

**The Nature and Nurture of Resilience:  
Exploring the Impact of Nature Preschools on Young Children's Protective Factors**

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Submitted May 30, 2018; accepted October 3, 2018

**ABSTRACT**

Resilience, the capacity to cope with stress and adversity, is universally regarded as a positive and valued trait (LeBuffe & Naglieri, 2012). The purpose of this study was to explore the potential for nature preschools to support the development of initiative, self-regulation, and attachment, which are key protective factors that can offset or moderate the effects of stress and adversity and allow a child to thrive or even be transformed by adversity. The Devereaux Early Childhood Assessment for Preschoolers, Second Edition (DECA-P2) was used in a pretest and posttest of a sample of 78 children who attended nature preschools, as well as in a baseline group of 14 children who attended a non-nature preschool. Results suggest a significant strengthening of these protective factors over the course of a school year in preschool participants who attended a nature preschool. Implications are discussed in the context of the study's limitations.

*Keywords:* nature preschool, resilience, initiative, self-regulation, attachment

A recent multidisciplinary review of literature pertaining to the benefits of nature contact for human health and well-being describes these benefits as being of an "extraordinarily broad range" (Frumkin et al., 2017, p. 1). While the authors acknowledge that this range of benefits is grounded in varying levels of evidentiary support, the current level of scientific interest in studying nature contact, coupled with this growing body of evidence, is encouraging. Among the evidence-based benefits included in Frumkin and colleagues' review were reduced stress, anxiety, and depression, as well as greater happiness, well-being, and life satisfaction.

Psychological resilience, which is defined as a positive, adaptive response to stress and adversity (Masten, 2001), has been extensively studied and reported in the mental health and human development literature, but has yet to make a prominent entry into the literature base regarding the benefits of nature on human health and well-being. However, a recent ethnographic study by Chawla et al. (2014) suggests the potential for children to experience reduced stress and develop protective factors associated with resilience through nature contact in green schoolyards. Additionally, concerns regarding the decline of psychological resilience is surfacing in the academic and popular literature, along with concerns regarding increases in children's stress, anxiety, and depression (Gray, 2013; Twenge et al., 2010). Thus, studying the impact of nature contact on psychological resilience is relevant and timely, particularly as so many children face threats to their healthy development on a daily basis and as societal concern regarding the decline of resilience grows (Children's Defense Fund, 2011).

## **Definitions of Resilience**

Resilience has been defined in a number of ways, as well as used in a variety of contexts. In the biological sciences, resilience is described as an ability to make an adjustment in behavior toward adaptability (Hanson & Gottesman, 2012). Resilience in ecological contexts is the capacity of a system to absorb and adapt to unforeseen future events (Holling, 1973). In the engineering sciences, it is the competency of systems to perform in risk or adversity (Hanson & Gottesman, 2012). The study at hand focused on psychological resilience, which is the human capacity to cope with stress and adversity (Masten, 2001). It is commonly described as the ability to bounce back from difficult times. Other definitions include the human capacity to overcome challenging stressors and become competent, confident, and caring individuals (Benard, 2004), or the positive, adaptive response in the face of significant adversity (Luthar, Cicchetti & Becker, 2000). There are several broad categories that appear in the literature on human development: beating the odds (developing well in the context of high cumulative risk for developmental problems); coping (functioning well under currently adverse circumstances or conditions); self-righting (recovery to normal functioning after catastrophic adversity); and transforming (positive reorganization of systems, such that adaptive functioning is better than it was prior to adverse or traumatic experiences) (Masten, 2007).

## **The Study of Resilience**

The science of resilience in human development has evolved over time. In the 1960s and 1970s, the study of psychosocial resilience emerged in the context of children at risk for developmental and psychopathological problems, due to genetic or experiential circumstances. The study of resilience grew to focus on not only the risk factors, but what enabled children to flourish even under adverse circumstances. Two landmark studies, Werner and Smith's (1988) longitudinal study of 600 Hawaiians, and Garnezy and Rutter's (1983) study of 200 children in mainland U.S., suggested that most children have self-righting tendencies, and that competence, confidence, and caring can flourish even within adverse conditions. Thus, the focus shifted from a problem-based deficit model to a strengths-based model, as positive relationships rather than specific risk factors seemed to have a more profound impact on the direction that lives take (Howard, Dryden, & Johnson, 1999). From this shift in focus, characteristics of children, families, relationships, and environments that seemed to correlate with resilience were extensively studied, as were processes that might explain these correlates (Masten, 2007). Additionally, research focused on how to engage or boost protective processes toward promoting competence and wellness (Cicchetti et al., 2000). Currently, the study of resilience has deepened to explore positive adaptation at cellular or neural levels, such as the role of brain plasticity on adaptive functioning and development (Romer & Walker, 2007).

