

International Journal of Early Childhood Environmental Education

Addressing Policy, Practice, and Research That Matters

Yash Bhagwanji, Editor

ISSN 2331-0464 (online) | Volume 8, Number 3 | Summer 2021



naaee

North American Association
for Environmental Education

International Journal of Early Childhood Environmental Education

Addressing Policy, Practice, and Research That Matters
ISSN 2331-0464 (online)

Yash Bhagwanji
Executive Editor
Florida Atlantic University, USA

Bora Simmons
Associate Executive Editor
University of Oregon, USA

Judy Braus
Associate Executive Editor
NAAEE, USA

CONSULTING EDITORS

Patti Bailie	University of Maine at Farmington, USA
Alexia Barrable	University of Dundee, Scotland, UK
Vicki Bohling-Philippi	Forest Lake Family Center, USA
Elizabeth Boileau	Lakehead University, Canada
Patty Born	Hamline University, USA
Sylvia Collazo	Florida Atlantic University, USA
Courtney Crim	Trinity University, USA
Amy Cutter-Mackenzie	Southern Cross University, Australia
Madeleine de Venoge	Project Learning Tree, Washington, DC, USA
Carie Green	University of Alaska Fairbanks, USA
Sue Elliott	University of New England, Australia
Julie Ernst	University of Minnesota Duluth, USA
Ken Finch	Green Hearts Institute for Nature in Childhood, USA
Suzanne Levenson Goldstein	University of Phoenix, USA
Carla Gull	University of Phoenix, USA
Deepti Kharod	University of the Incarnate Word, USA
Christine Kiewra	Dimensions Educational Research Foundation, USA
Rachel Larimore	Michigan State University, USA
Stacy McReynolds	San Antonio Zoo, USA
Deb Moore	Deakin University, Australia
Leigh O'Brien	State University of New York Geneseo, USA
Robert Galin	University of New Mexico, Gallup, USA
Mamata Pandya	Centre for Environment Education, India
Ingrid Pramling Samuelsson	University of Gothenburg, Sweden
Sheila Williams Ridge	University of Minnesota Minneapolis, USA
Jenny Ritchie	Victoria University of Wellington, New Zealand
Mary Rivkin	University of Maryland - Baltimore County, USA
Jaelyn Stallard	Project Learning Tree, Washington, DC, USA
Julia Torquati	University of Nebraska, Lincoln, USA
Ruth Wilson	Bowling Green State University, USA
Susie Wirth	Dimensions Educational Research Foundation, USA

BOOK AND RESOURCE REVIEW EDITOR

Carla Gull University of Phoenix, USA

North American Association for Environmental Education (NAAEE)

Promoting Excellence in Environmental Education - Education We Need for the World We Want

Judy Braus	Executive Director
Christy Merrick	Natural Start Alliance Director
Betty Olivolo	Natural Start Alliance Assistant Director
Emily Van Laan	Natural Start Alliance Communications and Conference Coordinator

International Journal of Early Childhood Environmental Education

ISSN 2331-0464 (online), Volume 8, Number 3, Summer 2021

TABLE OF CONTENTS

RESEARCH

<i>Nature preschool as a promoter of physical activity in young children: An exploratory study of nature preschool in a northern climate</i>	3
Julie Ernst, University of Minnesota Duluth, USA Eva Burgess, Oak Hill School, USA Lexi Bruno, Wind Ridge School House, USA	
<i>Kindergarten deforestation experts: Interdisciplinary learning for understanding and addressing global issues</i>	20
Kim Waite, Prescott College, USA	
Information for Authors	40

Nature Preschool as a Promoter of Physical Activity in Young Children: An Exploratory Study of Nature Preschool in a Northern Climate

Julie Ernst

University of Minnesota Duluth, USA

Eva Burgess

Oak Hill School, USA

Lexi Bruno

Wind Ridge School House, USA

Submitted February 16, 2021; accepted July 20, 2021

ABSTRACT

Preschools and other early childhood education and care settings are influential in the promotion of physical activity (PA) for young children. This study utilized the Yamax Digiwalker pedometer within a quasi-experimental design to quantitatively explore the influence of nature preschools on the PA of 154 preschool-aged children. Results suggest that nature preschools support sufficient PA; furthermore, participants were able to achieve recommended PA during cold and wet months through unstructured nature play. These findings suggest that nature preschools support PA, even during winter months. The results also point to the important role unstructured nature play has in supporting children's physical activity and overall well-being. Implications for practice and further research are discussed.

Keywords: nature preschool, nature play, step-based physical activity

Physical activity is a critical component of the health and development of children (Pate et al., 2006). It promotes cardiovascular and musculoskeletal health (Janssen & Leblanc, 2010), and it has been associated with mental health, including a reduction in depression and anxiety, and with academic achievement (Strong et al., 2005). Additionally, physical activity is protective against obesity in the preschool years and has a strong protective effect on body fat accumulation through adolescence and adulthood (Tandon et al., 2012). A favorable combination of lower levels of sedentary behavior and higher levels of physical activity is positively associated with fitness and motor development (Kuzik et al., 2017). An analysis guided by the "Australian 24-hour Movement Guidelines" found that meeting physical activity, sleep, and screen time guidelines (Cliff et al., 2014) was positively associated with better social-cognitive development. Furthermore, physical activity levels and behaviors extend from early childhood to adolescence and beyond, thus underscoring the importance of establishing positive physical activity habits from a young age (Jones et al., 2013; Jones et al., 2019).

Guidance for Young Children's Physical Activity

Due to the importance of physical activity for children's growth and development, a variety of organizations have worked to establish guidelines or recommendations for children's physical activity. Guidelines from the United Kingdom (Department of Health and Social Care, 2019) and Canada (Canadian Society for Exercise Physiology, 2017)

call for a minimum of 180 minutes of physical activity per day, at least 60 minutes of which should be spent in energetic play. These guidelines further recommend children under the age of five years not be required to stay in a sedentary state for more than one hour, unless sleeping (Canadian Society for Exercise Physiology, 2017). The U.S. Institute of Medicine (McGuire, 2012) provides specific recommendations around sedentary behavior and physical activity for preschools and childcare centers, emphasizing that young children should be allowed to move freely, with periods of sitting or standing still limited to 30 minutes at a time. They further recommend that children participate in physical activity for at least 15 minutes per hour of care. Other guidelines in the U.S., from the Society of Health and Physical Educators (SHAPE, 2020), recommend that children participate in 2 hours of physical activity a day, with 60 minutes coming from structured physical activity and 60 minutes from unstructured or spontaneous active play. When taken in whole, the variety of guidelines underscore the importance of movement from an early age and seem to suggest that a sustainable increase in physical activity, especially when replacing sedentary behavior and/or screen time, may have positive benefits for young children.

While physical activity recommendations are often in the form of minutes per day, there have been efforts to convert these guidelines into step count targets to provide a mechanism for practitioners and researchers to monitor physical activity. Researchers have recognized that although evidence-based steps/day translations of national guidelines for specific age groups are useful and needed, accurately translating recommended minutes to recommended steps is a complex undertaking (Tudor-Locket et al., 2011). Adams et al. (2013) comment on the lack of a definitively identified, precise translation of the needed steps/day for youth, and encourage researchers to undertake further studies toward proposing reasonable “rule of thumb” values. Toward this end, research by Gabel et al. (2013) suggests a step count target of 6000 steps per day to determine if 3- to 5-year-old children are active for the recommended 180 minutes per day, per the U.K. and Canadian guidance. This recommendation of 6000 steps per day is commonly used in the research literature, as is another translation from Vale et al. (2015), which suggests preschool-aged children who accumulate less than 9000 steps per day may be considered insufficiently active.

Need for Increasing Physical Activity of Young Children

Despite the importance of physical activity for young children, it appears that many young children may not be sufficiently active. For example, in Tucker’s (2008) review of 39 studies from the United States, Scotland, Finland, Australia, Chile, Estonia, and Belgium only about half (54%) of preschool age children were meeting recommended physical activity guidelines. It is thought that increases in screen time, the fact that children have fewer siblings to play with than children of previous generations, and greater parental constraints in play places and safety concerns have resulted in dramatic increases in sedentary behavior (Boreham & Riddoch, 2001).

It has been suggested that the amount of time children spend in daycare is also associated with increasing sedentary behaviors among preschool children (Tucker, 2008). As over half of American children are enrolled in preschools or center-based care, spending from 4 to 10 hours per day on average in these settings, the preschool/childcare environment is influential on children’s physical activity levels (O’Neill et al., 2016). Studies confirm Tucker’s speculation, with data suggesting preschoolers in preschool/childcare environments are spending little time both in physical activity and in outdoor play (Trost et al., 2003). Similarly, another more recent study found that children spent 48.4% of time at childcare sitting (Ellis et al., 2017). This may be due to teachers assuming preschool-aged children are very active and engage in sufficient activity outside of childcare/preschool (Salbe et al., 1997), thereby deemphasizing the importance of encouraging physical activity within preschool or childcare settings (Tucker, 2008). More recent research further suggests that opportunities for physical activity are often lacking in preschool and childcare settings, with the majority of children’s activity being sedentary. This recent study of 10 Seattle childcare centers found preschoolers were offered only 48 minutes a day for active play, with 73% of their day in sedentary activities (Tandon et al., 2015).

Characteristics Associated with Young Children’s Physical Activity Levels

While childcare settings appear to contribute to this lack of physical activity, the strong correlation between characteristics of the childcare environment and children’s level of physical activity suggests a potential for using this setting toward increasing physical activity (Pate et al., 2008). Thus, while there is much need and opportunity

within the preschool and childcare setting to intervene toward increased physical activity, “the research on how to best organize childcare time to optimize physical activity and decrease sedentary behavior is in its nascence” (Tandon et al., 2018). Emergent characteristics associated with increased physical activity include overall preschool quality and teachers’ physical activity training (Dowda et al., 2009), as well as less fixed playground equipment, the amount of open space in the childcare/preschool setting and the amount of outdoor playtime included in the daily schedule (Bower et al., 2008). Tandon et al., (2018) found that preschool children were more active and less sedentary when they were outdoors, and that child-initiated activity (free play) resulted in more active play than teacher-led physical activity. In a similar vein, due to children’s increased levels of physical activity when playing outdoors, the American Academy of Pediatrics recommends children play outside as much as possible (Yogman et al., 2018). The Canadian 24-hour Movement Guidelines also state that replacing indoor time with outdoor time may provide greater health benefits (Canadian Society for Exercise Physiology, 2017).

Supporting Young Children’s Physical Activity through Nature Preschool

Although these findings suggest the positive impact of time spent outdoors on children’s PA, the research also suggests preschool-age children may not be getting much outdoor playtime while in childcare/preschool settings. Copeland et al., (2016) reported that only 3 in 10 children in the 30 childcare centers they studied participated in 60 minutes of outdoor play time. They also found that in many centers, outdoor play time actually occurred less frequently than scheduled, and that about a third of young children experienced no outdoor playtime whatsoever (Copeland et al., 2016).

In northern latitudes, the significant decline in childcare-related physical activity and outdoor playtime across seasonal changes represents another concerning trend (Schunta et al., 2016). Temperature, precipitation, and daylight hours can be barriers to physical activity and may explain seasonal variation in physical activity (Merrill et al., 2005; Berkey et al., 2003). Studies have suggested that total activity levels among youth are often highest in spring and summer. For example, Fisher et al. (2005) reported the highest activity level for preschool age children in the U.K. was in the summer months. Kolle et al. (2009) found Norwegian children were more likely to meet recommended levels of physical activity during spring than during winter. Research by Baranowski et al. (1993) suggests changes in the amount of outdoor time are associated with seasonal variations in physical activity levels among young children.

In contrast, nature preschools are an early childhood setting where unstructured, outdoor playtime occurs across all seasons and in all types of weather. Further, nature preschools combine two of the emerging characteristics that are associated with increased physical activity in young children: extended periods of free play and time outdoors. Nature preschools use the natural environment as the outdoor setting for this extended free play, which contrasts the more common fixed playground equipment where most outdoor play at childcare centers occurs. Play in the natural environment has been shown to have a positive effect on children’s motor development and level of physical activity (Fjortoft & Sageie, 2000; Fjortoft, 2004). This finding is consistent with a study of preschool age children in a climate of moderate temperatures (approximately 70 degrees Fahrenheit), which found increased physical activity after a playground was renovated to include more natural environments (Coe et al., 2014).

A rapidly growing movement within the U.S., nature preschools are defined as preschools that use the natural world to support both child development and the development of conservation values or an environmental ethic (North American Association of Environmental Education [NAAEE], 2017). Nature is the central organizing concept of the program - the integrating thread that intentionally ties together the preschool’s philosophy, methodologies, classroom design, outdoor spaces, and public identity (The Natural Start Alliance, 2019). Despite an expanding body of literature regarding the benefits, the emphasis on early academic preparation in the U.S. education system continues to limit this movement from reaching its full potential. Tandon et al. (2018) suggest, “Although the relationship between physical activity and learning is gaining considerable support through research in school-aged children, it is not yet as well established in preschoolers” (p. 1429). Research on the impact of nature preschools on children’s physical activity, coupled with existing research on the benefits of nature preschools on cognitive functions and social-emotional outcomes (such as that by Ulset et al. (2017) which found a positive relationship between the

time spent outdoors in preschool and children's working memory and an inverse relationship with inattention-hyperactivity symptoms), can help counter the idea that active play and learning are mutually exclusive.

METHODOLOGY

Research Purpose

This purpose of this study was to explore the potential for nature preschools, with their emphasis on nature play, to promote young children's physical activity in preschool/childcare settings, particularly in northern climates. Given the gap between recommendations for physical activity and actual practices in childcare settings, and in light of little research regarding how to arrange childcare time and settings to optimize physical activity, the study aimed to contribute to this developing body of literature. Notably, growth within this area of research may help to promote early learning practices and policies that are supportive of active play outdoors and oriented toward supporting the development of children across all domains. Further, documenting physical activity at nature preschools, particularly in late fall and winter months, would advance an understanding of the potential of nature preschools to counter the seasonal decline of outdoor physical activity. Specifically, the following research questions were addressed in this study:

1. Do nature preschools in northern climates promote seasonal physical activity toward meeting recommended physical activity guidelines?
2. When controlling for age, gender, and prior physical activity levels, are nature preschoolers more active while at preschool than their peers in non-nature programs?

