

Date: July 9, 2009

Principal Investigator: Marilyn Read, Design & Human Environment
Study Team Members: Davis Harte, Student Researcher

Re: 4340 - The Impact of Houseplants in the Child Development Center on Children's Directed Attention

Review Category: Expedited

Approval Date: July 6, 2009 Expiration Date: July 5, 2009

Approved Number of Participants: 39

The above referenced project was reviewed and approved by the Oregon State University's Institutional Review Board (IRB).

The IRB has approved the: Initial Application

If study involves children, the risk level is[1]: §46.405

As principal investigator of the research, you are responsible for fulfilling the following requirements of approval:

1) All study team members should be kept informed of the status of the research.
2) Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes.
3) Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
4) Only consent forms with a valid approval stamp may be presented to participants.
5) Submit a continuing review application or final report to the IRB for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

If you have any questions, please contact the IRB Office at IRB@oregonstate.edu or by phone at (541) 737-8008.

[1] Where parental permission is to be obtained, the IRB may find that the permission of one parent is sufficient for research to be conducted under §46.404 or §46.405. Where research is covered by §§46.406 and 46.407 and permission is to be obtained from parents, both parents must give their permission unless one parent is deceased, unknown, incompetent, or not reasonably available, or when only one parent has legal responsibility for the care and custody of the child.

Institutional Review Board • Office of Research Integrity
8308 Kerr Administration Building, Corvallis, Oregon 97331-2140
Tel 541-737-8008 | Fax 541-737-3093 | IRB@oregonstate.edu
http://oregonstate.edu/research/ori/humansubjects.htm

NOTIFICATION OF APPROVAL

June 28, 2010

Principal Investigator:	Marilyn Read	Department:	Design & Human Environment
Study Team Members:	N/A		
Student Researcher:	J. Davis Harte		
Study Number:	4340		
Study Title:	The Impact of Houseplants in the Child Development Center on Children's Directed Attention		
Funding Source:	None		
Submission Type:	Continuing Review Application received 06/25/10		
Review Category:	Expedited	Category Number:	6
Waiver(s):	None	Number of Participants:	39
Risk level for children[1]:	§46.404 minimal risk		

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

Approval Date: 06/28/10
Expiration Date: 07/05/11

Annual continuing review applications are due at least 30 days prior to expiration date

Documents included in IRB approval:

- ☐ Protocol
- ☐ Consent forms
- ☐ Assent forms
- ☐ Grant/contract
- ☐ Recruiting tools
- ☐ Test instruments
- ☐ Attachment A: Radiation
- ☐ Letters of support
- ☐ External IRB approvals
- ☐ Translated documents
- ☐ Attachment B: Human materials
- ☒ Other: CRA - Data Analysis Stage

☐ Project revisions:

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes.
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.
- Submit a continuing review application or final report to the IRB for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

If you have any questions, please contact the IRB Office at IRB@oregonstate.edu or by phone at (541) 737-8008.

[1] Where parental permission is to be obtained, the IRB may find that the permission of one parent is sufficient for research to be conducted under §46.404 or §46.405. Where research is covered by §§46.406 and 46.407 and permission is to be obtained from parents, both parents must give their permission unless one parent is deceased, unknown, incompetent, or not reasonably available, or when only one parent has legal responsibility for the care and custody of the child.