Through these decades of research, the thinking that children who are resilient in the face of adversity are "invulnerable or invincible" has been replaced by the understanding of "the ordinariness of the phenomena" (Masten, 2001, p. 227). When basic human adaptation systems are protected and in good working order, "development is robust even in the face of severe adversity; if these major systems are impaired, then the risk for developmental problems is much greater, particularly if the environmental hazards are prolonged" (Masten, 2001, p. 227). With advances in the ability to study the neurobiology of resilience, it is now recognized that resilience is embedded in complex, adaptive and interacting systems, and that these interacting systems shape the course of development from the molecular to the macro-levels of physical and sociocultural ecologies (Masten, 2014). Thus, resilience perhaps can more accurately be defined as the capacity of a dynamic system to adapt successfully to disturbances that threaten system function, viability, or development (Masten & Cicchetti, 2016).

## **Promoting Resilience**

It is important to note that resilience is not only dynamic, but also contextual and malleable. It is not a "trait" that children do or do not possess. While there are personality dimensions that may be associated with resilience, it is recognized that experiences shape personality traits, which in turn can influence exposure to adversity; similarly, the same trait can "function as a vulnerability or protective influence, depending on the domain of adaptation, the physical or sociocultural value and meaning of the trait, and the age or gender of the individual" (Masten, 2014, p. 14). There are, however, a set of protective mechanisms that have been remarkably consistent in the literature

across time that seem to give rise to successful adaptation in the face of adversity (Benard, 2004). These protective factors include qualities in a person (such as problem-solving abilities, initiative, a sense of self-efficacy, a sense of purpose in life, self-regulation skills, persistence, belief that life has meaning, etc.), as well as contextual and/or environmental factors, such as positive relationships with caring adults, effective parenting, positive friendships, and effective teachers and schools (Wright & Masten, 2005; Masten, et al., 2008). These protective factors lend insight into how resilience can be promoted.

In light of the dynamic and contextual nature of resilience, Masten (2014) describes a model of resilience that is useful toward thinking about how to promote resilience. According to this model, adaptive success is influenced by threats/risks and protections/assets. Thus, strategies for promoting resilience can be risk-focused (preventing or reducing exposure to risks or adversity) or asset-focused (increasing assets or access to protective resources within or external to the child). Strategies could also be process-focused, with efforts to restore or harness the power of human adaptive systems. Examples include fostering secure attachment relationships, promoting bonds with competent and caring adults, protecting and nurturing brain development, and supporting the development of positive peer friendships (Masten & Reed, 2002; Masten, 2014). A review of outcome studies of strengths-based resilience intervention programs (Brownlee et al., 2013) yielded the following themes that further guide efforts to promote resiliency in children and adults: personal competency, coping strategies, social competency, pro-social involvement, and cultural identity.

### **Promoting Resilience through Nature Contact**

The effect of nature on the mental well-being of children has been well-documented and continues to grow. Benefits include restorative effects from stress and an improved sense of well-being, as well as more positive emotions (Wells & Rollings, 2012). However, “for the most part, the literature on coping and resilience has failed to reflect the importance of positive human connections with the natural world” (Chawla, et al., 2014, p. 2). Consequently, Chawla et al. (2014) sought to investigate the influence of green schoolyards on reducing children’s stress and promoting protective factors associated with resilience. Their qualitative findings suggest that not only did children experience peace, calm, and relaxation in their green schoolyards and gardens, but they also experienced opportunities to feel competent and opportunities for the development of supportive social relationships, which are important protective factors for resilience (Chawla, et al., 2014).

Beyond this study by Chawla et al. (2014), there are several other studies that further suggest the potential for nature experiences to support the development of resilience. A 2015 study by Buchecker and Degenhardt, similarly prompted by gaps in the literature, reports on the potential for nearby nature to positively influence individuals’ emotional well-being and resilience. Their survey research found that regular outdoor recreation significantly, but marginally, increased urban adults’ psychological resilience. While easy access to recreation areas affords regular outdoor recreation participation, their study suggests that other parameters are also important, including satisfaction with the recreation area, as well as the quality of the recreation experience. Findings from a study by Ritchie et al. (2014) suggest the positive impact of a 10-day outdoor adventure leadership experience on the resilience and well-being of First Nations adolescents in Canada, as measured through a 14-item resilience scale.