Research Design

Our study utilized a pretest posttest non-equivalent control group design. This quasi-experimental design, commonly employed in education research settings, was necessitated due to the inability to randomly assign children to preschool settings. To control for potential pre-existing differences among the children, data was collected on children's age and gender. Due to a lack of variability in terms of racial and ethnic diversity within the geographic region of the study, race and ethnicity of participants were not collected. To control for pre-existing differences in activity level prior to preschool participation, parents of participating children were asked to complete a brief questionnaire, the Early Years Physical Activity Questionnaire (EY-PAQ) (Bingham et al., 2016), which contains items that gather data about the activity level of their children. This questionnaire has been validated for use in assessing young children's baseline physical activity in situations when objective, direct assessments are not feasible (Bingham et al., 2016).

Participants in the treatment group were children attending one of the five participating nature preschools, located in northern Minnesota, U.S. Participants in the non-equivalent control group attended one of three non-nature preschools, also located in northern Minnesota. Of the five nature preschools and three non-nature preschools, one of the preschools in each grouping was a Head Start preschool program; the rest of the programs were private preschools, with the exception of one that was affiliated with a public university. Participating sites were asked to complete a brief form, specifying the average length of their preschool day and the average amount of time daily spent in free play indoors, free play outdoors, teacher-led physical activity indoors, and teacher-led physical activity outdoors. Teachers were also asked to specify the location of their outdoor free play, and also if any of these responses varied monthly or seasonal, and if so, to indicate which months and the amount of time across the aforementioned activities (these daily averages are reported in Table 1).

Nature and non-nature preschools differ in philosophy as well as in instructional methods and time allocation of the school day. The five nature preschools applied a nature-focused, child-directed play philosophy. Regardless of weather, the majority of the day was spent outdoors in nature play (defined for this study as child-initiated play that take place in and with nature). For children in the full day program, this schedule allowed for approximately four to five hours of daily nature play. Outdoor play occurred in a variety of nature settings including "wild" (unmaintained)

natural space, minimally managed space, and natural playscapes designed specifically for nature play. The natural playscapes included “structures” such as stepping stones or stumps, digging areas, and a collection of loose natural parts for building and creating. Indoor spaces were used minimally for approximately thirty to ninety minutes. Indoor time was devoted primarily to free play; although, teachers typically led loosely structured, playful learning experiences for approximately 15-30 minutes each day. These five nature preschools had a combined total of 98 participants, with 48% of them female.

For this study design, three non-nature preschools served as a comparison or baseline group, rather than a true control group, due to fewer participants and the lack of random assignment. The comparison schools were selected based on willingness to participate as well as a similar geographic location, tuition structure, and demographic makeup in relation to the treatment schools. All three programs shared the aim of supporting children’s cognitive, social, emotional, and physical development. The majority of play at these programs occurred indoors, with varying amounts of the preschool day devoted to unstructured or loosely guided play (one to four hours). In addition to indoor playtime, these three programs provided opportunities for outdoor play, varying in length from 30 minutes to 2 hours and 30 minutes. Outdoor play was primarily in a maintained outdoor space with typical, fixed playground equipment. Children also experienced teacher-guided learning, with the amount of time varying by site (from 15 minutes to 2 hours). The comparison group was comprised of a total of 56 participants, with 48% of the participant female.

Based on these defining characteristics, participants across the preschools shared similar geographic locations and experienced developmentally appropriate programs led by caring and responsive teachers. The proportion of daily preschool time spent in free (unstructured) play and the location of the unstructured play time served as the main differentiation between the nature and non-nature preschools. See Table 1 for a description of participating nature sites.

Research Instrument and Procedures

The Yamax Digiwalker Pedometer is an electronic pedometer that measures vertical oscillations and provides a total count of accumulated movements. It has been shown to have functional utility in assessing physical activity in school children and has been validated for measuring physical activity in young children (Cardon & Bourdeaudhuij, 2007). Schunta et al. (2016) suggest a consecutive five-day period yields sufficiently reliable physical activity data in young children. Thus, data was collected during a five-day period during the end of October and again during a five-day period at the end of February. These months were selected as they are often less conducive to outdoor play. Temperature in both months is often in the 20-degree Fahrenheit range, with generally little snow on the ground in October, changing to significant snow on the ground in February; the region averages 70 inches of snow annually. In order to control for potential weather variations week to week that could affect activity levels, the same five-day period in February and October was used for data collection at each of the sites.

Procedures used in Vale et al. (2015) guided the protocol regarding use of the pedometers for data collection. Following approval from the University’s Institutional Review Board, researchers met with each lead teacher at the participating preschools to ensure proper use/wear of the devices and to clarify data collection protocol. This protocol involved obtaining consent from parents and asking parents that granted consent to complete the EY-PAQ, which served as the proxy measure of pre-existing physical activity level (the baseline measure for the survey). Parents were asked to complete the questionnaire for the time period of August, which was the month that preceded preschool participation; this was done so that the baseline was measured prior to the start of the treatment. While the strategy of asking parents to have their children wear pedometers and record data prior to the start of the academic year was considered, this approach for obtaining baseline PA data didn’t seem feasible (due to not having access to participants to administer the consent process and provide them with pedometers, prior to the start of the school year, and due concerns that the time and effort involved on the part of parents would result in a decrease in participation rates).

For the five-day data collection periods, the lead teacher was responsible for fastening children’s pedometers on the waistbands of their left hip, in alignment with the midpoint of their knee, upon their arrival. They were also

responsible for removing it at the end of the preschool day during the two specified five-day periods. The preschool teacher recorded the time of arrival and departure during data collection days, so that variations in length of preschool day for each child were controlled for in the analysis. Additionally, teachers recorded the number of minutes of napping/resting time per day, to account for variations across sites and so that these minutes were not considered within physical activity assessments. To reduce the influence of inter-device variability on physical activity measurements, children wore the same device for each of the data collection days and across both data collection time periods. The devices were “taped” so that the display screens were covered; this was to prevent the devices from being distractions to the children and to avoid encouraging interaction with the device.

RESULTS

Descriptive statistics were used to analyze the data toward addressing the first research question regarding nature preschools and if they promoted physical activity toward meeting recommended physical activity guidelines. As noted in the literature review, achieving 6000-9000 steps per day was used as the indicator of meeting recommended daily physical activity for preschool-age children, per Gabel et al. (2013) and Vale et al. (2015). For participating sites, average step counts per minute for late October and late February are reported in Table 1. Table 1 also reports the average steps achieved during the preschool day, which were calculated by multiplying average steps per minute by average length of preschool day in minutes. Based on data yielded in the two data collection periods in this study, and using this analysis approach, all three full-day nature preschools are generally supporting sufficient physical activity among their preschool participants. Late October average daily step counts ranged from 6821 to 8100 steps. For the late February data collection window, steps were lower (5765 to 7390 steps), but still generally within (close to) the targeted range of step-based physical activity. While the guidelines for recommended daily steps are more difficult to apply to half-day preschool programs, due to the shorter length of time children spend at preschool, preschoolers attending the half-day nature preschools averaged 4033 to 4595 daily steps (see Table 1).

To address the second research question regarding if young children in nature preschool programs had significantly more steps per minute than children in the non-nature preschools, general linear modelling (between-subjects multivariate testing) was used. In this analysis, the between-factor (independent variable) was program type, with three levels (half-day nature, full-day nature, and non-nature). The dependent variables were average steps/minute in late October and average steps/minute in late February. The covariates in the analysis were age, gender, and baseline physical activity.

The results suggest a significant difference in steps/minute by program type for both late October data and late February data, $F(2) = 11.48, p < .001$ and $F(2) = 13.85, p < .001$ respectively (see Table 2). Estimated marginal means by program type are reported in Table 3. Pairwise comparisons of estimated marginal means for data from late October suggest children in the half-day and full-day nature preschools were significantly more active than children in the non-nature programs in late October (MD = 6.25, SE = 1.34, $p < .001$; MD = 4.35, SE = 1.19, $p < .001$, respectively). For the late February data, one of the non-nature preschool sites did not collect data. February data from the sites who did collect data indicates children in the half-day nature preschools were significantly more active than children in both the full-day non-nature preschool and nature preschools (MD = 6.36, SE = 1.29, $p < .001$; MD = 4.68, SE = 1.11, $p < .001$, respectively). There was not a significant difference between children in the full-day nature and non-nature programs, which will be discussed below in light of the change in number of participating sites. See Table 4 for statistical data for these pairwise comparisons.

DISCUSSION

Physical activity behavior trends in preschool tend to extend into childhood (5-8 years old), thus highlighting the importance of developing strong PA levels from an early age (Jones et al., 2013; Jones et al., 2019). Because children may spend from 4 to 10 hours per day in childcare (O'Neill et al., 2016), understanding practices that support PA are of utmost importance. Nature preschools offer promising opportunity as they combine two characteristics that have been positively associated with increased PA: free play and outdoor play. Therefore, this study sought to offer empirical evidence regarding the effect nature preschools have on physical activity.

Table 1
 Description of Study Sites and Summary of Participants Physical Activity Levels

Site	Number of Participating children	Nature (Nat) or Non-Nature (Non)	Full or Half Day Program	Average Length of Preschool Day, in Minutes ^a	Average play or PA minutes/daytime minutes (percentage of daytime minutes) ^b				M (SD) pre-Physical Activity Level ^c	M (SD) Steps/Min Last week of October	M (SD) Steps/Min Last week of February	Total Average Steps Achieved During Preschool Day for Oct/Feb ^d
					Free play indoors	Free play outdoors	Teacher-led indoor PA	Teacher-led outdoor PA				
1	16	Nat	Full	410	60 min (14%)	300 min (73%)	-	-	37.43 (22.25)	17.75 (5.58)	14.06 (5.35)	7100/5765
2	17	Nat	Full	390	90 min (23%)	270 (70%)	-	-	47.35 (21.25)	20.77 (4.42)	18.95 (5.23)	8100/7390
3	27	Nat	Full	345	30 min (9%)	225 min (65%)	-	-	57.32 (37.99)	19.77 (3.83)	17.95 (3.96)	6821/6193
4	23	Nat	Half	195	40 min (20%)	100 min (50%)	20 min (10%)	20 min (10%)	42.73 (23.86)	20.68 (4.81)	21.99 (5.56)	4033/4288
5	9	Nat	Half	180	90 min (50%)	60 min (33%)	5 min (3%)	-	29.63 (19.37)	25.53 (4.66)	25.41 (7.01)	4595/4574
6	21	Non	Full	345	60 min (17%)	60 min (17%) *30 min (8%) in Feb	30 min (8%) *50 min (14%) in Feb	-	38.61 (11.28)	12.25 (3.88)	14.48 (4.34)	4226/4996
7	9	Non	Full	430	250 min (58%)	150 min (35%)	-	-	30.81 (21.82)	22.49 (4.28)	17.09 (3.44)	9675/7353
8	14	Non	Full	320	90 min (28%)	30 min (10%)	20 min (6%)	-	51.40 (47.62)	17.61 (5.15)	--	5632

Notes:

- ^a Length of day in minutes excluding nap/rest time (daytime minutes); to account for variability across children within sites for drop-off and pick up times, length of day was average length of day for participants (calculated by average number of minutes pedometers worn minus napping minutes)
- ^b Day is defined as daytime or non-napping minutes; percentage of daytime (non-napping) minutes during preschool day; same for October and February, unless noted
- ^c Calculated from average total minutes of moderate to vigorous physical activity, as reported by parents on EY-PAQ for their children's physical activity levels the month prior to preschool participation, divided by 840 daytime (awake) min/day multiplied by 100 to yield proportion of waking day in moderate to vigorous physical activity; number reported in column is site average across participants
- ^d Calculated by average steps/min multiplied by average length of minutes in preschool day

Table 2

Statistical Results of Multivariate Between-Subjects Test for Effect of Preschool Program Type on Physical Activity

Source	Dependent Variable	df	F	Significance
Pre-physical activity level	Late Oct. steps/min	1	1.37	.24
	Late Feb. steps/min	1	.31	.58
Age	Late Oct. steps/min	1	1.20	.28
	Late Feb. steps/min	1	.27	.60
Gender	Late Oct. steps/min	1	3.91	.05
	Late Feb. steps/min	1	9.20	.003
Program Type (Nature full, Nature half, Non-Nature Full)	Late Oct. steps/min	2	11.48	<.001
	Late Feb. steps/min	2	13.84	<.001

Table 3

Estimated Means and Standard Errors of Physical Activity Levels by Program Type

Program Type	Dependent Variable	Mean	Std. Error
Full-day Nature	Late Oct. steps/min	19.65	.67
	Late Feb. steps/min	17.33	.65
Half-day Nature	Late Oct. steps/min	21.56	.94
	Late Feb. steps/min	22.00	.90
Full-day Non-Nature	Late Oct. steps/min	15.31	.96
	Late Feb. steps/min	15.64	.93

Note: Covariates in the model evaluated at the following values: Pre-physical activity level = 43.98; Age = 4.33

Table 4
Pairwise Comparisons of Physical Activity Levels by Program Type

Dependent Variable	Program Comparison	Mean Difference	Std. Error	Significance
Late October Steps/Minute	Full-day Nature and Half-day Nature	-1.91	1.16	.10
	Full-day Nature and Full-day Non-Nature	4.35	1.19	<.001*
	Half-day Nature and Full-day Non-Nature	6.25	1.34	<.001*
Late February Steps/Minute	Full-day Nature and Half-day Nature	-4.68	1.11	<.001*
	Full-day Nature and Full-day Non-Nature	1.69	1.15	.14
	Half-day Nature and Full-day Non-Nature	6.36	1.29	<.001*

The results of this study suggest the potential for nature preschools to positively impact children's seasonal PA. Children in the full-day nature programs were meeting recommended levels of physical activity while at preschool, which is meaningful toward countering the likely lower physical activity opportunities during the after-care hours (in light of less daylight, evening routines, etc.). Children in the half-day nature programs had high levels of physical activity, achieving about 4000-5000 of the recommended 6000-9000 steps in a relatively small proportion of their waking day (about three to four hours of a 12- to 14-hour waking day). While steps decreased slightly during the second collection window (late February), children were still close to the targeted range of PA. It is worth noting, too, that depth of snow in February may have reduced the total number of steps taken or the total number of steps detected by the pedometers, as these devices were not validated for movement in snow environments. Little is known about the connection between movement through snow and impacts on health. However, it is possible that while movement in snow may yield fewer steps, it could also be associated with higher levels of physical exertion and thus other positive impacts on physical health.

