Nature + Nurture

An Exploration of forest kindergartens and Nature-Based Learning

Amina Brown

M.S. Data Visualization Candidate, Parsons School of Design

Thesis Advisor: Daniel Sauter

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Abstract

Outdoor education is not a new concept. It's been used around the world in various forms for decades and is increasingly popular in the United States in the form of forest kindergartens. forest kindergarten is a pedagogy rooted in the idea of free-flow learning, nature immersion, and child-led curriculums. Since the introduction of these programs in the United States, those involved have praised the educational, developmental, and physical benefits, with many academic sources conducting research to back them up. Even still, those just learning about the concept have a variety of questions about its efficacy, many that seem to be driven by a sense of bewilderment that a program so different from the traditional structure could possibly lend the same results. This project aims to show how these programs operate in relation to the traditional kindergarten system and how the current public education structure can begin to think about adopting and benefiting from the concepts applied in the nature-based programs.

Table of Contents

Introduction

At the outbreak of the coronavirus pandemic in the United States, the education system was turned on its head. As students and educators alike turned to virtual learning, those same educators began to work on crafting solutions that would allow students to safely return to in person learning. Many school systems began to focus on how to transform their existing classrooms into well-spaced and ventilated areas. For others, another solution presented itself: outdoor learning.

The reality is that outdoor education is not a new concept. It's been used around the world in various forms for decades and has been increasingly popular in the United States in the form of forest kindergartens.

The label "forest kindergarten" is the one widely used in the United States and is a direct translation of the German term for the programs, "Waldkindergarten". In true German fashion, the term is an exact description of the concept, a kindergarten in the forest. Even still, many Americans still ask for clarification when the term is referenced. forest kindergarten is a pedagogy rooted in the idea of free-flow learning, nature immersion, and child-led curriculums.[1] Most programs aim to spend 100% of their time outside, so the properly suited up kids can explore and learn in a biodiverse environment that allows them to benefit both academically and physically from their schooling.

Since the introduction of these programs in the United States, those involved have praised the educational, developmental, and physical benefits, with many academic sources conducting research to back them up. The research has focused on a variety of reported benefits, including academic performance, increased confidence, and enthusiasm for learning.

Even still, those just learning about the concept have a variety of questions about its efficacy. Some question the idea of running any type of school fully outside, especially one for small children who might not thrive in harsh weather. Others simply wonder if leaving the classroom behind means sacrificing development of reading, writing, and math skills. In some ways, the questions all seem to be driven by a sense of bewilderment that a program so different from the traditional structure could possibly lend the same results.

In recent years, the structure of traditional kindergarten programs has been more focused on academic tasks rather than play and discovery. This has led to push back from some parents and educators who have seen this move as a departure from the intent of the original kindergartens. The term "Kindergarten" was coined by Freidrich Froebel with the idea to relate the education process to a garden where children could learn and explore with free-form curiosity. The recent changes have often led to sacrificing the time previously used for play.[2]

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[1] (American Forest Kindergarten Association 2021)
[2] (Joe Martin 2020)

The purpose of any education system is to foster the learning and development of the pupils. In this context, the pupils are the children, and the choices around how to structure the system fall to the educators and the parents. It's safe to say that both stakeholders are interested in designing the most effective program possible, meaning that both educators and parents are, hopefully, constantly looking to improve the current kindergarten system. Given the proven benefits of nature-based education, it would seem that forest kindergartens offer up a selection of potential improvements to the current system.

As it currently stands, the concepts used in forest kindergartens have not been widely adopted by the American education system. Instead, these programs have continued to exist in more spacious and affluent areas and have not permeated the public education system. This project aims to show how these programs operate in relation to the traditional kindergarten system and how the current public education structure can begin to think about adopting and benefiting from the concepts applied in the nature-based programs.

Ideally, parents and educators alike will be able to use the project as a tool to address questions and concerns about forest kindergarten programs. They can also use it to start to consider what resources are readily available and could be easily integrated into the current kindergarten system. The end goal is to provide a collection of information about nature-based kindergarten programs to enable audiences in urban, rural, wealthy, and struggling areas to equally learn and benefit from educational developments happening around the country and the world.