McArdle, Harrison and Harrison (2013) investigated the effect of the “Nature Nurture” project in Aberdeen, Scotland on the well-being and resilience of four- and five-year old children. This project intentionally used outdoor free play and nurturing relationships toward supporting resilience in children who have had disruptions in attachment relationships during their first three years of life. The qualitative data from their ethnographic study were analyzed using the PERIK (Positive Entwicklung und Resilienz im Kindergartenalltag) model, which is designed for observing and assessing child well-being. The results of their ethnographic study suggest all six dimensions of well-being, including confidence in the face of new challenges, self-control, empathy, motivation, focus, and perseverance, were enhanced through the combination of the nurturing approach and natural environment.

Collectively, these studies suggest the potential of time and experiences in nature to contribute to fostering the strengths and protective factors that children can draw upon in the face of adversity. Further study of the potential of nature experiences to support factors associated with resilience, however, is needed, as are studies focusing

specifically on young children. While resilience can be developed and demonstrated at every age, there are certain windows of opportunity, for example, in early childhood when brain plasticity is surging, where fostering the development of protective factors and harnessing the power of protective systems are especially key (Masten, 2008). Likewise, competence begets competence in the context of resilience, and thus investing early is recommended (Masten, 2008), and there is a documented high return on investment in early child development documented by Heckman (2006). Consequently, the study at hand sought to explore the potential of nature preschools to support the development of protective factors in young children.

## METHODOLOGY

### Research Purpose

The purpose of this exploratory study was to investigate the influence of nature preschool participation on young children's protective factors (initiative, self-regulation, and attachment) that are associated with resilience. Specifically, the following research question guided this exploratory study: Was there significant growth in nature preschooler's protective factors from the beginning to the end of their preschool year?

### Participants

Participants in this study included 78 three- to five-year olds who attended four nature preschools in Minnesota. The average age of these participants was four years old, and 50% were male and 50% were female. Data on race and ethnicity were not collected, due to the homogenous nature of the participants in the nature preschools in this region, and also due to the lack of evidence suggesting variability in protective factors by race or ethnicity (LeBuffe & Naglieri, 2012). In addition, there were 14 participants from a non-nature preschool in the same geographic region who participated in the study, forming a baseline group from which comparisons could be made toward interpreting practical significance of the statistical data. These children were of an average age of four, and 64% were male and 36% were female. All enrolled preschool children at this non-nature preschool, as well as the four nature preschools, were invited to participate, and all but three received parental consent for participation. At the nature preschools, this high parent consent rate was likely due to parents recognizing that the nature preschool movement is relatively new in this region, and that research is needed to support this approach to preschool. The high rate of participation at the non-nature preschool was likely due to it being located at and administered by a university, and thus parents are used to the program being used as a research study site.

### Design

This exploratory study used a pre-experimental pretest-posttest design. Initially, the intention was to use a quasi-experimental design (a pretest-posttest nonequivalent control group design), as a true experimental design was not possible due to the intact nature of groups and lack of ability for random assignment. However, there was difficulty finding non-nature preschools who were willing to participate in the study as the control group, due to concerns about further "testing" their children and because of the perceived time intensive nature of the research instrument for both parents and teachers.

Consequently, the one university-administered, non-nature preschool who did grant permission served as a baseline from which general comparisons could be made, toward helping interpret the findings from nature preschools and understanding if any statistically significant growth was also practically significant (meaningful). It was not considered a true control group, due to lack of nonrandom assignment, nor was it treated as a nonequivalent control group due to the small sample size (14 children v. the 78 children from the nature preschools). Instead, it provided a reference for understanding growth in protective factors in the nature preschool children, showing how children in a non-nature preschool classroom might be expected to grow in protective factors over the course of the school year in high quality preschool programming under the care of a consistent, experienced teacher.