Children in the nature preschools achieved the recommended physical activity primarily through unstructured nature play, rather than through structured activity (see Table 1). Some guidelines suggest that part of young children's PA should come in the form of teacher-led exercises (SHAPE, 2020). Yet many caregivers do not feel trained or confident in leading such exercise (Jones et al., 2019), which may create a barrier to children engaging in such forms of PA. However, in the current study, even in the absence of structured teacher-led exercises, preschoolers were able to achieve the recommended number of steps. Children innately know how to play and engage in the natural world, thus allowing them to meet PA guidelines through their own volition. Not only did nature preschoolers generally meet the recommended PA levels, but they also experienced a limited amount of sedentary time, spending much of their day in unstructured play. These activity levels align with the SHAPE guidelines which recommend children participate in unstructured physical activity for a minimum of 60 minutes, but for up to several hours, per day (2020). Thus, these findings support the notion that children can get enough steps through play.

Beyond meeting general PA recommendations through play, children in the nature preschool setting got enough steps in their day without having to go indoors during the winter months. The geographical area in which the preschools studied are located sees significant precipitation and cold temperatures throughout many months of the year, with February temperatures typically ranging from -7 degrees to 31 degrees Fahrenheit. These findings challenge the commonly held response to changes in weather and seasons. A 2007 review identified that 73% of studies on the topic found changes in weather had significant effect on participants' PA levels (Tucker & Gilliland). Typical solutions for this decline advise providing kids with more indoor opportunities during the winter months (Silva et al., 2011; Tucker & Gilliland, 2007). In contrast, the current findings suggest that heading indoors is not the only way to stay active during wet and cold weather. Based on the many studies highlighting the importance of PA in young children, adding yet another solution (nature play) to the mix of viable options for increasing winter activity offers valuable insight. Additionally, while sending children indoors may offer one avenue for maintaining activity levels, it could limit other benefits of outdoor play and learning, such as the positive impacts nature play has upon children's cognitive development (Dankiw et al., 2020).

Taken collectively, the data shows that while physical recommendations suggest indoor activities in the winter months (Silva, et al., 2015) and structured PA (SHAPE, 2020) are necessary for young children, a focus on play may provide another important strategy for increasing PA in children, as children in the nature preschools studied achieved PA without indoor, structured PA. As the literature review shows, increasing movement in young children brings a host of positive benefits. Regardless of this evidence, young children generally still experience a lack of PA and the associated negative impacts. Many factors may coalesce to impact low levels of PA (Burdette & Whitaker, 2005; O'Neill et al., 2016; Jones et al., 2019), may coalesce to impact low levels of PA. Burdette and Whitaker suggest that the campaign to increase PA in children may be more successful if the language and outcomes shift to promoting play and its myriad of total health benefits (2005). Rather than focusing on just physical health, researchers and practitioners should perhaps shift to focus on the overall well-being indicators of attention (cognitive), affiliation (social), and affect (emotional) health. When the results of this study are viewed in the context of the other research-based positive outcomes associated with nature play, then perhaps sending kids outside to play in all weather is good for both body and mind.

In addition to the results of this study demonstrating that nature preschools can be conducive to supporting physical activity, also of interest was the level of physical activity at the nature preschools relative to the level of physical activity at the non-nature preschools. Results from the first data collection (late October) suggest that children in the half-day and full-day nature preschools were significantly more active than children in the non-nature programs. The second data collection (late February) showed that children in the half-day nature preschools were significantly more active than children in both the full-day nature and non-nature programs, while children in nature and non-nature full-day programs had similar levels of physical activity. As noted in the results, one of the three full-day non-nature preschools did not collect their February data, resulting in an imbalance of sites (three nature preschool programs in the treatment group and two non-nature preschools in the comparison). Thus, it is hard to know if the physical activity levels on average were truly similar. For example, the snow cover may have potentially slowed down or reduced the children's actual activity level, or influenced the pedometer's detection of step, or influenced both. Or perhaps the variation was compounded by the small sample number of sites in each group, making interpretations of the data challenging. In general, high standard deviations and standard errors in the data suggest variability in physical activity levels within and across preschool settings, which makes comparisons challenging and points to the need for further research with more sites within each comparison group, thus providing the opportunity for multi-level modelling to accommodate the "nesting" of the data (children within preschool sites within comparison groups).

Based on the current data set, the half-day nature preschool was the most conducive setting for encouraging PA. Children in this setting had significantly higher average PA levels during preschool hours than children at both the full-day nature and non-nature preschools, in both October and February. These results suggest the potential influence of the proportion of program activity (ex: play time versus sedentary time) on physical activity rather than just the location of play (indoors v. outdoors). For example, during the half-day nature preschool, much of the day was spent in play with less time focused on sedentary activities like lunch and learning circles. Past research has theorized that genetic factors may play a large role in shaping children's activity (Rowland, 1998). However, O'Neill et al. (2016) found that while this genetic influence may exist, the effects of social and physical environmental factors play a far greater role in influencing children's physical activity. Their findings, coupled with those of this study, further underscore the importance of additional research that leads to a greater understanding of the specific factors within the preschool day that help support and encourage children's physical activity.

The results of this study also speak to the important influence all preschools have on PA levels of young children. Given the percentage of time children spend at preschool, their experience there can drastically support or limit PA. One study found that preschools range from 0% to 83% of children meeting PA guidelines (O'Neill et al., 2016). Factors such as classroom management style, teaching philosophy, and amount of time spent in teacher-led lessons may all have an effect on the overall amount of PA. Within this present exploratory study at hand, children at one of the non-nature preschools also had high levels of PA, which demonstrates the potential for both nature and non-nature preschools to positively influence or constrain PA levels. There are likely a variety of characteristics such as the teacher, the setting, and schedule/routine/activity, as well as multiple combinations that are conducive to PA, with unstructured nature play outdoors being one of them. However, from the perspective of impacting children's overall well-being, a building body of research suggests nature play may offer social, emotional, and cognitive benefits as well as the physical benefits accompanying increased PA (Dankiw, et al., 2020).

Limitations and Recommendations for Further Research

It is important to acknowledge that the findings of this pilot study are based on data taken from a relatively small and locally specific sample. Accordingly, as noted previously, further research should aim to reduce these limitations by utilizing a larger sample size, as well as a more equivalent control group in order to more fully assert nature preschools' influence on young children's physical activity. Furthermore, extending this research to a large population with greater ethnic, racial, and socioeconomic variability would lend further insight into the possible wide scale influence of nature preschools on physical activity. Cold weather does create some barriers in terms of knowledge of and access to the correct clothing to stay warm and safe. Thus, as researchers and practitioners examine ways to expand opportunities and methods to promote physical activity, this socioeconomic and cultural barrier must be included in the bigger picture. Future studies might explore young children's PA levels in snowy

environments (particularly deep snow conditions) to better understand the relationship across changes in step-based PA levels and intensity of PA, as well as the ability for step-based activity tracking devices to collect valid step counts.

Another important direction for further research includes working towards deeper understanding of what aspects of the nature preschool experience are most influential in supporting physical activity. As noted in the literature, overall preschool quality and teachers' physical activity training (Dowda et al., 2009), less fixed playground equipment, amount of open space and amount of outdoor playtime (Bower et al., 2008), and child-initiated free play (Tandon et al., 2018) have all been positively associated with increased physical activity in prior research. This study at hand supports the positive role nature preschools can play in supporting physical activity. However, there is still much to examine in terms of how and why nature preschools are conducive to physical activity. Potential questions to consider include, "How influential is the location of play (indoors versus outdoors) relative to the influence of the amount of time spent in free play?" and "What is the role of loose parts versus fixed equipment?" Both types of play materials can be used in an outdoor and indoor setting and thus may add another layer of variability when investigating physical activity. For example, gym play with loose parts like balls and jump ropes might generate more steps than exploring fixed equipment outside in the winter. Further analysis of the physical elements of the space and the ways in which children interact with these elements is an important next step in the research (Dankiw et al., 2020). A deeper understanding of these nuances would allow practitioners greater insight and strategy in terms of how to arrange both the time and setting of the preschool day in order to optimize physical activity.

Recent reviews have called for creative and unique PA interventions (Jones et al., 2019). Reframing PA as play, and looking at the myriad of connected benefits may just be one answer. While isolating variables is important in these early stages of research, it will also be important to approach this research with a holistic lens. While physical activity is a key aspect of child development and wellbeing, so too are many other characteristics that may be positively influenced by nature preschools and outdoor free play. For example, SHAPE recommends that preschoolers should not be sedentary for lengths of time greater than 60 minutes, except when they are sleeping. While the exact schedule of daily activities is outside the scope of this research study, it is worth noting that, excluding nap/rest time, 4 out of 5 of the nature preschools did not have 60 minutes left in their day once all play time was accounted for. Perhaps, because nature play allows children to meet academic and developmental outcomes while playing, there is more time left in the day for physical activity. Considering these outcomes through the lens of play may promote a more holistic picture of all of the needs of a developing young mind and body.

CONCLUSION

The significance of this study lies in the critical importance of physical activity in the healthy development of young children. Globally, there are more than 42 million preschool children classified as overweight or obese, and early intervention is needed to "increase daily physical activity levels and promote positive lifestyle behaviors that will track into adulthood" (Sharp et al., 2017, p. 1). This has become a public health priority, as physical inactivity contributes to the many non-communicable, chronic diseases (Sharp et al., 2017). Although children spend a significant amount of time in childcare, they are often not sufficiently active in these settings (Reilly, 2010). Given that preschools are influential toward countering other barriers to physical activity such as time, daylight, and afterschool schedules, additional successful interventions for increasing physical activity within the preschool/childcare setting are needed. In this study, physical activity recommendations were generally achieved through play and specifically outdoor play, which comes with many other development benefits including social emotional learning skills (Lithoxoidou et al., 2017), cognitive skills (Ulset et al., 2017; Dankiw et al., 2020), and emotional well-being (Brussoni et al., 2017; Groves & McNish, 2011).

However, as previously noted, the small sample size and homogenous makeup of the study participants make it necessary to use caution when speculating about correlations, impacts, and influence. Even with these limitations and a need for further research in mind, the results of this exploratory study suggest nature preschools are conducive to supporting physical activity, and potentially more conducive than non-nature preschools. Further research should work to identify if variation across nature preschools influences children's physical activity and if so, what characteristics seems to be associated with this variation. This research should aim towards a deeper understanding

of the how and why of influencing factors such as program length and schedule, teacher mindset, and children's specific behaviors and interactions with the play space.

ACKNOWLEDGEMENTS

This study was funded by the University of Minnesota's Office of the Vice President for Research through their Grant-in-Aid of Research, Artistry, and Scholarship program. We wish to extend appreciation for the funding that supported this research, as well as to the Co-PI on the funding proposal, Dr. Charles Fountaine, a professor of exercise science at the University of MN Duluth, who provided valuable methodological guidance. We also wish to acknowledge and extend appreciation for the wonderful and on-going cooperation of the local preschools who participated in this study.

REFERENCES

- Adams, M. A., Johnson, W. D., & Tudor-Locke, C. (2013). Steps/day translation of the moderate-to-vigorous physical activity guideline for children and adolescents. *The International Journal of Behavioral Nutrition and Physical Activity*, *10*(49), 1-11. <https://doi.org/10.1186/1479-5868-10-49>
- Baranowski, T., Thompson, W. O., Durant, R. H., Baranowski J., Puhl, J. (1993) Observations on physical activity in physical locations: Age, gender, ethnicity, and month effects. *Research Quarterly for Exercise and Sport*, *64*(2), 127-133.
- Berkey, C. S., Rockett H. R., Gillman M. W., Colditz, G. A. (2003). One-year changes in activity and in inactivity among to 10- to 15-year-old boys and girls: Relationship to change in body mass index. *Pediatrics*, *111*(4), 836-843. [10.1542/peds.111.4.836](https://doi.org/10.1542/peds.111.4.836)
- Bingham, D. D., Collings, P. J., Clemes, S. A., Costa, S., Santorelli, G., Griffiths, P., & Barber, S. E. (2016). Reliability and validity of the early years physical activity questionnaire (EY-PAQ). *Sports*, *4*(2), 30. <https://doi.org/10.3390/sports4020030>
- Boreham, C., & Riddoch, C. (2001). The physical activity, fitness and health of children. *Journal of Sports Sciences*, *19*, 915-929.
- Bower, J. K., Hales, D. P., Tate, D. F., Rubin, D. A., Benjamin, S. E., & Ward, D. S. (2008). The childcare environment and children's physical activity. *American Journal of Preventative Medicine*, *34*(1), 23-29. [10.1016/j.amepre.2007.09.022](https://doi.org/10.1016/j.amepre.2007.09.022). PMID: 18083447
- Brussoni, M., Ishikawa, T., Brunelle, S., & Herrington, S. (2017). Landscapes for play: Effects of an intervention to promote nature-based risky play in early childhood centres. *Journal of Environmental Psychology*, *54*. 139-150.
- Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting free play in young children: Looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatric and Adolescent Medicine*, *159*(1), 46-50. [doi:10.1001/archpedi.159.1.46](https://doi.org/10.1001/archpedi.159.1.46)
- Canadian Society for Exercise Physiology. (2017). *Canadian 24-hour movement guidelines for the early years (0-4 years): An integration of physical activity, sedentary behaviour, and sleep*. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/29219102/>
- Cardon, G. & Bourdeaudhuij, I. (2007). Comparison of pedometer and accelerometer measures of physical activity in preschool children. *Pediatric Exercise Science*. *19*(2). 205-214. [10.1123/pes.19.2.205](https://doi.org/10.1123/pes.19.2.205).
- Centers for Disease Control and Prevention. (2003). Physical activity levels among children aged 9-13 years—United States, 2002. *MMWR*, *52*(33), 785-788.
- Cliff, D. P., McNeill, J., Vella, S. A., Howard, S. J., Santos, R., Batterham, M., Melhuish, E., Okely, A. D., & Rosnay, M. (2014) Adherence to 24-hour movement guidelines for the early years and associations with social-cognitive development among Australian preschool children. *BMC Public Health*, *17*.
- Coe, D. P. (2018). Means of optimizing physical activity in the preschool environment. *American Journal of Lifestyle Medicine*, *14*(1), 16-23. [10.1177/1559827618818419](https://doi.org/10.1177/1559827618818419).
- Coe, D. P., Flynn, J. I., Wolff, D. L., Scott, S. N., & Durham, S. (2014). Children's physical activity levels and utilization of a traditional versus natural playground. *Children, Youth and Environments*, *24*(3), 1-15. [0.7721/chilyoutenvi.24.3.0001](https://doi.org/10.7721/chilyoutenvi.24.3.0001)