The project itself is broken down into four sections: Origins, Structure, Outcomes, and Implementation. The origins section tackles the history and development of similar programs around the world in an attempt to establish the credibility of the pedagogy and provide context to the audience. The structure section operates as a side-by-side comparison of nature-based and traditional kindergarten programs in the US. The outcomes section addresses the studies published in relation to academic, mental health, and physical health benefits of the programs. Finally, the implementation section addresses the resources needed to start a program and some basic points of accessibility to said resources.

Treatment

Origins

The program credited as the first forest kindergarten was started in Denmark in 1952. It was based on the educational principles put forth in the Waldorf-Steiner method and was (and still is) referred to as a "Naturbørnehaven".[3] Realistically, other forms of outdoor early education existed long before that, but they lacked the structure and intention of the modern forest school. An example of an earlier program is the Laona Forest School in Laona, Wisconsin. This program was started in 1928 and focused on integrating environmental education into the curriculum rather than integrating the curriculum into a forest setting.[4] It's also important to note that most of the documented history of nature-based education is centered in western cultures. This does not mean that other cultures have not used or do not currently use nature-based programs, but rather that the modern definition of forest schools is centered on the original Danish blueprint.

Following the success of the Naturbørnehavens in Denmark, programs began to develop in the surrounding countries. The town of Reggio Emilia in Italy launched its first municipal early childhood education program in 1963, and with that introduced the now widely used Reggio Emilia pedagogy that is rooted in nature and community connections.[5] The Montessori pedagogy, which is similarly based on child-led learning and emphasis on nature, was also developed in Italy by Dr. Maria Montessori.[6] Many present-day programs cite the Waldorf-Steiner, Reggio Emilia, and/or Montessori pedagogies as the backbone of their philosophy. In relation to international program development, Sweden's first I Ur Och Sku (Rain or Shine School) was started in 1985, though the idea of connecting children and nature had existed for many years prior to that. In Germany, the first state recognized Waldkindergarten started in 1993 and the concept has spread throughout the country to the point that there are over 1500 programs in place today. Notable programs also exist in Switzerland, with the Langnau am Albis program being featured in the 2013 award winning documentary, *School's Out*. Since the introduction of forest kindergartens in Germany, programs and nature-based learning initiatives have popped up across the six developed continents in nations like the United Kingdom, the United States, Brazil, Canada, India, Australia, and South Africa.[7]

After the introduction of environmental education in the Laona curriculum, outdoor learning saw little development around the United States until the late 1990s in California when the Wild Roots Forest School was opened.[8] This is credited as the first modern forest kindergarten in the US. It wasn't until 2005, with the publishing of "Last Child in the Woods" by Richard Louv, that the concept gained visibility nationwide. In his book, Louv coins the term "nature-deficit" and addresses what he sees as a "staggering divide between children and the outdoors."[9] The

[3] ("A Brief History of Forest Schools Around The World" 2020)
[4] ("School Forests: Their Origin in Wisconsin" 2021)
[5] (Reggio Children 2020)
[6] (Montessori 2021)
[7] (Sara Knight et al. 2013)
[8] (CAForestSchools 2021)
[9] (Richard Louv 2005)

principles and concerns laid out in "Last Child in the Woods" inspired Erin Kenny to develop the Cedarsong Nature School in 2007. As part of the process, Kenny researched and interacted with programs around the world and created the Cedarsong Way, a pedagogy for outdoor education that focuses on unstructured time and has since emerged into an accreditation and certification process for programs and teachers, respectively.[10]

The history and development of forest schools is structured much like a tree, with many branches splitting off and growing in their own direction. In referencing the details and methodology used to help these programs grow, the visualization is establishing the credibility of these ideas. Given the unstructured nature of the programs, it's easy for parents and educators to also see the pedagogy as unstructured and not thought out. The existence of a robust, documented, history is important in establishing that those contributing to the forest school movement have both credibility and reasons for making and developing the programs in a specific way. In navigating the visualization, it's vital to present this information up front to prevent the audience from writing off the idea before they've had time to fully understand the intention of forest kindergarten programs.

Structure

The main difference between a forest kindergarten and a traditional kindergarten, aside from the location, is the structure. While traditional kindergarten has recently become more and more structured, a key aspect of forest kindergarten is that it is child-led and focused on fostering creativity and discovery. This means that the approaches to leading the children through the kindergarten process are fundamentally different, which is likely to cause parents and educators to feel out of their comfort zone. In presenting the structures in parallel, the project is allowing them to navigate the new idea in relation to the familiar context of the current education system.