## Treatment

The treatment for this study was participation at a nature preschool during the 2016-2017 school year. A nature preschool is one that “puts nature at the heart of its program,” is based on high-quality early childhood education *and* environmental education practices, and helps lay a foundation for environmental literacy (North American Association for Environmental Education, 2013). The Natural Start Alliance offers the following three defining criteria: 1) Nature is the central thread that weaves together the preschool’s philosophy, methodologies, class-room design, outdoor spaces, and public identity; 2) High-quality early childhood education and environmental education practices ground and guide the program; and 3) The natural world is used to support goals that address both holistic child development and conservation values (North American Association for Environmental Education, 2013).

The four nature preschools in the study met these defining criteria and worked together under an informal collaborative of nature preschools in the same geographic region. They met monthly to share ideas, problem-solve, and provide assistance to other providers who were wanting to incorporate nature play into their preschool programs or start nature preschools of their own. One of the nature preschools was affiliated with a nature center, two were operated out of homes and licensed as family childcare providers, and one operated out of a church under a specialized family childcare license. All four utilized a combination of unmaintained natural settings, natural spaces that were minimally managed for nature play, and natural playscapes designed specifically for nature play. Each had indoor areas that were used minimally throughout the day. A child-directed approach was used at all four of these nature preschools, with the majority of time spent outdoors in free play or guided play outdoors in unmaintained or minimally maintained natural settings. At each of these four nature preschools, there was a caring, responsive lead teacher who had been at that particular nature preschool since its inception, serving not only as the lead teacher, but also the founder and director.

The university-administered, non-nature preschool also had experienced and stable teachers, with a caregiving style that similarly could be described as caring and responsive. This non-nature preschool was connected to the university’s early childhood education department and rooted in developmentally-appropriate practices. Their guiding philosophy emphasized child-directed play for supporting cognitive, social, emotional, and physical development. The majority of time in this non-nature preschool was spent inside, with children playing outside for 30-60 minutes daily in a fenced in playground area, with smaller sized, plastic play structures. The cost for attending this non-nature preschool was similar to the costs associated with the nature preschools, and therefore it was assumed that participants across the nature and non-nature preschools were relatively similar in terms of economic background, as well as similar in terms of age, gender, race, and ethnicity. Thus, participants across the preschools shared similar demographic characteristics and experienced a child-centered, play-based, developmentally-appropriate preschool program that aimed to support holistic development across the domains. These shared characteristics allowed for exploring the potential influence of sustained nature play experiences on the development of resilience, beyond what one might expect to see from a high quality, play-based non-nature preschool program.

## Instrument

The instrument used in this study was the Devereux Early Childhood Assessment for Preschoolers, Second Edition (DECA-P2) (LeBuffe & Naglieri, 2012). This instrument is a standardized, norm-referenced behavior rating scale that is used to assess within-child protective factors related to resilience. The instrument is completed by parents and teachers/caregivers and evaluates the frequency of 27 positive behaviors (strengths). These 27 items form subscales that assess three within-child protective factors of initiative, self-regulation, and attachment. The *initiative* subscale contains items measuring a child’s ability to “use independent thought and action to meet his or her needs; children who score high are often engaged learners who will start or organize activities with other children, are good at solving problems, are responsible, show self-awareness, and enjoy challenges” (LeBuffe & Naglieri, 2012, p 92). The *self-regulation* subscale assesses “the child’s ability to express emotions and manage behavior in healthy ways; children who receive high ratings on this scale are generally able to handle frustration and negative emotions without exhibiting challenging behaviors, are often patient and cooperative, and are respectful and considerate of

others” (LeBuffe & Naglieri, 2012, p. 92). The *attachment/relationships* scale assesses “the child’s ability to promote and maintain mutual, positive connections with other children and significant adults; children who receive high scores on the attachment/relationship scale actively seek out adults and other children, are effective in gaining positive attention, and tend to be affectionate, trusting, optimistic, and often have a happy disposition” (LeBuffe & Naglieri, 2012).

The scores from these three subscales are combined to form a “total protective factor” score, which provides an overall indication of the child’s social and emotional strengths relating to resilience, and is “the most reliable and valid overall indicator of strengths related to resilience.” (LeBuffe & Naglieri, 2012, p. 92). It is the score recommended by the instrument developers for outcome measurement and program evaluation; however, because a child can have differing ratings within the subscales (for example, rate “typical” on the total protective factor yet have “an area of need” rating on one of the subscales, it is useful to consider this overall “total protective factor” score alongside the scores from the three subscales. The reported internal reliability coefficient for the overall scale is .92 for parent raters, and .95 for teacher raters (LeBuffe & Naglieri, 2012). For the initiative subscale, the reported internal reliability coefficient was .88 for parents and .92 for teachers, and for self-regulation, .90 and .94 respectively. The attachment/relationships subscale was slightly lower, .79 and .85 respectively, but still at level for sufficient use. Construct validity and criterion validity was established during the test development through literature reviews, focus groups with professionals, and comparisons with performance measures (see LeBuffe & Naglieri, 2012 for details).