- Copeland, K. A., Khoury, J. C., Kalkwarf, H. J. (2016). Child care center characteristics associated with preschoolers' physical activity. *American Journal of Preventive Medicine, 50*(4), 470-479. 10.1016/j.amepre.2015.08.028
- Dankiw, K. A., Tsiros, M. D., Baldock, K. L., Kumar, S. (2020). The impacts of unstructured nature play on health in early childhood development: A systematic review. *Plos ONE*.
<https://doi.org/10.1371/journal.pone.0229006>
- Department of Health and Social Care. (2019). *UK chief medical officers' physical activity guidelines*.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/832868/uk-chief-medical-officers-physical-activity-guidelines.pdf
- Dowda, M., Brown, W., Mclver, K., Pfeiffer, K. A., O'Neill, J. R., Addy, C. L., Pate, R. R. (2009). Policies and characteristics of the preschool environment and physical activity of young children. *Pediatrics, 123*(2), e261-e266. 10.1542/peds.2008-2498
- Ellis, Y. G., Cliff, D. P., Janssen, X., Jones, R. A., Reilly, J. J., Okely, A. D. (2017). Sedentary time, physical activity and compliance with IOM recommendations in young children at childcare. *Preventive Medicine Reports, 7*, 221-226.
- Gabel, L., Proudfoot, N. A., Obeid, J., MacDonald, M. J., Bray, S. R., Cairney, J., & Timmons, B. W. (2013). Step count targets corresponding to new physical activity guidelines for the early years. *Medicine and science in sports and exercise, 45*(2), 314-318.
- Goldfield, G. S., Harvey, A., Grattan, K., & Adamo, K. B. (2012). Physical activity promotion in the preschool years: A critical period to intervene. *International Journal of Environmental Research and Public Health, 9*(4), 1326-1342. <https://doi.org/10.3390/ijerph9041326>
- Groves, L., & McNish, H. (2011). Natural play: Making a difference to children's learning and wellbeing. Scotland Forestry Commission. <http://outdoorplayandlearning.org.uk/wp-content/uploads/2016/07/naturalplaystudyfull-1.pdf>.
- Fisher, A., Reilly, J. J., Montgomery, C., Kelly, L., Williamson, A., Jackson, D. M., Paton, J. Y., Grant, S. (2005) Seasonality in physical activity and sedentary behavior in young children. *Pediatric Exercise Science, 3*, 31-40.
- Fjortoft, I. (2004). Landscapes as playscape: The effects of natural environments on children's play and motor development. *Children, Youth and Environments, 14*(2). 21-44.
- Fjortoft, I. and Sageie, J. (2000). The natural environment as a playground for children. *Landscape and Urban Planning, 48*(1/2), 83-97.
- Fox, K. R. (2011). *Start active, stay active: A report on physical activity for health from the four home countries' chief medical officers*. Department of Health; Physical Activity; Health Improvement and Protection.
- Janssen, I., & Leblanc, A. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavior, Nutrition, and Physical Activity, 7*(40). 10.1186/1479-5868-7-40.
- Jones, R. A., Hinkley, T., Okely, A. D., & Salmon, J. (2013). Tracking physical activity and sedentary behavior in childhood: A systematic review. *American Journal of Preventive Medicine, 44*(6), 651-658.
- Jones, R. A., Sousa-Sá, E., Peden, M., & Okely, A. D. (2019). Childcare physical activity interventions: A discussion of similarities and differences and trends, issues, and recommendations. *International Journal of Environmental Research and Public Health, 16*(23). <https://doi.org/10.3390/ijerph16234836>
- Kuzik, N., Poitras, V. J., Tremblay, M. S., Lee, E. Y., Hunter, S., & Carson, V. (2017). Systematic review of the relationships between combinations of movement behaviours and health indicators in the early years (0-4 years). *BMC Public Health, 17*.
- Kolle, E., Steene-Johannessen, J., Andersen, L. B., & Anderssen, S. A. (2009) Seasonal variation in objectively assessed physical activity among children and adolescents in Norway: A cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity, 6*(36), 1-9.
- Lithoxidou, L. S., Georgopoulos, A. D., Dimitriou, A. T., Xenitidou, S. C. (2017). "Trees have a soul too!" Developing empathy and environmental values in early childhood. *International Journal of Early Childhood Education, 5*(1), 68-88.
- McGuire, S. (2012). Institute of medicine early childhood obesity prevention policies. *Advances in Nutrition, 3*(1), 56-57. <https://doi.org/10.3945/an.111.001347>
- Merrill, R. M., Shields, E. C., White, G. L., & Druce, D. (2005). Climate conditions and physical activity in the United States. *American Journal of Health Behavior, 29*, 371-381.

- Natural Start Alliance (2019). *Nature-based preschool professional practice guidebook*. Washington, D.C., NAAEE.
- North American Association for Environmental Education (NAAEE). (2017). *Nature preschools and forest kindergartens: 2017 national survey*. Retrieved from https://naturalstart.org/sites/default/files/staff/nature_preschools_national_survey_2017.pdf
- Ogden, C., Carroll, M., Kit, B., & Flegal, K. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*, *311*(8), 806-814.
- O'Neill, J. R., Pfeiffer, K. A., Dowda, M., & Pate, R. R. (2016). In-school and out-of-school physical activity in preschool children. *Journal of Physical Activity & Health*, *13*(6), 606–610. <https://doi.org/10.1123/jpah.2015-0245>
- Pate, R., Davis, M., Robinson, T., Stone, E., McKenzie, T., & Young, J. (2006). A leadership role for schools: A scientific statement from the American Heart Association Council on nutrition, physical activity, and metabolism (physical activity committee) in collaboration with the councils on cardiovascular disease in the young and cardiovascular nursing. *Circulation*, *114*(11), 1214-1222.
- Rowland T. W. (1998). The biological basis of physical activity. *Medical Science of Sports Exercise*, *30*, 392–399.
- Salbe, A. D., Fontvieille, A. M., Harper, I. T., & Ravussin, E. (1997). Low levels of physical activity in 5-year-old children. *Journal of Pediatrics*, *131*(3), 423-429. [10.1016/s0022-3476\(97\)80069-8](https://doi.org/10.1016/s0022-3476(97)80069-8)
- Salmon, J., Tremblay, M. S., Marshall, S. J., & Hume, C. (2011). Health risks, correlates, and interventions to reduce sedentary behavior in young people. *American Journal of Preventive Medicine*, *41*(2), 197–206.
- Schunta, J. M., Liguori, G., & Tucker, J. (2016). Seasonal changes in preschoolers' sedentary times and physical activity at childcare. *Lifescience Global*, *5*(1).
- SHAPE America. (2020, 3rd Edition). *Active start: A statement of physical activity guidelines for children from birth to age 5*. Annapolis, MD: Author.
- Silva, P., Santos, R., Welk, G., & Mota, J. (2011). Seasonal differences in physical activity and sedentary patterns: The relevance of the PA context. *Journal of Sports Science & Medicine*, *10*(1), 66–72.
- Tandon, P. S., Saelens, B. E., & Christakis, D. A. (2015) Active play opportunities at childcare. *American Academy of Pediatrics*. *135*(6). e1425-e1431. <https://doi.org/10.1542/peds.2014-2750>
- Tandon, P. S., Saelens, B. E., Zhou, C., & Christakis, D. A. (2018). A comparison of preschoolers' physical activity indoors versus outdoors at child care. *International Journal of Environmental Research and Public Health*, *15*(11). [10.3390/ijerph15112463](https://doi.org/10.3390/ijerph15112463)
- Tandon, P. S., Zhou, C., & Christakis, D. A. (2012). The frequency of outdoor play for preschoolage children cared for at home-based child care settings. *Academic Pediatrics*, *12*(6), 475-480. [10.1016/j.acap.2012.06.010](https://doi.org/10.1016/j.acap.2012.06.010)
- Trost, S. G., Sirard, J. R., Dowda, M., Pfeiffer, K. A., and Pate, R. R. (2003). Physical activity in overweight and nonoverweight preschool children. *International Journal of Obesity and Related Metabolic Disorders*, *27*(7), 834-839. [10.1038/sj.ijo.0802311](https://doi.org/10.1038/sj.ijo.0802311)
- Trost, S. (2009). *Active education: Physical education, physical activity, and academics performance*. Princeton, NJ. Robert Wood Johnson Foundation.
- Tucker, P. & Gilliland, J. (2007). The effect of season and weather on physical activity: A systematic review. *Public Health*, *121*(12), 909-922. [0.1016/j.puhe.2007.04.009](https://doi.org/10.1016/j.puhe.2007.04.009)
- Tucker, T. (2008). The physical activity levels of preschool-aged children: A systematic review. *Early Childhood Research Quarterly*, *23*, 547-558. [10.1016/j.ecresq.2008.08.005](https://doi.org/10.1016/j.ecresq.2008.08.005)
- Tudor-Locke, C., Craig, C. L., Beets, M. W., Belton, S., Cardon, G. M., Duncan, S., Hatano, Y., Lubans, D. R., Olds, T. S., Raustorp, A., Rowe, D. A., Spence, J. C., Tanaka, S., & Blair, S. N. (2011). How many steps/day are enough? Children and adolescents. *The International Journal of Behavioral Nutrition and Physical Activity*, *8*(78). [10.1186/1479-5868-8-78](https://doi.org/10.1186/1479-5868-8-78)
- Tremblay, M. S., LeBlanc, A. G., Carson, V., Choquette, L., Connor Gorber, S., Dillman, C., Duggan, M., Gordon, M. J., Hicks, A., Janssen, I., Kho, M. E., Latimer-Cheung, A. E., Leblanc, C., Murumets, K., Okely, A. D., Reilly, J. J., Spence, J. C., Stearns, J. A., & Timmons, B. W. (2012). Canadian physical activity guidelines for the early years (aged 0-4 years). *Applied Physiology, Nutrition, and Metabolism*, *37*(2), 345–356.
- Ulset, V., Vitaro, F., Brendgen, M., Bekkhus, M., & Borge, A. (2017). Time spent outdoors during preschool: Links with children's cognitive and behavioral development. *Journal of Environmental Psychology*, *52*, 69-80. [10.1016/j.jenvp.2017.05.007](https://doi.org/10.1016/j.jenvp.2017.05.007)

Vale, S., Trost, S., Duncan, M., & Mota, J. (2014). Step based physical activity guidelines for preschool-aged children. *Preventive Medicine, 70*. 10.1016/j.ypmed.2014.11.008

Yogman, M., Garner, A., Hutchinson, J., Hirsh-Pasek, K., & Golinkoff, R. M. (2018). The power of play: A pediatric role in enhancing development in young children. *Pediatrics, 142*(3). <https://doi.org/10.1542/peds.2018-2058>

Julie Ernst is a Professor and Director of the Master of Environmental Education Program at the University of Minnesota Duluth. She can be reached at jernst@d.umn.edu.

Eva Burgess is a classroom teacher at Oak Hill School in Eugene, Oregon. She may be reached at eburgess@oakhillschool.net.

Lexi Bruno is a nature preschool teacher at Wind Ridge School House in Duluth, Minnesota. She can be reached at bruno042@d.umn.edu.

Kindergarten Deforestation Experts: Interdisciplinary Learning for Understanding and Addressing Global Issues

Kim Waite
Prescott College, USA

Submitted April 10, 2021; accepted August 21, 2021

ABSTRACT

In our interconnected world, what does it mean to teach global environmental issues to young children? Using theoretical foundations from the social justice learning community and child-directed, inquiry-based learning best practices, this practitioner reflection details a seven-week, student-centered, interdisciplinary learning experience conducted in the author's classroom. This exploration of the Amazon rainforest and deforestation promoted content knowledge development across fine arts, math, earth science, English language arts, and social studies disciplines; standards-based skills acquisition; collaboration; self-determination; and critical engagement among students in a diverse kindergarten class at a public school in Los Angeles County, California, in the United States. To guide the development of the project, an appropriate social studies framework was utilized along with the popular culture resource "3 Questions That Can Change The World" from the Kid President enterprise. Students conducted research and took concrete action through a variety of projects, including raising and donating funds for injured wildlife and reporting on their experiences verbally, in writing, and graphically. I analyzed my field notes, reflective teacher journal, and student work samples to improve my practice and pedagogical progress in teaching young students about global environmental issues. In this process of critical reflection and action inspired by Freire's (1993) concept of praxis, I found that inquiry-based learning that encourages students to ask meaningful questions, investigate answers through interdisciplinary learning, and find meaningful solutions to the problems they encounter increases their self-determination.

Keywords: early childhood education, sustainability education, social justice education, global education, interdisciplinary learning

Theoretical Foundations and Teaching Context Connection

Social Justice Learning Community

Diaz and Flores (2001) argue that teachers often take on sociocultural mediator roles in addition to their traditional academic teaching roles. To be effective sociocultural mediators, teachers - especially those with students of color or other minoritized students - should be aware that students bring a wealth of experiences and personal, cultural, and community knowledge with them into the classroom. As such, teaching and learning is viewed as a mutual and collaborative endeavor between teacher and students, in which the teacher views the students as capable of creating, rather than only passively receiving, knowledge. The theoretical implications of Diaz and Flores' (2001) study of teacher as sociocultural mediator and guide greatly influenced my pedagogical approach and praxis (Freire, 1993) in planning and conducting this unit. I drew heavily from traditional critical pedagogy, which, as Duncan-Andrade and Morell (2008) remind us,

is an approach to education that is rooted in the existential experiences of marginalized peoples that is centered in a critique of structural, economic, and racial oppression; that is focused on

dialogue instead of a one-way transmission of knowledge; and that is structured to empower individuals and collectives as agents of social change (p. 1).

In positioning students as capable knowledge creators, I hoped to embrace the sociocultural mediator role in my pedagogical practice and help my students maximize their potential.

Additionally, in my positionality as an educator of color and an educator-activist-scholar (Suzuki & Mayoraga, 2014), I am committed to practicing critical reflexivity in pursuit of educational justice (Alim & Paris, 2014). As a social justice educator, my positionality and international teaching experiences have been critical in informing my philosophy of education, my teaching style, and in creating the kindergarten classroom community I have always envisioned: where students are a mutually supportive community of learners whose dreams, hopes, wishes, and interests are reflected in the curriculum. Peterson (2012b) asserts that curricula that reflect students' lives and encourage their engagement in meaningful dialogue, questioning, and problem solving, with an emphasis on critiquing biases and prejudice and activism for social justice can foster social justice learning communities. My aim was assisting participating students in meaningfully connecting what we were learning in the classroom with real-world issues that are global in scope. My classroom is a laboratory dedicated to creating a more just society, a laboratory where students can learn about global issues through interdisciplinary projects, questioning the way things are, and thinking critically about meaningful collaborative action we can take to effect change. To promote globally relevant education, I hope to assist my students in cultivating their critical consciousness (Ladson-Billings, 1995) by encouraging them to critique global and local issues and identify social inequities from a young age, which may prepare them for leadership roles.