The notable changes to the structure are related to the scheduling (or lack thereof) of daily activities, the tools needed to facilitate the learning process, and the intended curriculum. These topics are covered in three sections: Schedule, Supplies, and Curriculum. The idea is to answer these questions in this order: What are the children going to be doing? What do they need to be prepared for this style of learning? What skills are they obtaining and are they going to be missing out on skills they would normally be receiving in a traditional classroom?

Schedule

With regards to scheduling, the key difference between a forest program and a traditional program is the number of planned out activities set for the students each day. While a traditional kindergarten structure is dictated by public school regulations, the forest kindergarten activities are more fluid. Traditional kindergarten programs have mandates for scheduling a certain number of hours for various subjects throughout the week, meaning they

[10] (The Cedarsong Way 2021)

have less time to improvise or tailor the schedule around other activities, forest kindergarten schedules are much more flexible.

For Jane Mitchell, a public school kindergarten teacher in Rhode Island, a single day in her classroom runs from 8:05 to 2:40 and is broken into 15 distinct sections. While the exact order and content changes day to day, the lessons cover math, writing, reading, science, and movement. Mitchell is required to have a total of 1 hour of math per day, which is delivered through various means including digital platforms, morning meetings, and more traditional lessons. Additionally, she is required to have 30 to 40 minutes of writing per day and 1 hour of science per week.

In a discussion about her scheduling, Mitchell noted that she prioritized allowing the kids to move around and get outside, which is reflected in her schedule, but that the need to add in the other activities limited the amount of time and opportunities she had to do so. In total, the planned schedule includes only 45 minutes of movement or outdoor time on a normal day, with an additional 45 minutes of activity during Physical Education class that happens twice a week. Lastly, Mitchell aims to schedule her hour of science lessons as outdoor activities to also increase the time spent outside.[11]

In comparison, Lauren Roddick-Brown, founder and director of the Asheville Farmstead School in Candler, North Carolina, runs her program 100% outside. When asked about a daily schedule and activities, the answer was short and to the point: the majority of the time is spent on free play with occasional moments used to take nature notes meant to increase environmental awareness.[12] The more detailed schedule has other topics built in, but they all are structured as free play outdoor activities.[13] The intention of focusing on free play is to allow the children to learn and explore on their own and develop social and awareness skills rather than dive into a strict academic setting at a young age.

Here, the differences between the programs become particularly apparent. The positioning of a more traditional public school program as a government regulated institution means that public school teachers must trade in free play time for mandated lessons in the common academic subject areas. This might make the forest programs seem like the ideal option since they have more freedom, but Roddick-Brown noted that, with the exception of programs in Washington State, forest kindergarten programs are not licensed, which means they cannot run for a full school day. The Littlest Learners program at the Asheville Farmstead School is billed as two 4 hour programs, and these limitations mean that many forest kindergartens have a harder time serving households where all parents are working full days. In terms of scheduling, the lack of licensure can make it more difficult to plan a day when programs are limited by the time they can operate or need to plan multiple sessions rather than one continuous one.

Supplies

[11] (Mitchell 2021)
[12] (Roddick-Brown 2021)
[13] (Asheville Farmstead 2021)

The supply lists provide a different look into the various tasks the students might complete throughout the day, though the main difference is the need for proper outdoor clothing for all the forest kindergarten students. The supply list for Mitchell's public school class includes the expected classroom items such as pencils, crayons, and erasers.[14] The supply list for Roddick-Brown's forest program is a bit more involved as it includes not just the expected items, but also additional items for adapting learning to an outdoor environment, plus the aforementioned outdoor gear.

The outdoor gear differs from program to program based on the climate. Warmer and drier climates are likely to require less gear, while programs like the one at the Asheville Farmstead School require more. Roddick-Brown explained that because Asheville is in a mountainous area, the students need multiple pairs of waterproof boots (with and without insulation), as well as the proper layers for the colder winter temperatures and gear for rainy days.[15]

As one can imagine, the additional gear leads to additional costs. Since most programs are not licensed, they are not eligible for public funding and therefore cannot easily provide financial assistance for gear or other necessities (including tuition). In the case of some more established programs, they have been able to build up a collection of gear to be loaned to students who might have struggled to get it otherwise. This is an idea that other programs, including Roddick-Brown's, are working towards, but given that many forest kindergartens are newer, they haven't had the time and opportunity to do so.