LeBuffe and Naglieri (2012) report only minor variability across the 3- through 5-year old age range, “indicating an absence of age trends” in this age range, and thus norms are provided in the testing manual for these ages combined. Due to small differences in gender, particularly in the self-regulation subscale for teacher raters where girls tend to show more behaviors related to self-regulation than boys, raw-score-to-T-score norm-conversion tables are provided for boys and girls. However, only the self-regulation subscale for teacher raters shows a difference that is significant (with a moderate effect size), suggesting the need to take into consideration gender in analyses regarding self-regulation with data from teacher raters.

### **Data Collection and Scoring Procedures**

Prior to administration of the pretest, IRB approval was obtained and consent forms were given to guardians of children at the participating preschools. For children for whom consent was granted, parents were asked to complete the DECA during the first week of the preschool year (early September 2016). Teachers also were asked to complete the DECA for each of the children. However, as guided by the DECA User’s Guide and Technical Manual (LeBuffe & Naglieri, 2012), the teachers were asked to complete the DECA four weeks after the preschool year began (early October), to allow them time for getting to know the children and observe them over a period of time prior to rating them on the set of DECA items. Parents and teachers were asked to complete the same DECA instrument near the end of the preschool year (late April 2017).

The DECA rating forms were scored following scoring procedures in DECA User’s Guide and Technical Manual (LeBuffe & Naglieri, 2012). Using tables provided in the testing manual, the raw scores for the overall total protective factors as well as the three subscales were converted to standard scores (T-scores) with a mean of 50 and standard deviation of 10. In addition, the manual also contains T-score range descriptions that can aid in interpreting the scores, where T-scores are classified as “strength” (total protective factor T-score of 60-72), “typical” (total protective factor T-score of 41-59), and “area of need” (total protective factor T-score of 28-40). As directed by the manual, the T-scores are to be used in pretest-posttest comparisons at the child- and/or program-levels. Differences in children’s scores from across parent to teacher rater are not considered problematic, but instead reflective of how children’s behavior can differ across home and school settings, as well as differ under the presence of different adults and circumstances.

## **RESULTS**

Descriptive statistics for the data are reported in Table 1. To investigate if children’s resilience significantly increased

from beginning to end of the nature preschool year, repeated measures ANOVA were run for the total protective factors overall scale and for the three subscales of initiative, self-regulation, and attachment/relationships for the data from the teachers and from the parents. Age was not a covariate, per LeBuffe and Naglieri (2012) indicating there is only minor variability due to age across the 3- through 5-year-old age range. Nor was ethnicity or race a covariate in the analyses, due to the lack of variance within the study participants. Also per LeBuffe and Naglieri (2012), gender was a covariate in the analysis of data from teacher raters on the self-regulation subscale, due to the significant difference between boys and girls found in the normed data. To control for an inflated Type I error from running multiple inferential tests within the same data set, Bonferroni procedures guided the significance rate of  $\alpha = .01$ .

Table 1  
*Pretest and Posttest Means and Standard Deviations for Nature Preschool Participants*

	Teacher Rating		Parent Rating	
	Pretest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Posttest Mean (SD)
Total Protective Factors	54.54 (5.95)	57.71 (7.87)*	50.21 (7.62)	53.13 (8.81)*
Initiative	52.74 (7.98)	56.93 (8.55)*	49.84 (8.45)	53.63 (8.17)*
Self-Regulation	54.49 (6.00)	56.78 (8.05)*	49.31 (7.98)	53.34 (9.34)*
Attachment	55.26 (6.91)	57.21 (7.45)	51.64 (7.24)	51.39 (9.93)

Note. \*indicates significant growth from pre to posttest,  $p = .01$ .