Upon further reflection on my positionality, education philosophy, and teaching style, I realized that curriculum integration is one of my greatest strengths. Some of the most powerful teaching and learning occurs when students are inspired to think broadly across different disciplines and subjects and are offered opportunities for making practical connections in their learning. For example, in his work focusing on social justice mathematics, Peterson (2012a) suggests that when math is integrated with other subjects such as social studies, it can be used as a language and a tool for explaining the world and global issues and helping students understand social inequities. To that end, I planned a seven-week unit on deforestation in the Amazon rainforest that integrates social studies, earth science, visual arts, English language arts, writing, and math. My main imperatives, after addressing and understanding deforestation as an issue, was energizing students and inspiring them to take direct action to make a positive difference in their own communities and to realize that children, not just adults, are capable of making meaningful changes in this world,.

Global Education and Global Competence

One's global competence is a toolbox comprising sets of knowledge, skills, mindsets, and values needed to thrive in a diverse, globalized society. It can effectively equip students for college study and for careers in a globally connected economy (Asia Society & Longview Foundation, 2016) and foster individually and collectively responsible global citizens who try to make their local communities, countries, and world more just and sustainable for us all (Banks, 2014; Zhao, 2010). Global competence should not be an "add on" to curricula; rather, foundations in interdisciplinary knowledge should be integrated across curricula in all subjects throughout the school year (Mansilla & Jackson, 2011). In today's interconnected world, global competence includes tools for disrupting local and global injustices, which students can use to ensure that the communities they live in are diverse and equitable (Tichnor-Wagner, 2016). At its core, teaching for global competence is about supporting students in embracing mutual responsibility for our common humanity and shared global risks (Reimers et al., 2016). In creating a classroom environment that values diversity and global engagement, teachers who utilize culturally responsive and culturally sustaining pedagogy fill their classrooms with diverse resources that reflect the world's diversity of people and places and guide students to collaborate with those who have different ideas and worldviews (Tichnor-Wagner et al., 2019). Educators dedicated to developing engaged global citizens must provide students with opportunities for practicing and developing global competency, which begins with reflecting on their own pedagogical practices, or praxis (Freire, 1993).

Through their systematic review, Tichnor-Wagner et al. (2019) identify twelve elements that teachers are already implementing in their globally competent teaching; these are categorized by dispositions—such as empathy, valuing multiple perspectives, and commitment to equity worldwide; knowledge—such as understanding global conditions and events, the interconnected world, multiple cultures, and intercultural communications; and skills—such as being multilingual and being able to conduct global competence assessment and content-aligned global investigations, form global learning partnerships, engage in intercultural conversations, and foster classroom environments that value diversity. Tichnor-Wagner et al., (2019) then developed the Globally Competent Learning Continuum (GCLC) tool for teachers to self-assess the level of their pedagogical practices for each element on a five-point scale from “nascent” to “advanced.” On this continuum, assisting students in taking action to address global issues is what distinguishes advanced level globally competent teaching from the other levels (Tichnor-Wagner et al., 2019 p. 25).

Global Issues in Early Childhood Education for Environmental Sustainability

Sobel (2013) argues that teachers prefer studying rainforests with their students because rainforests are “tidier” to deal with than some other issues and do not generally involve taking students outside. He states, “to study rainforests, you can stay inside and look at pretty pictures of all those strange and wonderful animals and make miniature cardboard rainforests safe within the confines of the classroom walls” (p. 6). However, educational equity and educational access may not have been necessarily taken into consideration in his analysis. Many educators who teach in low-income schools and who work with historically minoritized populations do not always have the means or resources to explore local natural outdoors phenomena such as “the muskrats in the pond across the street” (p. 7) that Sobel references. Additionally, due to systemic racism in urban planning practices in the United States, a large majority of urban schools are located in areas with little to no green space or safe access to nearby green space. Sobel (2013) furthermore argues that “in-depth rainforest curricula may be perfectly appropriate in middle or high school, but it doesn’t belong in the primary grades” (p. 7). This assertion is highly debatable, as numerous standards-based English language development texts feature rainforests as a way to engage students in oral language development and language practice, both of which are key aspects of primary education. Moreover, this assertion belies the professional discretion of teachers, trusted professionals who will make pedagogically and developmentally appropriate choices for students. Sobel (2013) furthermore maintains that curricula featuring environmental problems “will be most successful when it starts in fifth or sixth grade and focuses on local problems where children can make a real difference” (p. 35). This fails to consider the children in kindergarten through fourth grade whose studies of social studies, English language arts, and fine arts typically explicitly include environmental problems in standards, curricula, or both. Young children are fully capable of learning about complex, interdisciplinary issues and taking action on such issues to make a difference in their world. The integration of high-quality civics and social studies education and student-centered learning contributes greatly to fostering such capacities in younger children. A foundation of global competency that begins in primary school (or even earlier) can help prepare these global citizens for more advanced study and action throughout their lives.

Early Childhood Education for Sustainability

Identifying and reflecting upon the theoretical foundations that inform my professional praxis (Freire, 1993) as a social justice educator are in line with Green’s (2015) assertion that scholars “must also identify the theories and methods that frame their approaches.... which stems from [their] philosophical assumptions in regard to childhood and environmental education” (p. 208). Historically, the practice of positioning children for action in early childhood environmental education and early childhood education for sustainability has existed on a continuum from encouraging them to take up educator-planned environment and sustainability action to actually “engaging [them] in research design, implementation, and data analysis” (Green, 2015 p. 224). The shift towards children as researchers requires environmental education professionals and scholars including elementary school classroom teachers to offer student-centered learning and allow students to choose their own topics, formulate their own research questions, choose appropriate data collection methods, collect and analyze data, and present the findings (Green, 2015 p. 226).

Toward such student-centered and inquiry based learning, I was most inspired by Belvins & LeCompte's (2015) practical and actionable "action civics framework," a social studies framework that intends to help students become informed citizens through engagement in critical, deep thinking that considers the multiple perspectives of a civics issue. In Phase 1, students attempt to identify understand and describe social or global issues of personal interest to them. In Phase 2, they explore the problem by researching their issues through a variety of resources and projects. In Phase 3, students develop plans of action for addressing the selected issue. Finally, in Phase 4, students share their results and findings at school, in their families and in the larger community. What most inspired me about this framework is that it asks students to learn about their world by taking direct action in that world in addition to exploring the many texts available.

Adults and children working together to make a powerful impact in the world can resonate deeply with people across generations. The Kid President enterprise, which includes videos that have been viewed by millions of children and adults worldwide is an example of such a collaboration. It began in 2013 when Roby Novak, then a fourth grader from Tennessee, and his adult brother-in-law Brad Montague created Kid President, a motivational character (played by Novak) with the intention of making the world a more "awesome" and "joyful" place. Kid President's words of wisdom (Novak & Montague, 2015) are delightful, and the characters' power lies in combining popular culture and "kid culture" to present powerful, meaningful messages in a format that is easily understandable by children and that encourages them to spread hope and joy and to inspire others. Kid President's three questions can help children identify things that they are passionate about, things they are good at, and things they can do to solve a given problem and thus make a powerful impact in the world. The questions are "What are you not okay with?" "What do you have?" and "What can you do?" I presumed that these simple but powerful questions could to encourage students to explore global sustainability issues and to see the relevance of such issues to their everyday lives.

Together, these two resources guided my unit plan outline and the structure and sequence of the interdisciplinary learning projects and framed my method of encouraging students as they developed understanding of deforestation in the Amazon rainforest. Students were already gaining basic background knowledge on deforestation through reading informational texts about animals and rainforests, as per the district-mandated, standards-based English Language Development (ELD) curriculum, and so I hoped to help them build on that knowledge by encouraging them to continuing exploring it in the project. Moreover, because of the many fields involved in the topic it seemed an appropriate for introducing students to interdisciplinary studies. Prior to the unit, students were very passionate about the subject, showed high levels of engagement, and kept asking for more projects, books, and activities related to this topic.

I mirrored Belvins & LeCompte's (2015) phases in the unit action plan I created to guide my pedagogy was separated into and used Kid President's three questions (Novak & Montague, 2015 p. 67) as essential guiding question for each phase. These questions were to frame students' thinking and help them capitalize on the background knowledge and personal experiences they would bring with them to each phase of the inquiry process. In designing Phase 3, the action development phase, I consulted Javna's (2009), which offers resources engaging activities for child environmentalists to empower them and show them they can make a difference. Additionally, similar to the Kid President's message, adults and children, teachers and students, are viewed as collaborative teams.

Developing a Social Justice Unit Plan

In a review of the methods, methodologies, and theories applied in early childhood environmental education research from 2004 to 2014, Green (2015) found that research studies were conducted across a continuum from research *on* children, to research *with* children, to research *by* children. Where each activity selected for each phase of the unit plan placed on the research continuum was also identified.

Phase 1: Identify a Problem (Week 1)

Survey of Students' Perceived Civic Agency. The school setting was an urban Title I public elementary school in South Los Angeles. In the participating kindergarten class of twenty-eight students, there were 13 English language learners, from average to intermediate levels. English and Spanish speakers were most common, and Portuguese,

Tagalog, and Arabic speakers were also present. To build fluency and academic vocabulary, “think-pair-share,” small, and whole group discussions were frequently held. Parental consent and student assent were obtained through parental forms and by students being given a choice to participate in the learning projects. Our syllabus included a forty-five-minute block (from 1:15 pm –2:00 pm) for “learning projects.” Four days a week, this became our Amazon rainforest projects time, or as one student called it, our “save the trees” time. I began by assessing students’ initial sense of civic agency using the question, “Can kindergarten students help change their community and help change the world?” They each wrote and drew their answers on a piece of paper. After all students had prepared an answer, we gathered as a class to share them. Each student shared their work, and I wrote their explanations on the backs of their papers and on sticky notes for future reference. In this representational activity to elicit students’ understanding and perspective on a given topic, phenomenological analysis was utilized to analyze the drawings paired with the behavioral observations (Christidou et al., 2013) that were recorded in a teaching journal.

Kid President Video. Next, we watched Kid President video *3 Questions That Can Change the World* (SoulPancake, 2014). Participating students had watched Kid President videos many times before in class and we used Kid President philosophies in creating our classroom culture. The first questions we used was: What are you not okay with? I wrote the question on butcher paper along with the sentence frame: “I’m not okay with _____.” I gave students time to engage with this question in “think/pair/share” sessions. Everyone shared their answers, and I recorded them on the butcher paper. The following day, we watched the video again, engaged in “think/pair/share” sessions, and made connections between the answers from both days. I circled the connections in pink marker for easy reference (See Appendix A). In this way, students identified, named, and discussed injustice that they found unacceptable. This scaffolded activity addresses the concern that “young children may have trouble articulating their thoughts and feelings, which could lead them to provide a single word-response” (Green, 2015 p. 221) by providing appropriate pedagogical support for English language learners and peer interaction through the “think-pair-share” sessions.

Phase 2: Explore the Problem (Weeks 2 and 3)

KWL Chart On Deforestation. To start the second week of the unit action plan, I created a KWL (know, want to know, learned) chart on a piece of butcher paper to use during class. I assessed students’ background knowledge of deforestation and recorded their answers in the “know” column of the chart. We talked about “deforestation and defined it together as a class. For the “want to know” column, I asked students what they wanted to know about deforestation and what specific questions they had about it. They engaged in “think/pair/share” sessions and then we held a whole group discussion. I recorded their answers in the “want to know” column on the butcher paper using a different color marker than for the “know” column. We then engaged in an interactive read-aloud from children’s books about deforestation (Greely, 2013) and filled in the “learned” column. This activity situates the teacher as sociocultural mediator (Diaz & Flores, 2001); it allows students to draw on their background knowledge and centers on their agency in the decision-making process. Using children’s literature to promote discussion and peer conversation about particular topics was an opportunity for doing research *with* children (Green, 2012).

Read-aloud of *The Lorax*. The following week, we performed an interactive read aloud of Dr. Seuss’ (1971) environmental parable *The Lorax* over three days. I marked pages with sticky notes to signal where I needed to pause the reading and model making inferences to enhance understanding, explain vocabulary words, ask questions, and ask students to make predictions. I divided the book into four segments to make it more accessible to kindergartners. During the reading, I drafted a bubble map graphic organizer on butcher paper to illustrate our progress. During the read-aloud of the first segment (pp. 1–10) I asked students to make predictions about what had happened to the Lorax, and I recorded their answers along with their names on the bubble map graphic organizer. In the second segment (pp. 11–22) I asked students, “Why is the Lorax so upset that the truffula tree was chopped down?” and added their thoughts and answers to the bubble map. In the third segment (pp. 23–50), I asked students to compare how the Truffula forest looked at the beginning of the story with how it looked at the end. They engaged in “think/pair/share” sessions, and we discussed answers as a class. I recorded their answers on the bubble map along with their names.

I hoped the reading would encourage students to begin thinking critically about why people cut down trees by exploring why the Once-ler (a manufacturer) was cutting down the Truffula tree and the effects of this on the forest.

To that end, we began a two-column T-chart. During “think/pair/share” sessions we listed the benefits of cutting down trees, in the context of the story, that is, what the trees could be used for, in the happy face column, and we listed the negative effects in the frowning face column. Students names were recorded along with their answers on the T-chart.

Read aloud of *The Great Kapok Tree*. We also held an interactive read-aloud of Cherry’s (1990) children’s picture book *The Great Kapok Tree*. In this story a man falls asleep in the Amazon rainforest after unsuccessfully trying to cut down a massive kapok tree. While he sleeps, an array of animals speak to him and explain how important the tree is for their survival. In this case, we engaged in “think/pair/share” sessions and individual question-and-answer sessions. We created a Venn diagram to compare and contrast the messages in Cherry’s book with the ones in Dr. Seuss’. We also discussed how each author portrayed effects of deforestation. I recorded students’ answers along with their names on the Venn diagram. Reading Cherry’s (1990) work helped them understand the Amazon rainforest as a habitat and an ecosystem, both of which are kindergarten earth science curricula standards. The beautifully detailed and realistic illustrations provided students with visual background knowledge on rainforest animals and the layered nature of the rainforest that they then used in a subsequent fine arts integration lesson. Utilizing representation art invites multimodal opportunities for students to create and represent their understandings (Green, 2012).