In the comparison of supplies needed for traditional and forest programs, the forest programs require a lot more and, in this realm, are less accessible for lower income families. As mentioned earlier, licensure would remove some of the barriers to entry for forest programs and help alleviate some of the costs of attendance. That being said, committing to running a program 100% outside will always require more gear than a traditional kindergarten.

Curriculum

The curriculums for traditional and forest programs are also quite different. This is a reflection of the opposing views on how kindergarten should be structured. Since the forest programs are based on the idea of free play and unstructured discovery, they do not have a curriculum like the traditional programs. The Asheville program chooses to prioritize the development of social skills and the kids' connection to nature instead of focusing so much on teaching the more classic academic skills.

Within the free play time, students at the Asheville Farmstead school are lightly exposed to more "formal" topics. Roddick-Brown mentioned that they acknowledge that it takes two years in the Littlest Learners program to achieve the same level of "formal" content a student would learn in one year in a traditional kindergarten. That being said, Roddick-Brown said that the

[14] (Mitchell 2021)
[15] (Roddick-Brown 2021)

reason for the different focus is due to research showing that there are no detrimental effects on the students if they learn the content later.[16]

On the opposite end of the spectrum, the public school kindergarten program has an extensive list of skills that the students are required to learn during the year. These range from having certain reading and math skills to understanding the different seasons. Many of these skills are also the ones parents may be worried about their children missing out on in a forest program, but Mitchell also notes that parents are often focused more on their kindergarteners' happiness with relation to school.

Looking closer at the public school skills, students are expected to learn introductory reading and math skills, understand the basic shapes, be able to count to 100, understand how print is formatted (spaces between words, periods, etc.), and have basic awareness of the weather, the seasons, and the environment. As one can imagine, some of these skills are all present in a forest kindergarten setting, namely the awareness of natural elements and the environment, but others are likely present as well. Roddick-Brown noted that STEM topics are the ones most easily transferred to an outdoor environment, providing building a small dam as an example of an activity that taps into the children's understanding of science topics.[17]

Overall, the main discrepancy between the two curricula, is the type of attention to reading and writing. The public school scheduling and curriculum focus on direct interactions with these skills, in the aim to boost the reading level and the understanding of written texts. Roddick-Brown stated that the Asheville program does provide exposure to these skills, but that the primary element in helping a child progress in these areas is spending time in proximity to them. This means that in the forest kindergarten, students will have "literacy activities", but will then focus more on free play and social development than sitting down to exclusively focus on reading and writing. In the end, it comes down to a notable difference in priorities and whether play or academic skills are more important for kindergarten students.

Outcomes

The reported benefits of forest kindergarten programs span many different aspects of child development. There are countless reports of qualitative evidence supporting claims of improvements in academic performance, mental health, and physical health, but only some supporting these arguments with quantitative data.

As it stands, the quantitative studies focused on academics are focused on the broader benefits of integrating nature with learning rather than the benefits of forest kindergarten specifically. While this may seem like a challenge in proving the efficacy of the programs, it does provide evidence that integrating any amount of nature into the classroom is beneficial. Seeing as moving to full blown nature-based learning is not a reality for some programs, especially those in cities, these studies are actually addressing the vital idea that nature-based education can be introduced at any level. This means that a program interacting with nature for

[16] (Roddick-Brown 2021)
[17] (Mitchell 2021)

only a few hours per week is still making a commitment towards improving the development of it's students.

The intention of the outcomes section of this project is to provide hard evidence in a side-by-side comparison between the programs. One of the primary concerns of parents and educators is whether or not they are providing the best possible education for the children. This means that in order to introduce a new pedagogy, the concerned parties need to be assured that the students will be receiving the same, if not better, education. To prove this, it's important to present them with reliable information regarding the impact of forest kindergartens in relation to multiple aspects of childhood development.

Academic

As stated above, the academic studies are focused on broader exposure to nature rather than forest kindergarten programs specifically. The results here come from three key studies done around the world. Each study chooses its own way to calculate the academic improvements.

The first study was conducted in the UK and aimed to identify the students' ability to transition from primary to secondary school. The basic premise was to offer different groups of students a specific orientation or induction program. In this case, they choose to have three groups, the first receiving a tailored outdoor adventure program, the second receiving a standard outdoor adventure program, and the third taking the traditional program. Here, the intention was to test, both qualitatively and quantitatively, how well the students responded in relation to their psychological wellbeing and self determination.