For data from the teacher raters, there was significant growth pretest to posttest in the total protective factors scores,  $F(1, 76) = 16.32, p < .001$ . Additionally, there was significant growth for the subscales of initiative ( $F(1,76) = 32.48, p < .001$ ) and self-regulation ( $F(1,76) = 10.65, p = .002$ ). There was not significant growth in attachment when using the Bonferroni-adjusted  $p$  value of  $.01, F(1,76) = 5.28, p = .02$ . These results suggest that children in the nature preschool had positive development in their overall social and emotional strengths related to resilience displayed in the school setting, as well as specifically in initiative and self-regulation.

Regarding the data from parent ratings, there was significant growth pretest to posttest in the total protective factors scores,  $F(1, 76) = 7.13, p = .009$ . Additionally, there was significant growth for the subscales of initiative ( $F(1,76) = 13.58, p < .001$ ) and self-regulation ( $F(1,76) = 10.34, p = .002$ ). There was not significant growth for the subscale of attachment ( $F(1,76) = .08, p = .78$ ). These results suggest that children in the nature preschool had positive development in their overall social and emotional strengths related to resilience displayed in the home setting, as well as specifically in initiative and self-regulation.

To guide interpretation of these results toward determining practical significance (meaningfulness), the same set of analyses were run on the data from the baseline group of the students in the non-nature preschool. Descriptive statistics are presented in Table 2.

Table 2  
*Pretest and Posttest Means and Standard Deviations for Non-Nature Preschool Participants (Baseline Group)*

	Teacher Rating		Parent Rating	
	Pretest Mean (SD)	Posttest Mean (SD)	Pretest Mean (SD)	Posttest Mean (SD)
Total Protective Factors	58.78 (6.48)	63.63 (3.75)	54.14 (4.07)	55.27 (6.02)
Initiative	57.93 (7.98)	66.36 (5.62)*	53.21 (6.19)	50.27 (8.60)
Self-Regulation	66.36 (5.63)	61.27 (5.08)	51.71 (4.50)	52.27 (9.12)
Attachment	61.27 (5.08)	60.18 (5.09)	54.57 (7.54)	54.91 (7.26)

*Note.* \*indicates significant growth from pre to posttest,  $p = .01$ .

The results from the students in the non-nature preschool indicate significant growth in initiative from the data from the teacher ratings,  $F(1,10) = 30.63$ ,  $p < .001$ . The results of the other analyses did not show statistical significance at the significance level of  $p = .01$ : total protective factors teacher rating,  $F(1, 10) = 6.88$ ,  $p = .03$ ; self-regulation teacher rating,  $F(1,10) = 3.24$ ,  $p = .11$ ; attachment teacher rating,  $F(1,10) = 2.34$ ,  $p = .16$ ; total protective factors parent rating,  $F(1,10) = 1.00$ ,  $p = .34$ ; initiative parent rating,  $F(1,10) = .53$ ,  $p = .48$ ; self-regulation parent rating,  $F(1,10) = .39$ ,  $p = .54$ ; attachment parent rating,  $F(1,10) = .16$ ,  $p = .70$ . These results suggest that children in non-nature preschools displayed significant growth in initiative in the school setting from beginning to end of the year, but not in the other areas measured.

Thus, when used to provide a sense of what might be expected through a quality preschool experience without the nature aspect, these results suggest children's initiative may grow over the course of a school year in a quality preschool. Therefore, the statistically significant growth in the nature preschoolers' total protective factors overall and self-regulation displayed in the school setting, and the significant growth in the total protective factors overall, initiative, and self-regulation displayed in the home setting, can be considered practically significant, and potentially a function of the nature aspect of the preschool, as similar significant growth was not seen in the baseline group participating in a quality, but non-nature based, preschool. Because a significant increase in initiative was also seen in school setting for the children in the non-nature preschool, the significant growth in initiative in the nature preschool children could be considered less significant from a practical standpoint (as participation in either type of preschool seems to be associated with an increase in initiative displayed in the school setting).