Math Integration. For the math integration section of the inquiry project, I asked students a question from Javna (2009): “How much of the Earth’s rainforest is destroyed every minute: Enough to fill the kindergarten yard (play area), enough to fill the cafeteria, or enough to fill 60 football fields?” (The answer was to be revealed in the Math integration section of Phase 3.) I created a chart with columns for each option and small illustrations to guide students reading (see appendix A). To introduce the question, I asked students if they knew how long a minute is and if it is a long or short amount of time. I explained that one minute is the same as sixty seconds, which is roughly the same amount of time as it takes to count from zero to sixty. For counting practice and to help give them a sense of the passage of time, we counted from zero to sixty, thereby integrating the kindergarten math standard of counting to a hundred. After the counting practice, I asked them, “During the time we were counting, how much of the earth’s rainforest was destroyed?” They presented their illustrated estimates on sticky notes after I modeled the answer form. We brought the sticky notes to the rug and discussed their answers in “think/pair/share” and whole group discussion formats. In the following weeks, we took a “math walk”, and each students counted how many steps it took them to cover the perimeters of the selected areas and recorded their answers. Through the utilization of math in this context, I hoped to further validate Peterson’s (2012a) argument for integrating math with subjects such as social studies to foster students’ understanding of social inequities and as both a language and a tool for explaining the world and global issues.

Class Amazon Rainforest Tree. During this phase of the seven-week unit, we also created a class Amazon rainforest tree to facilitate learning about the different layers of the rainforest, its climate, habitat, and animal inhabitants (See Appendix B). This project was completed over two days and incorporated science, fine arts, math, and English language arts. Prior to making the Amazon rainforest tree we took a “virtual fieldtrip” to the Amazon basin by watching a video overviewing the rainforest as one of the earth’s major habitats, the four layers that comprise it, its climate and temperature, the resources it contains, and the creatures that inhabit it (VirtualFieldTripsnet, 2014). After the video, we created a bubble map for recording rainforest facts. Students engaged in think “think/pair/share” sessions and whole-class discussions, and I recorded their answers along with their names on the bubble map. Next, we engaged in a fine arts lesson centered on drawing rainforest animals. Accordingly, we discussed the lines and shapes used to form each animal. For reference, we used Cherry’s (1990) illustrations and the video (VirtualFieldTripsnet, 2014). We transformed our alphabet identification tree into an Amazon rainforest tree so the creatures would have a home. I labeled the “canopy” and “understory” layers and added brown yarn and extra leaves to suggest vines. Students drew with pencils, markers, pens, and oil pastels. To informally assess their understanding of the layers of the rainforest, I asked each of them to identify the layer that their creature calls home and then stapled the drawings accordingly. This informal, standards-based assessment of students’ speaking and listening competencies integrates English language arts instruction with fine arts instruction. If effective, pairing informal assessment with artistic creation is supported by Green’s (2012) recommendation that representation art be “paired with other sources of data to increase the reliability of the findings” (p. 275-276). I played rainforest

sounds (UltimateRelaxation22, 2012) in the classroom while students were drawing to offer them an auditory experience as well.

Phase 3: Develop a Plan of Action (Week 4 and 5)

Penny Drive. In Phase 1 of the unit, I reintroduced the Kid President video (SoulPancake, 2014) and we discussing the remaining questions, “What do you have?” and “What can we do about it?” I wrote each questions on a piece of butcher paper along with the response sentence frames: “We have _____,” and “We can _____.” Students engaged in “think/pair/share” and whole-group discussions. I recorded their answers on the butcher papers along with their names. The ideas they generated were put into action during Phases 3 and 4. They developed productive answers, and many of them were convinced that saving the rainforest is a big job and that we would need money at some point. As a result, we decided to hold a penny drive. I sent home letters to parents explaining our project and that we were collecting pennies to donate to a rainforest conservation organization. We used the pennies we collected in another math integration activity; students practiced their number sense and counting skills by arranging pennies in groups of 2s, 5s, 10s, and 20s, thereby meeting a kindergarten math standard. After the penny drive, students wrote about their counting strategies during our writer’s workshop.

In order to support students in embracing their shared responsibility for our common humanity, we donated the funds collected in the penny drive to Kids Save The Rainforest, a non-profit organization started by children in Costa Rica after they witnessed the effects of deforestation on the local wildlife population. Specifically, our pennies contributed to support for a paralyzed three-toed sloth named Anakin, who was chosen by the students. After we watched a video (KidsSavingTheRainforest, 2016) about his story, students wrote about the experience. Through their fundraising work and subsequent donation, the class has progressed to the advanced level of the GCLC (Tichnor-Wagner et al., 2019 p. 25).

The Christmas Tree Farm and Environmental Responsibility. Toward encouraging further critical thinking about deforestation and to introduce the concept of environmental responsibility, we engaged in an interactive read-aloud of Purmell’s (2006) children’s picture book *The Christmas Tree Farm*, the story of a family who owns a Christmas tree farm and spends most of the year planting, cutting, and trimming trees so that they will be ready for the holiday season. I created a T-chart on a piece of butcher paper with the guiding question “In the story, was it okay that Grandpa was cutting down trees?” written at the top. I added a “yes” and a “no” column. Students then engaged in “think/pair/share” and whole class discussions on their thoughts and their answers, and I recorded their answers along with their names.

Math Walk. During this phase, we learned that according to Javna (2009), the answer to the question, “How much of the Earth’s rainforest is destroyed every minute?” is “enough to fill 60 football fields” (p. 45). To help students conceptualize this , we took a math walk around the school football field. I gave each student a sticky note and a pencil, and we walked the green line that painted around the field. Students counted their steps, stopping frequently to record their answers. When we returned to the class, I wrote the guiding question on a piece of butcher paper, and students added the sticky notes . After a few minutes of looking at all the different answers and calculations, students discussed their counting strategies in “think/pair/share” sessions and then as a whole class. Their responses were recorded on the butcher paper along with their names. Such exercises contribute to students’ development of critical consciousness (Ladson-Billings, 1995) by encouraging them to begin critiquing global and local issues, such as deforestation, at a young age, which prepares them for leadership roles.

Paper Recycling and Paper Making. In drafting our plan of action in Stage 3, one student constructed the sentence “We can create a class-recycling bin.” To implement this, I found a large cardboard box in the school copy room and put it near our class garbage can. Students began using it immediately. Students also recommended that we use more recycled paper. We had an aluminum casserole pan for recycled paper for our Letter Detective Center; during this phase, students added even more used papers for us to recycle. Students also recommended that we make our own paper. To implement their recommendation, we gathered paper pieces from the casserole pan and used butcher paper from the staff lounge and set about making paper. Our tools were a blender, empty aluminum casserole pans, aluminum foil, a strainer, water cups, and sponges. Small casserole pans of used paper were placed at each table, and students shredded the paper. Next, I blended the shredded paper with water. Students learned

the vocabulary words “pulp” and “environmental responsibility.” They took turns putting the pulp into the strainer and pushing the water out using their hands and a sponge. The paper was left to dry on aluminum foil and later used in an “upcycled” art project. By acting on ideas they themselves generate, students can experience truly student-centered learning. Students may also experience an increased sense of ownership over their learning when they see their ideas being directly put into action by peers and teachers.

Upcycled Art Project. The paper took a couple of days to dry. While we were waiting, we learned the term “upcycling” and created “upcycled” Mother’s Day gifts from the shredded paper scraps left-over from the paper making. At the beginning of the year, I saved small boxes from math manipulatives, and so each student received a small rectangular box. They glued the shredded paper to their boxes to create a mosaic vases (see Appendix B). We saved the parts of the box that had to be cut off, and one student said that they would be perfect painted red to look like ladybugs. In May, we will finish the project and create flowers with pipe cleaners and the handmade paper.

Language Arts Integration: The Writer’s Workshop. In February, the writer’s workshop curriculum focuses on students creating “All About ____” books” to practice writing informational texts about a specific topic. We chose to write about the rainforest and deforestation as a writing integration exercise, and students were able to demonstrate their knowledge about the rainforest from previous weeks. To establish a literacy-rich environment, I suggested they refer to our Amazon rainforest tree, and they did use it to help them label and illustrate their texts.

Phase 4: Share Results with the Community (Weeks 6 and 7)

Spreading Awareness of Deforestation Education. In this phase of the inquiry project, students wrote “All About Deforestation” books and began learning about persuasive writing and persuasive writing sentence frames. Previously, with the “we can ____” sentence frame, students emphasized that the school and the community needed to know about deforestation. As a result, I spoke with the school principal, and she enthusiastically agreed to feature the “All About ____” books from our writer’s workshop, writings and findings from our penny drive, and photographs of our interdisciplinary learning projects in the school’s March newsletter (see Appendix C). In this phase, we also conducted an educational awareness campaign, including creating posters and displaying them around the school (see Appendix B.). The posters featured writings, drawings, and examples of the projects that we completed in Phase 3. Phase 4, during which students present their findings in a developmentally appropriate way to the larger school community, primarily represents a *by children* approach (Green, 2015 p. 226) to research.

Survey of Students’ Perceived Civic Agency. To wrap up the seven-week interdisciplinary unit, I re-survey the participating students to assess their perceived levels of civic agency to look for changes or shifts from when they began seven weeks earlier. Students wrote and drew their answers and engaged in “think/pair/share” sessions and whole group discussion. I further recorded their verbal answers on the backs of their papers and on sticky notes for future reference.

DATA COLLECTION AND ANALYSIS

Data were collected throughout the seven-week unit using the following tools:

- Pre-unit survey of student civic agency (writing/drawing)
- KWL chart
- Student work from the Amazon Rainforest Tree” class project
- Charts and Venn diagram from Phase 3
- “All about_____” books from students’ writer’s workshop
- Pictures and student work samples from the Phase 4 action project
- Chart of students’ predictions of the answer to the math question.
- Students’ writings and findings on measuring school areas in steps (teacher’s journal; students’ notes)
- Penny drive writings
- Vocabulary word wall

Pictures of students taken throughout the inquiry project
 Post-unit student survey of civic agency at end of inquiry (writing/drawing)
 Teacher journal

I gathered student work samples completed during the seven weeks and grouped them by primary subject, i.e., science, math, social studies, art, and writing (see Table 1). Toward conducting an interdisciplinary analysis, I looked for general trends in students' learning and thinking across all subjects. I then looked for general trends within specific subjects. Through phenomenological inquiry-based data analysis, I sought to observe students' experiences and progression in thinking and learning about deforestation as a global issue during interdisciplinary learning. I paid special attention to the pre- and post-unit surveys of perceived civic agency to note any expanded sense of global competence.

Table 1
Interdisciplinary Learning Projects

Subject	Activity
Mathematics	Math integration answer prediction activity, i.e., "How much of the Earth's rainforest is being destroyed every minute? -Penny drive counting activity -Math walk counting activity
Visual arts:	-Class Amazon rainforest tree -Upcycled art projects -Deforestation posters
Earth Science:	-Class Amazon rainforest tree -Rainforest layers on the rainforest tree -Rainforest facts chart -Making recycled paper
Writing:	-"All About The Rainforest" books -"All About Deforestation" books -Penny drive writings -Anakin writings -Deforestation posters -Pre-unit survey of students' perceived civic agency -Post-unit survey of student civic agency
English language arts:	-Oral responses to teacher's question, i.e., "What layer of the rainforest does your animal live in?"

FINDINGS

Field notes, my reflective teacher journal, and student work samples were utilized to improve my teaching practices and analyze my pedagogical progress in teaching young students about global environmental issues. Throughout this process, inspired by Freire's (1993) concept of praxis comprising critical reflection and action, I confirmed that inquiry-based teaching strategies that encourage students to ask meaningful questions, research answers through interdisciplinary learning, and find meaningful solutions to their questions increase their self-determination. Through my experiences as an urban public school educator, I came to realize that children and adults experience the world differently and have different beliefs and thoughts about the environment; as such adults should not speak for children on environmental issues. To distinguish between my adult perspective and the students' perspectives, I will excerpt statements from students that I recorded in my teacher journal and offer a practitioner's commentary on their work samples. In this section, I hope to highlight the interdisciplinary nature of the inquiry and the flexibility of the teaching plan in terms of simultaneously meeting standards and allowing students to guide all phases of the unit with adult (teacher) support.

As noted, assisting students in taking direct action to address global issues constitutes advanced levels of teaching-learning along the GCLC (Tichnor-Wagner et al., 2019 p. 25). Thus, one of my main goals for the seven-week unit was to inspire students to understand deforestation and address it through direct action for change, locally and globally. I hoped to make the issue come alive for them and for them to understand it as personally relevant rather than as a passing topic in a book. Asking and answering meaningful questions is an important part of this process.

Pre- and post-unit assessment of perceived civic agency

I began the unit by assessing students' initial sense of civic agency with the question, "Can kindergarten students help change their community and help change the world?" Participating students seemed intrigued and engaged when this question was initially posed to them, and they responded to it with above average levels of optimism and energy. Many of them blurted out an enthusiastic, "yes!" without even taking time to think about the question.

As discussed, students wrote and drew their answers and participated in discussion. Most of them were literal in their responses, drawing sky, stars, and planets to represent the world and masses of black lines and a black ball to represent change. A lot of them wrote "yes" and "we can do it" and included symbols like the smiley face or the thumbs up. In most work samples, how this change could occur was not represented, only its possibility. Most students did not include themselves in the illustration or in their answers. However, three girls demonstrated a deeper understanding of the question; they drew themselves and their friends holding hands and working together and an image of the Earth. All three girls demonstrated high levels of perceived civic agency, and their answers suggested a working knowledge of collective action and referenced "working together," "teamwork," and enlisting the aid of friends. As noted, I repeated this survey at the end of the unit to see if there were changes in how they viewed the world and themselves after participating in projects that promoted and encouraged their civic agency.

I found the difference between the pre- and post-unit surveys remarkable, especially with respect to the drawings. For example, at the beginning of the unit, all students had optimistically and confidently agreed that they could effect positive change in the world, but they had struggled to express how or why. At the end of the unit, students illustrated an activity from Phase 4. Illustrations included the school corridors where we hung deforestation prevention posters, the class recycling bin, counting pennies from the penny drive, and donating pennies to help Anakin the sloth. Notably, most students included themselves in the drawings, clear pictures that symbolize working together, concrete examples of changes implemented as a classroom. Students post-unit responses also included much more writing, and they used more empowered and confident language, for example, "Yes we did," "We are brave," "We saved Anakin," "We counted pennies," "I feel happy," and "I did it!" When we debriefed as a class and all students had opportunities to share their answers, they wore expressions of pride, accomplishment, confidence, and joy on their faces.