The students were tested using the Warwick–Edinburgh Mental Well-Being Scale and the Basic Psychological Needs Satisfaction in Life Scale before and then 4 months after completion of the induction program. The reported outcomes were heavily favorable to the tailored outdoor program. In relation to the psychological wellbeing, they saw a significant increase in the average score, while the traditional program saw a decrease in the same metric. The self determination test is broken down into autonomy, competence, and relatedness. The tailored group was the only one with increase across the board, reporting 6.6%, 1.7%, and 14% increases, respectively. The traditional group reported decreases of 7.2% and 4% in the first two categories, and an increase of 5% in the last category.

While it may not be initially clear as to how these metrics are tied to academic performance, the author of the study noted that "Both the WEMWBS and the BPNS have established age-appropriate validity and reliability, possess positive links to increased psychosocial and academic functioning of pupils in schools [58,59] and relate closely to behaviors needed for successful transition."[18] This means that success in these metrics is a strong indicator that the students are well prepared to succeed in their academic pursuits down the road.

[18] (Vikki Slee and John F. Allan 2019)

The second study was conducted between 2006 and 2012 in Massachusetts and was published in 2014. It focused on the "greenness" of the environment surrounding the school relative to the school's MCAS results. MCAS is the statewide standardized test administered annually to students. This study chose to look at the results of 3rd graders scoring an "Above Proficient" score in English and Math. In addition, the study opted to collect and control for demographic breakdowns of the various school populations.

The results were consistent across the board. Schools were given an NDVI score (NDVI is a vegetation calculation provided by NASA sensors) and grouped by the amount of vegetation 250, 500, 1000, and 2000 meters from the school. Even when controlling for various demographics (gender, socio-economic status, etc.), the report found that significantly more students scored AP on the MCAS in schools with vegetation stretching 2000 meters from the grounds than students at schools with vegetation only within a 250 meter radius. These findings indicate that "greenness" is an important factor in academic achievement.[19]

Most notable about this study, is that it is one of the few that calculates academic achievement in a standard sense. This becomes key evidence in proving the efficacy of outdoor education since standardized tests have become the expected gauge of student success in the United States. Likely, this is the specific information that parents and educators interested in pursuing alternative kindergarten programs will need to know prior to making the decision to move learning outdoors.

The final report focused on academic performance was published in 2009. The intention of the study was to determine how the presence of indoor plants affected the students' "psychology, behavior, and health"[20] in the classroom. The experiment was conducted in a junior high school in Taiwan, with one group of students learning in a room with plants and the control group continuing to learn in the standard classroom without plants. The primary area of interest in conducting this study was to see if adding the vegetation could help reduce stress and mental fatigue in the students.

The details of the study are as follows: the study was run throughout one semester and the students filled out questionnaires every other week. This data was then paired with the quantitative values of their exam scores, sick days, and behavioral record. The test classroom was outfitted with six cinnamon trees, chosen due to the durable nature of the plants.

The results again favor the setting with natural elements. Students in the test classroom with the added plants reported "significantly stronger feelings of preference, comfort, and friendliness as compared to the control group." In the quantitative fields, there were notable decreases in the number of hours taken as sick time and the number of punishment records. Both of the quantitative measures are not direct measures of academic achievement, but they are tied to academic performance. Time away from school is an interruption to the child's education and can "hurt student achievement."[21] Additionally, punishment and behavioral

[19] (Wu et al. 2014)
[20] (Ke-Tsung Han 2009)
[21] (Denise-Marie Ordway 2020)

reprimanding can lead to students losing enthusiasm for school, which, in turn, may lead to attendance and performance issues.[22]

These outcomes further illustrate the benefits of exposing students to nature and greenery. The aforementioned evidence is primarily quantitative, but there are some notable qualitative results as well. Specifically, the UK study about induction programs provides quite impactful testimonies from it's participants. Some of the most academic based responses are below.

> *"I enjoyed learning outside because I didn't even think I was learning . . . it's boring in the classroom."*
>
> *"Having done the residential I think I can cope with this [secondary school] responsibility because I know I am capable of it"*
>
> *"My favourite thing was doing a presentation, this made me feel excited to do it again at school and be not so scared"*

Mental Health

In the realm of mental health outcomes, the quantitative studies are all focused on how the mental health and wellbeing of children is affected by time in nature. Once again, the research is not focused directly on forest kindergarten programs, but the general principles still apply. The hope in presenting this information is that the audience will see the broader benefits of children being in nature and be able to further understand the intention and evidence behind teaching children in an outdoor environment.