To further aid in interpreting these results, independent samples T tests were used to compare pretest means in the nature and non-nature preschool children. To account for an inflated Type I error rate from the multiple analyses, the significance level was set at .01. Due to unequal group sizes, equal variances were not assumed. The purpose of these analyses was to explore if either group entered into the preschool year with higher levels on any of the scales. For example, it seems that parents who choose nature preschools might also have a disposition toward other forms of nature engagement, beyond that which happens at the nature preschool. Accordingly, then it would be more difficult to attribute growth in any of these protective factors to the nature preschool, but potentially instead explained by a combination of nature-related experiences within and external to what happens in the nature preschool, or by other experiences in the out-of-preschool time. However, the results of the analyses suggest that the only significant difference in pretest scores was for total protective factors for the parent rating, with children in the non-nature preschool starting significantly higher than children in the nature preschool (Mean Difference = 3.93,  $t(32.83) = 2.82$ ,  $p = .008$ ). This suggests it is less likely for the significant growth in protective factors seen in the nature preschool participants to be attributed to parental or out-of-school experiences, as if that were the case, children in the nature preschool would likely have started the preschool year with significantly higher scores than the children in the non-nature preschool. Thus, this again adds to the practical significance of these findings overall, with significant growth in protective factors in the nature preschool children that is not observed in the non-nature preschool children, and unlikely to be due (or at least not solely due to) parents' provision of additional nature experiences during out of school time.

## DISCUSSION

It is important to consider these findings in the context of the study's limitation. The pre-experimental design limits the internal validity of the study, making it difficult to attribute the significant growth in protective factors to participation in nature preschools. However, this limitation was somewhat addressed through the use of a baseline comparison group, and also through analyses of pretest scores. However, the small sample size of this baseline comparison group suggests cautious interpretation and generalization, as this small sample may have negatively influenced the power of the analyses to detect significant differences.

The results of this study suggest the potential for nature preschools to have a positive influence on children's overall social and emotional strengths related to resilience in both the school and home setting, as well as in self-regulation and initiative in both the home and school settings. This significant growth is not explained by cognitive maturation,

due to the stability of these factors across the three-five year old age range. Further, this growth is different from what was seen in a non-nature, quality preschool that focused on holistic child development through a play-based approach. While there was significant growth in initiative in the non-nature preschool setting, suggesting initiative might grow in a variety of high quality, nature- or non-nature-based preschool settings, significant growth wasn't observed in any other of the protective factors in children attending the non-nature preschool. Similar to findings from the green schoolyards study (Chawla et al., 2014) and the "Nature Nurture" early childhood program (McArdle, Harrison, & Harrison, 2013), these results suggest there likely may be something to the "nature" focus and setting inherent in the nature preschool approach.

Chawla et al. (2014) noted younger elementary school students expressed value in the free movement and free choice during recess in their green schoolyard. They speculate that the "freedom of choice, a great variety of objects for discovery, and loose parts that children could use imaginatively" enabled children to select roles and activities in which they felt comfortable and competent (Chawla et al., 2014, p. 11). They further speculate that this cooperative, imaginative play afforded by the free play, nature environment supported feelings of effectance (seeing they can have a visible impact on their environment) and a sense of efficacy (feelings of mastery and self-esteem that develop through repeated experiences of successfully meeting challenges). For example, they note the example of children guiding their own graduated levels of competency, setting increasingly challenging goals, "such as heavier rocks to lift or more complex techniques for fort construction" (Chawla et al., 2014, p. 11). They also comment on the supportive peer relationships facilitated through children's freedom to choose from a variety of potential activities that afforded cooperative activities and gave them control over social interactions and roles (Chawla et al., 2014). McArdle, Harrison, and Harrison (2013), in their study of the "Nature Nurture" early childhood program, suggest the natural environment provided children with new challenges and appropriate risks, promoted positive self-esteem, persistence and concentration, and contributed to increased calm and relaxation. In the study at hand, similar reasonings could be applied as to the child-initiated, nature play approach affording diverse and expansive opportunities for young children to take appropriate risks, set their own goals, problem-solve, and choose roles and activities that produce feelings of comfort and competence and support positive peer relationships. While child-initiated play in an indoor setting or on a playground might allow for some of this, it seems possible that the opportunities for these experiences are even greater in nature, as the boundaries and variety and holistic challenges are likely to be more extensive.