Based on the observations recorded in my teacher journal and the significant shifts in student work samples and responses pre- and post-unit, I can conclude that the participating students experienced increased confidence and self-empowerment from taking action in our school and global communities. These findings validate Reimers et al.'s (2016 p. xi) argument that teaching for global competence is about supporting students in embracing their shared responsibility for our common humanity and shared global risks. I can furthermore conclude that the student-centered curriculum that positioned adults and children as teams that can work together made possible the development of the participating students' civic identities and the realizations that they are important and can make a real, positive difference in the world.

Inquiry Based Learning

Students' thoughts and ideas were included to structure the learning sequences in the unit from the very beginning. In Phase 1 (Belvins & LeCompte, 2015), we explored the first question from Kid President "What are you not okay with?" as the catalyst for inquiry and an essential frame. Students spent time exploring the sentence frame: "I am not okay with _____" in "think/pair/share" and whole class discussion (See Appendix A).

The application of sentence frames and “think/pair/share” is a standards-based pedagogical strategy for English language arts and English language development that is commonly utilized by teachers in most elementary school classrooms. Group discussions and peer-to-peer interactions constitute methods of conducting research *with* children; such research may be subject to the following limitations: children may mimic their peers, outspoken peers may silence less vocal students, and group members may be uncomfortable with one another (Green, 2012 p. 275–276). However, pairing students according to their English language development level, is an effective strategy in English language arts and English language development instruction. In my classroom, students work with their peers every day during English language development practice, and they utilize the sentence frames provided to differentiate instruction and as support for different levels of oral language competency and comprehension. As a kid speaking to other kids, the Kid President character served as a popular culture “hook” to capture student interest. Students naturally speak more when they are engaged and when they are interested in the topic.

I have found the Kid President videos effective in provoking, inspiring, and reaching children in a simple and powerful way. Students appeared to be immediately engaged and inspired and were able to speak freely about the question. Everyone had something to contribute and discuss, even introverted and beginning level English language learners who find such discussions challenging. Students’ answers were often simultaneously thought provoking, hilarious, and insightful. Some students were concerned about issues of global inequity: “I’m not okay with people being poor,” “I’m not okay with guns and violence,” “I’m not okay with shooting, punching, and kicking people,” “I’m not okay with some people not having food,” and “I’m not okay with stealing and taking money.” Others were concerned about perceived inequities at school: “I’m not okay with 4th graders having a longer lunch,” “I’m not okay with the big kids having a bigger recess,” “I’m not okay with [people popping] my space bubble,” “I’m not okay when I’m on yellow [on the behavior chart],” and “I’m not okay with people who don’t share.”

Students accumulated background knowledge on the global issue of Amazon rainforest deforestation in Phase 2 during weeks 2 and 3. We held read aloud from environmental picture books, integrated math and counting activities, and learned about the layers of the rainforest by making our Class Amazon Rainforest Tree (See table). This background knowledge they acquired prepared them for Phase 3: Develop A Plan of Action (weeks 4 and 5). To develop their action plans, students explored the second and third Kid President questions “What do you have?” and “What can we do about it?” (SoulPancake, 2014) using the appropriate sentence frames: “We have _____” and “We can _____.” Ideas generated by the students were put directly into action during Phases 3 and 4, demonstrating the flexibility of this interactive child-centered model. During these exercises, students appeared confident that they could use their words, voices, and actions to help directly effect needed changes: “We can tell people to not cut down the trees and help,” “We can tell people ‘this is a problem’ and ask for their help,” and “We can use our words, pictures, and writings and make speeches.” Our reading of *The Christmas Tree Farm* (Purnell, 2006) inspired students to make changes in our own classroom community: “We can make a recycle bin,” “We can save some papers for later,” “We can use one [paper] towel at a time,” “We can use only a little paper and then put it back,” and “We can make our own paper to use.” As noted, students voiced the practical concern that “saving the trees is a big job” and indicated a rather mature understanding that money and adult help and guidance would contribute to success. Students were very confident in my ability to help them take on this big job of “saving the world’s trees,” and one student remarked, “We can do it because we have a nice teacher to help us!” To measure up to their expectations and help them address their practical concerns through solid action, I suggested the penny drive to raise funds to donate to a rainforest conservation organization. Most parents helped their children collect pennies, and several parents told me about their students’ enthusiastic responses such as: “I was told that we need to save the rainforest, so we need to save our pennies,” and “[my child] told me that we have to save the trees.”

We were able to then use the pennies we collected, approximately twenty-six dollars, in math integration activities that, among other things, promoted their number sense and counting. Toward further integration, students wrote about their counting strategies during writer’s workshop sessions. After donating the funds to Kids Saving The Rainforest to help support Anakin, we watched a video (KidsSavingTheRainforest, 2016) telling his story, and students did more writing about the experience. Students seemed particularly eager to write during the “Anakin writings” sessions of our writer’s workshop and appeared to genuinely look forward to it. Personal comments from students include: “My mom and dad helped me get pennies so we can save Anakin and save the trees,” “Thank you Ms. Waite for showing us Anakin,” and “I’m glad we can help Anakin; he needs medicine.” Throughout the 7-week

inquiry, having their voices and opinions heard, understood, viewed as important, and put into action contributed to the development of students' critical consciousness (Ladson-Billings, 1995) and to their beginning to critique global and local issues and social inequities at a young age, which may prepare them to take on leadership roles.

Teachers' Roles

As noted, Diaz and Flores (2001) found that many teachers were taking on the sociocultural mediator role through awareness of and respect for the diversity of their students' sociocultural backgrounds and experiences. Accordingly, I treat classroom inquiry as a collaborative effort between teacher and students, and acknowledge students' ability to create knowledge in addition to receiving it. By immediately positioning students as capable of creating knowledge by asking them to engage with the Kid President questions, I embraced my role and identity as a sociocultural mediator, and my students were inspired and energized in the process.

In addition, supporting my students' voices, and embracing and encouraged their views of the world throughout the inquiry, I help students choose appropriate topics and provided them with guidance and support, thus fulfilling other important teaching roles. For example, during our whole-class discussions in Phase 1, I used pink marker to highlight student responses I believed would effectively guide them towards critically thinking about deforestation: "I'm not okay with animals dying," "I'm not okay with when people have no home," and "I'm not okay with someone taking my things." After highlighting those responses, I asked them if we had learned anything about animals dying and having no home. Their background knowledge obtained from informational texts on animals and rainforests (part of the ELD curriculum) allowed them to immediately made the connection: "The tree frogs...they're so cute!" "Monkeys live in trees, and when people cut down trees, they have no home," "Humans are predators to animals and trees," and "We should save the animals."

Another important role was interacting with and including them in the inquiry. For example, involving parents in the penny drive established a home-school connection: it positioned parents as learning partners taking on the big job of "saving the world's trees." This partnership-based strategy allowed all partners to contribute in decision-making process, including which global issue to examine. Most importantly, through these different teacher roles, I was able to ensure that student voices were literally integrated into the curriculum throughout the inquiry process, resulting in personally invested, engaged, inspired, and energized learners.

Student-centered interdisciplinary learning: Popular projects and activities

The creation of student-centered interdisciplinary learning projects resulted in high levels of student engagement, excitement, and passion; a deeper understanding and awareness of global issues; and in equitable pathways that encourage the participation all learners. To find out which projects most fulfilled these purposes for my students, I asked them directly what made sense to them, what challenged them and extended their learning, and what made their hearts happy.

The class Amazon rainforest tree was one of the most popular interdisciplinary projects. The two-day project incorporated science, fine arts, math, and English language arts. We took a "virtual fieldtrip" to the Amazon basin, engaged in "think/pair/share" and whole class discussions about rainforest facts, and took part in a drawing lesson. Requiring students to state which rainforest layer their creature belonged to before allowing it to be placed on the tree incentivized students to successfully retain the information; they were able to recall their creatures' rainforest layers two months later. This section of the unit appeared to have stimulated their oral language practice. Popular sentence types included: "I'm making a _____," "Look at my _____," "My _____ lives in the _____". Students looked forward to this community-building activity and the community art project. When we finished creating the tree and stood back and looked at it, most students were impressed; remarks included: "Wow, how beautiful!" "We are artists!" and "It looks like grownups did it!"

The penny drive was also greatly popular with students. It helped reinforce knowledge we obtained through prior study of economics, money, and different types of coins and dollar bills as required in the social studies curriculum; and facilitated smooth integration of math and speaking and writing. For example, in groups of two or three,

students practiced counting pennies in different ways and made various arrangements on the floor, including random piles, rows, stacks, and groupings. While they were working, I interviewed them in groups about their counting, mathematical thinking and counting strategies. Some strategies included grouping by 10 and making stacks of the same height counting the stacks. One student with excellent number sense lamented: "Counting by 10s takes forever!" I asked prompted him with the question, "Is there another number that you can count by?" He stated, "Twenty! I can count by tens, and two tens makes twenty! Now I'll count!"

During Phase 4, students' most beloved activities involved donating the funds raised in the penny drive to support for Anakin, the paralyzed three-toed sloth. They loved "meeting" Anakin in the video about his life (KidsSavingTheRainforest, 2016) and took a personal interest in his story. We learned sloth facts and discussed sloths at length. When I showed students the email we they responded enthusiastically: "We helped him!" "Now maybe Anakin can walk!" "My heart feels so happy!" and "I'm so excited!" Students expressed empathy and compassion when writing about Anakin: "Anakin the sloth is important because it needs medicine, and it is sad because he is hurt," "We can save Anakin and all the animals. Anakin is a sloth; the rainforest has Anakin," and "We can save money to save the animals. We can save Anakin and all the animals. I like Anakin." Students drew the our Amazon rainforest tree, labeled the layers correctly, and added Anakin to the correct layer. Without prompting, they consulted the tree to check the spelling of the rainforest terminology they used in their work. They became emotionally and personally invested in our quest to save Anakin, the trees in the Amazon rainforest, and all of the animals even continuing their discussions during recess: one student told me, "Ms. Waite, [my friend] and I are going to save the trees! We're making more plans!"

As noted, a crucial aspect of my philosophy of education is the belief that the most powerful teaching and learning occurs when students are fully engaged, inspired, and take a personal interest in what they are learning because it is relevant to their lives. As suggested by Peterson (2012a), through integration of math with social studies, language arts, and fine arts, students were able to better understand the issues at hand; moreover, they began using math as both a language and a tool for explaining and understanding deforestation issues. With such tools in their global competence toolbox, students will be able take further direct action toward making a difference in their local and global communities: their schools, homes, and world. I hoped that our project would show them that great things can happen when grownups and children work together.

Equitable Pathways Through Interdisciplinary Learning

The interdisciplinary approach not only resulted in a deeper understanding and awareness of the Amazon Rainforest and deforestation, but it also provided equitable pathways to promote participation by all learners in the class. For example, artistic and visual learners were thrilled to be creating their own animals and creatures for our rainforest tree. Students who love writing were deeply engaged in putting their best effort into their writer's workshop pieces, and the students with keen number sense were in their element during the penny drive counting activities. All of the participating students really love animals, especially small and cute one, so encountering Anakin and doing something to help him truly spoke to their hearts. The drawings produced in the writing integration activities presented numerous interdisciplinary connections: the use of different lines and shapes for the rainforest animals (fine arts, math, and earth science), writing numbers during the penny drive counting (math), listing the layers of the rainforest (earth science), and writing and speaking about how they helped Anakin (English language arts).

Implications for Teaching and Further Study

Teaching Global Issues to Young Children

Global competence should not be treated as an "add on" to curricula; it should be integrated across the curriculum and across subjects throughout the school year (Mansilla & Jackson, 2011). Global competence is a necessity in today's interconnected world, and as noted, teaching for global competence promotes shared responsibility and understanding of shared risks across the local-global continuum (Reimers et al., 2016). Additionally, as global education is interdisciplinary, and global competence should be taught across disciplines, assessment methods

should match content lesson objectives (Tichnor-Wagner et al., 2019 p. 203). Assessment should be viewed as something done in partnership with students rather than something done to them (Deardorff, 2018 p. 2).

Accordingly, after initial analysis of the data collected (as detailed previously), I went back and, very carefully tried to see my students' work through their eyes: What learning projects engaged them the most deeply, spoke loudest to their hearts, delighted and inspired them most intensely, and had the greatest impact on their worldviews? As a social justice educator committed to including students' voices, hopes, dreams, wishes, and interests in the curriculum, it only made sense that I included their voices in the analysis as well.

As more fully described above, I asked my students directly about which activities made the most impact on them. They all told me that working on the Rainforest tree, the penny drive counting and writing activities, and the Anakin writings were their favorites. After our conversations, I examined the student work samples to find additional answers on why those projects were so important to them, and I included my findings above.

I began the unit with the perceived civic agency survey because before we could work together as a class to understand and address global issues, I needed to understand their worlds and how they saw themselves in those worlds. I needed to learn about their experiences and hear their voices and their hopes and dreams for the future. For students' voices to be heard and understood, it is necessary to create a learning environment that is truly a community of learners and not just a classroom. The many outcomes of this seven-week unit were made possible because of the classroom culture that my students and I began building together on the first day of school. The project was the result of yearlong effort that came full circle, and the more we learned about the destruction of the rainforests in the Amazon basin, the more we learned more about ourselves. Perhaps most importantly, we learned through practice about some ways to take direct action toward making positive changes in our communities and the world. Moreover, through inquiry-based teaching, we, students and teachers, were released from our traditional roles, that is, teachers as transmitters of knowledge and the students as receivers. Instead, students were encouraged to take to ownership of and responsibility for their learning. This approach to teaching-learning global competency ensures that what students encounter in the classroom is relevant to their worlds and thus starts them on paths of lifelong learning. Interdisciplinary, student-centered, globally competent teaching-learning strategies serve as the cornerstone of social justice education by empowering students to empower themselves.

Limitations

As a social justice educator, I have high expectations for students, and I provide transparent and equitable paths and tools to achieve these. Additionally, I am very skilled in behavior management, and students have individual, small group, and whole class accountability systems and expectations. The many outcomes of this seven-week unit were made possible because of the classroom culture that my students and I began building together on the first day, combined with the strong routines and management systems that were established. Our syllabus included a 45 minute block (from 1:15 pm–2:00 pm) for "learning projects." For a total of four days a week, this time was dedicated to our Amazon rainforest projects. Thus, a strong classroom culture, the teacher's skills and training in behavior management, as well as time in the daily schedule to implement interdisciplinary learning projects, must all be taken into consideration for replication of the seven-week unit. Additionally, prior to engaging in the seven-week unit, students were already gaining basic background knowledge on deforestation through reading informational texts about animals and rainforests, as per the district-mandated, standards-based English Language Development (ELD) curriculum.