Children in the nature preschools demonstrated growth in initiative at school and at home; this is the ability to use independent thought and action to meet his or her needs. Children who have high levels of initiative are often engaged learners who will start or organize activities with other children, are good at solving problems, are responsible, show self-awareness, and enjoy challenges (LeBuffe & Naglieri, 2012). While the natural setting was likely conducive to the type of play that can build initiative, also important may have been the style of interactions between the nature preschool teachers and the children. For example, at the nature preschools in this study, children are allowed to play at greater distances from the teacher, sometimes within sight, and other times beyond sight but within established boundaries. At one of the nature preschools studied, children can play at even greater distances from the teacher, through carrying "walkie talkies" in a backpack and being within the reach of the teacher by sound if necessary, not by sight. Thus, interactions with teachers change, and children rely more on themselves and their peers for coming up with ideas regarding what to play, solving problems that arise, assisting each other during challenging activities, and taking care of their own needs rather than relying on their teachers for things they can do themselves. This might be why this growth in initiative seen in the nature preschool children was also observed in the home settings, in contrast with children in the non-nature preschool, where there was growth in the preschool setting but not observed at home. Psychologist Peter Gray, in his book *Free to Learn* (2013), speculates similarly, suggesting that the rise in anxiety and decline in resilience corresponds with a dramatic decline in children's opportunities to play, explore, and pursue their own interests away from adults. He advocates for children having the opportunity to learn to solve their own problems, get into trouble and find their way out, and experience failure and realize they can survive it, all of which can happen in free play in nature.

Children also grew in self-regulation through their experiences in the nature preschools. Self-regulation is the ability to express emotions and manage behavior in healthy ways. Children with high levels of self-regulation are "generally able to handle frustration and negative emotions without exhibiting challenging behaviors, are often patient and

cooperative, and are respectful and considerate of others” (LeBuffe & Naglieri, 2012, p. 92). In a parent guide for building resilience in young children, parents are encouraged to help their children develop self-control and build self-regulation through “encouraging children to keep on trying even when it is hard or frustrating” (Health Nexus Sante, n.d.). Child-initiated free play again might afford opportunities for building self-regulation, as it might be easier for children to persist in a challenging situation when what they are doing is directed toward their goals and intrinsically motivated, rather than their teachers’ goals. In a London study of 4- and 5-year olds, children were significantly more likely to demonstrate self-regulation in child-initiated activity; in adult-initiated activities children, appeared to cede control to adults (Robson, 2015). Peter Gray also asserts how playing with other children, away from adults, is how children learn to control their own emotions and impulses, negotiate differences with others, and learn to make their own decisions (2013). Thus, it may be the degree of child-initiated play, rather than specifically nature, is the operative variable, in the case of self-regulation, although nature seems to offer great opportunities and even arguably more opportunities for this type of play than indoor or maintained outdoor environments.

However, as noted prior, caution in making claims regarding impact is necessary, as is speculating why, due to the pre-experimental design of the study and the small sample size of the non-nature preschool group. Consequently, further research is needed to more definitively state nature preschools have a positive influence on children’s protective factors relating to resilience. It would be important for future research to utilize large sampler sizes and also ideally a randomized control group (or at least a non-equivalent control group of a similar size and demographic characteristics).

A second important direction for further research would be toward understanding what about the nature preschool experience is influential in achieving these positive outcomes relating to resilience. Rickinson, Hall, & Reid (2015) raise concerns regarding the research literature in EE being swayed toward studies of program impact, with limited investigation into program influence (how and why programs work). They suggest moving beyond questions of “What works?” to questions of “What is it about this programme that works for whom in what circumstances” (Rickinson, Hall, & Reid, 2015, p. 2). Similarly, in their review of outcome studies of strengths-based resilience programs, Brownlee et al. (2013) also point to the need to better understand what about the programs are associated with the impacts, as this would lead to improvements in interventions. Results of this study suggest participation in the nature preschool seems to have increased protective factors, but the pathway of nature and other likely mediators, such as the role of the teacher, risk, amount of time in play and play in nature, degree of play (free v. guided), degree of “wild” v. smaller-scale nature, etc., was not directly studied.

Thus, while more research is needed, these results are encouraging. As Joan Almon notes, “As with so many aspects of healthy development, children have an innate capacity to be resilient” (2015, p. 5). It appears from this study, nature preschools are helping bring that capacity to fruition, surrounding children “with love and warmth that does not smother them but gives them a strong foundation for meeting life’s obstacles” and cultivating a “love of nature and a trust in its cycles of death and rebirth” (Almon, 2015, p. 5). Through strengthening children’s internal protective factors, and through supportive contexts and relationships, children will have the capacity to function well in spite of adversity. Not only will this serve them well, but the benefits extend into the communities in which they live, and the ecosystems on which life depends (Chawla, et al., 2014; Tidball & Krasny, 2014).

### **Acknowledgements**

This project was supported by the University of Minnesota’s Undergraduate Research Opportunities Program and The Scientific and Technological Research Council of Turkey (TUBITAK).

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