Plans for Future Research

In our interconnected world, and in the current sociopolitical moment, including a global pandemic, racial injustices, and the effects of a climate emergency, there is a clear need to help students of all ages prepare to engage with societal issues and gain the knowledge, skills, and capacities to participate in civic life (Rogers et al., 2020); they must learn to take action on environmental issues of local and global concern, using inquiry-based interdisciplinary teaching-learning strategies. As environmental issues and concerns are one of the most popular and widely used

contexts for civic education (NAAEE, 2020), establishing high-quality global environmental civics curricula is imperative in early childhood education as well as in kindergarten through twelfth grades.

These findings and practitioner reflections represent the beginning of a journey into creating an interdisciplinary global environmental civics curriculum, with foundations in social justice education pedagogy. Since the conclusion of the seven-week unit, I have used Belvins & LeCompte's (2015) practical and actionable "action civics framework," and Kid President's "3 Questions That Can Change The World" (p. 67) to frame interdisciplinary global environmental civics units when working with scientists and bringing their research into the classroom through inquiry-based teaching. I plan to expand upon these findings for my dissertation research for a Ph.D. in Sustainability Education.

References

- Ardoin, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2018). Environmental education and K-12 student outcomes: A review and analysis of research. *The Journal of Environmental Education, 49*(1), 1–17. <https://doi.org/10.1080/00958964.2017.1366155>
- Asia Society & Longview Foundation. (2016). *Preparing a globally competent workforce through high-quality career and technical education*. <https://asiasociety.org/education/leadership-global-competence>
- Banks, J.A. (2008) Diversity, group identity, and citizenship education in a global age. *Educational Researcher, 37*(3), 128–136. <https://doi.org/10.3102/0013189X08317501>
- Blevins, B., LeCompte, K. (2015). I am engaged: Action civics in four steps. *Social Studies and The Young Learner, 27* (4), 23–26.
- Cherry, L. (1990). *The great kapok tree: A tale of the amazon rainforest*. Houghton Mifflin Harcourt.
- Christidou, V., Tsevreni, I., Epitropou, M., & Kittas, C. (2013). Exploring primary children's views and experiences of the school ground: The case of a Greek School. *International Journal of Environmental and Science Education, 8*(1), 59–83.
- Deardorff, D. K. (2018, January 31). How to assess global competence. *Education Week Global Learning Blog*. <https://www.edweek.org/teaching-learning/opinion-how-to-assess-global-competence/2018/01>
- Diaz, E., & Flores, B. (2001). Teaching as a sociocultural, sociohistorical mediator. In J.J. Halcon & M. de la Reyes (Eds.), *The best for our children: Critical perspectives on literacy for Latino students* (pp. 29–47). Teachers College Press.
- Dr. Seuss (1971). *The Lorax*. Random House.
- Duncan-Andrade, J. M. R., & Morrell, E. (2008). *The art of critical pedagogy: Possibilities for moving from theory to practice in urban schools*. Peter Lang Publishing.
- Freire, P. (1993). *Pedagogy of the oppressed* (M. Ramos, Trans). Penguin.
- Greely, A. (2003). *Fading forests: The destruction of our rainforests*. PowerKids Press.
- Green, C. (2012). Listening to children: Exploring intuitive strategies and interactive methods in a study of children's special places. *International Journal of Early Childhood, 44*(3), 269–285.
- Green, C. J. (2015). Toward young children as active researchers: A critical review of the methodologies and methods in early childhood environmental education. *The Journal of Environmental Education, 46*(4), 207–229. <https://doi.org/10.1080/00958964.2015.1050345>
- James, A., & Prout, A. (Eds.). (2015). *Constructing and reconstructing childhood: Contemporary issues in the sociological study of childhood*. Routledge.
- Javna, J (2009). *The new 50 simple things kids can do to save the earth*. Andrews McMeel Publishing.
- KidsSavingThe Rainforest. (2016, Feb 17) *Anakin's campaign* [video]. <https://www.youtube.com/watch?v=agx1hBeelZw>.
- Ladson-Billings, G. (1995). But that's just good teaching! The case for culturally relevant pedagogy. *Theory into Practice, 34*, 159–165. <https://doi.org/10.1080/00405849509543675>
- Mansilla, V. B., & Jackson, A. (2011). *Educating for global competence: Preparing our youth to engage the world*. Harvard Graduate School of Education.
- Novak, R & Montague, B (2015). *Kid president's guide to being awesome*. HarperCollins Publishers.
- North American Association for Environmental Education (NAAEE). (2021). *Early childhood environmental education programs: Guidelines for excellence*. NAAEE.

- North American Association for Environmental Education (NAAEE). (2020). *The promise of civic engagement for environmental issues: Synergy of environmental education and civic education*. NAAEE.
- Paris, D. & Alim, H.S. (2014). What are we seeking to sustain through culturally sustaining pedagogy. A loving critique forward. *Harvard Educational Review*, 84(1), 85–100.
<https://doi.org/10.17763/haer.84.1.982l873k2ht16m77>
- Peterson, B. (2012a). Teaching math across the curriculum. In *Rethinking Elementary Education* (pp. 205–210). Rethinking Schools.
- Peterson, B. (2012b). Teaching for social justice. In *Rethinking Elementary Education*, (pp. 49–56.) Rethinking Schools.
- Purmell, A. (2006). *The Christmas tree farm*. Holiday House Books.
- Reimers, F., Chopra, V., Chung, C. K., Higdon, J., & O'Donnell, E. B. (2016). *Empowering global citizens: A world course*. CreateSpace Independent Publishing Platform.
- Rogers, J., Hodgin, E., Kahne, J., Cooper Geller, R., Kwako, A., Alkam S., & Bingener, C. (2020). *Reclaiming the Democratic Purpose of California's Public Schools*. Research Report, Leveraging Equity & Access in Democratic Education Initiative at UCLA & UC Riverside.
- Sobel, D. (1995). Beyond ecophobia: Reclaiming the heart in nature education. *Clearing*, 91, 16–20.
- SoulPancake. (2014). *3 questions that could change the world from kid president* [video].
https://www.youtube.com/watch?v=0sbG-172e_Y
- Suzuki, D., & Mayorga, E. (2014). Scholar-activism: A twice told tale. *Multicultural Perspectives*, 16(1), 16–20.
<https://doi.org/10.1080/15210960.2013.867405>
- Tichnor-Wagner, A. (2016). *Global education politics and policy: Discourses, coalitions, and co-construction amongst globally committed national, state, and district actors* [unpublished doctoral dissertation]. University of North Carolina at Chapel Hill.
- Tichnor-Wagner, A., Parkhouse, H., Glazier, J., & Cain, J. M. (2019). *Becoming a globally competent teacher*. ASCD.
- UltimateRelaxation22. (2012). *Sounds of nature: Amazon rainforest* [video].
<https://www.youtube.com/watch?v=gbgLvUSrOX4>.
- Van Roekel, N. P. D. (2010). Global competence is a 21st century imperative. *NEA Policy and Practice Department*.
- VirtualFieldTripsnet. (2014, Nov 1). Virtual fieldtrip—Amazon rainforest [video file]. Retrieved from
<https://www.youtube.com/watch?v=JEsV5rqbVnQ>.
- Zhao, Y. (2010). Preparing globally competent teachers: A new imperative for teacher education. *Journal of teacher education*, 61(5), 422–431. <https://doi.org/10.1177/0022487110375802>

Appendix A
Teaching Materials

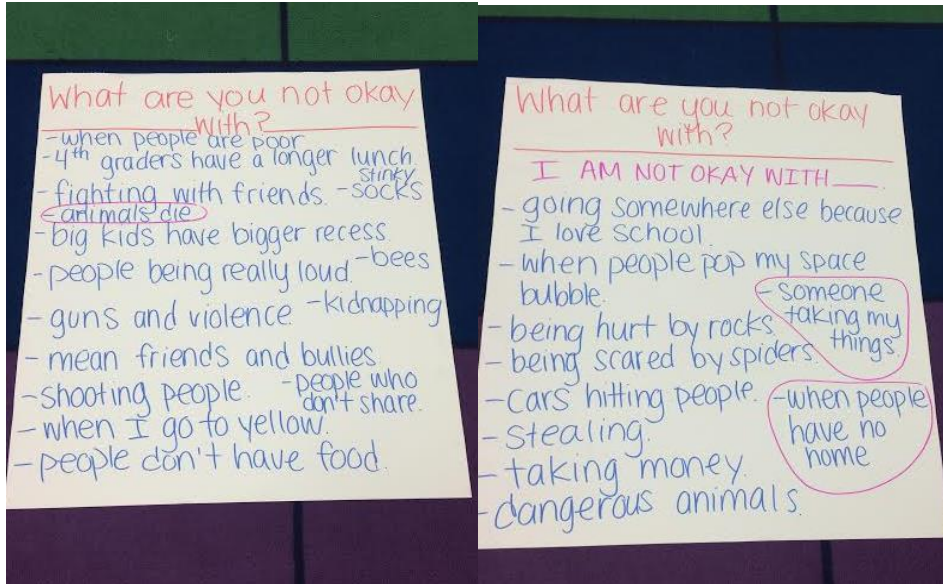


Figure 1. "I'm not okay with _____" chart

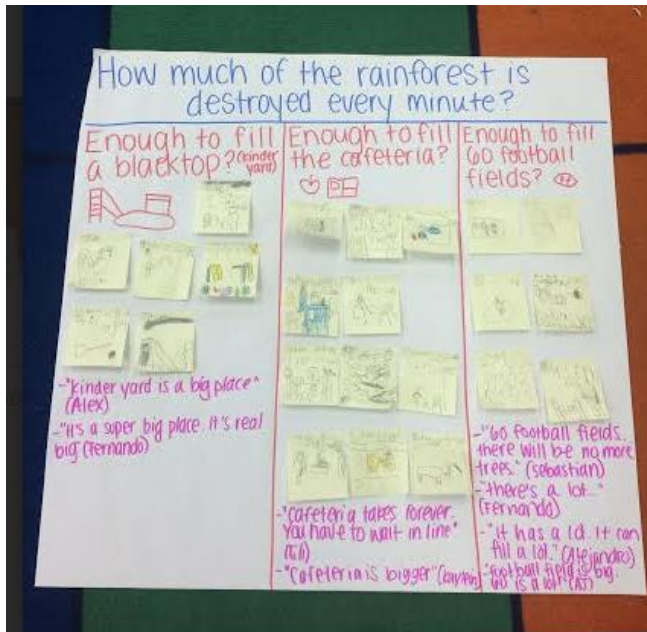


Figure 2. Rainforest Math Chart

Appendix B
Student Work Samples



Figure 1. Class Amazon Rainforest Tree



Figure 2. Deforestation Posters



Figure 3. Upcycled Mother's Day Vases with Flowers



Figure 4. Penny Drive Counting Pictures

Appendix C
Miscellaneous

Kindergarten Deforestation Experts:

The kindergarten students in Ms. Waite's class have become Deforestation experts! They did some amazing activities while learning about this topic. They turned their letter ID tree into an Amazon Rainforest tree to learn about rainforest letters, and they wrote "All About the Rainforest" books. They also did activities to help support the rainforests. They did a penny drive to collect money to donate to a rainforest conservation organization, they made hand-made paper to learn about recycling, and they have even started a class recycling bin. The students have also made posters to put around campus to teach all of us about this important topic.

Figure 1. Excerpt from March Newsletter

INTERNATIONAL JOURNAL OF EARLY CHILDHOOD ENVIRONMENTAL EDUCATION (IJECEE)
Addressing Issues, Policies, Practices, and Research That Matter

Information for Authors

The journal has two broad visions:

- (a) To encourage thoughtful sharing of information about important ideas, conceptualizations, and frameworks, as well as effective practices and policies in early childhood environmental education; and
- (b) To reach an extensive global readership in order to maximize the impact of the thoughtful information.

Thoughtful information may manifest through book reviews, description of educational approaches and programs, research investigations, and development or interpretation of theoretical perspectives. Associations among and between the following will be emphasized:

- Young children
- Family circumstances
- Community opportunities
- Policy mandates or recommendations
- Environmental activities, education, or experiences
- Mechanisms or processes related to knowledge acquisition
- Attachment or maintenance of affective dispositions
- Abilities, behaviors, or skills development related to good decision making in a range of environmental contexts; and
- Cognitive, economic, and social influences or impacts.

In order to reach an extensive global leadership, the journal will be available electronically, at no cost. NAAEE will permanently post all issues of the journal on the *Publications* link on its website. Translation of the articles into other languages is encouraged.

SUBMISSION PROCEDURES

Manuscripts, along with email notes, should be submitted to the IJECEE Executive Editor (ybhagwan@fau.edu). Manuscripts must follow APA formatting style, including a cover page, and attached as Microsoft Word documents. Once received, authors will be acknowledged with a manuscript code to be used in consequent communication. The editorial board will also prepare the manuscripts for a blind peer-review process. It is estimated that the review process may take between 12-16 weeks to complete.

In the email note, please indicate the author name(s), provide contact information, and a statement that permissions or releases have been obtained for all pertinent aspects in the articles (e.g., consent for research studies, illustrative renderings, photographs).

Although copyright of articles is maintained by the authors, IJECEE requests the right to be the first publisher of the articles. Along with the first serial publication rights, authors are required to indicate the following statement in the email note:

“All authors confirm that the manuscript has not been published previously and all permissions related to the attached manuscript have been obtained. (The co-authors and) I indemnify NAAEE and IJECEE against any violations of copyright or privacy right, as well as against any claims, damages, and legal suits. (The co-authors and) I provide IJECEE the first right to publish the manuscript in an electronic format on its website and on electronic education databases published by others receiving our permission.”

The submission of the email note itself will serve as proof of the author signing off on the confirmation, as well as the date of virtual signature.

Please contact Yash Bhagwanji, IJECEE Executive Editor (ybhagwan@fau.edu), with further inquiries or questions.



1725 DeSales Street, NW, Suite 401, Washington, DC 20036

naaee.org

NAAEE is the professional organization for environmental educators
in North America and beyond.

The Natural Start Alliance is NAAEE's program to advance early
childhood environmental education.

To find out more, go to **naturalstart.org**.