This section might not seem like an obvious choice for evaluating the impact of outdoor education on young children, but as stated in an article from Mental Health America, "Good mental health allows children to think clearly, develop socially and learn new skills."[23] All things important in setting a child up for success both in and out of the classroom.

The first noteworthy mental health report, published in 2020, tackles the "impact of exercise environments on adolescents' cognitive and psychological outcomes."[24] Veering away from the pattern of clear-cut benefits in the academic section, the results of this trial did not yield results that outright support a linear correlation between time and nature and mental health outcomes or the "nature-gradient hypothesis." The results do, however, have some points of interest.

The trial was structured as a before and after testing scenario with a mix of self-reported data and cognitive test results. The students were broken into four groups, the first group being the control group in a standard classroom, the second group exercising indoors, the third exercising in a park, and the last group exercising in "nature", which is being defined here as a

[22] (Intervention Central 2021)
[23] (Mental Health America 2021)
[24] (Putra et al. 2020)

biodiverse forest setting. The study looked into a few different psychological metrics, but the significant findings were limited to attention accuracy, cognitive arousal, and vitality. In these three metrics, the indoor group outperformed the park group, the indoor and nature groups outperformed the control group, and the park group outperformed the control group, respectively.

While these results are not ideal for supporting that nature, exclusively, can help improve mental function, the fact that the three test groups outperformed the control group is noteworthy. These findings lend themselves to the idea that any level of activity to engage the children away from their desks or structure of the traditional classroom is beneficial to their cognitive performance.

In a study conducted in Korea published in 2018, researchers found that activities associated with the environment are correlated with higher levels of subjective wellbeing (SWB). The broader study was focused on the role that organized youth activities play in determining SWB. SWB is a measure used to gauge one's perception of their own wellbeing. The argument for using the metric is that the individual has a better sense of how they are doing or responding to a specific activity than some of the objective metrics often use.

The study uses data collected from questionnaires administered multiple times over a two year period. From this dataset, the researchers looked into measures of happiness, joy, and worry. Here, the findings are more linear than the previously discussed cognitive study. The results show that there is a positive correlation between happiness and joy and the length of time spent in an organized activity. More importantly, for the context of forest kindergartens, organized activities held in nature are found to be significantly beneficial in raising children's subjective wellbeing. [25]

These results are particularly important in the case for forest kindergartens as they showcase the importance of outdoor activities, but specifically, organized ones. This means that while one might not argue with the benefits of spending time outdoors, encouraging your kid to play in nature outside of school hours is not necessarily a replacement for them learning and developing in nature within a designated program.

When the education system was forced to transition to remote learning during the coronavirus pandemic, one common concern was that the isolation would have a negative impact on the social development of children. Parents seemed concerned that their children were missing out on important group interactions that helped them learn about boundaries and working with others. These discussions helped establish that parents and educators are aware and concerned about the social benefits of school in addition to the academic benefits.

A 2020 report published in the Frontiers in Psychology journal focuses specifically on how prosocial behaviors in children are related to nature and green spaces. The article looked at a selection of studies focusing on the topic and found that the majority of them reported positive prosocial benefits for children in nature. While only a portion of those were found to be

[25] (Kyoungmi Park and Shun Wang 2019)

statistically significant, the general finding is that the patterns identified serve as valid preliminary evidence that shows that the two concepts are connected.[26]

Prosocial behavior is defined as actions voluntarily taken to benefit others. In the context of forest kindergartens, these findings indicate that students in nature-based programs may be more likely to exhibit positive helpful attitudes towards their peers. Having previously established that the adults involved in the education ecosystem are concerned about these behaviors, one could safely say that this pattern establishes an additional benefit to forest kindergarten programs that may not also be found in the corresponding traditional program.

Physical Health

Of all of the outcomes categories, the benefits of forest kindergarten programs on physical health may seem the most obvious. Simply put, the unstructured environment of a nature-based education lends itself to frequent movement, whereas the structured setting of the traditional classroom requires a certain amount of sedentary activity. That being said, the reported physical health benefits of forest kindergartens and outdoor education expand beyond the exercise-based ones. In addition to reduction in obesity, benefits span immune regulation, neuro-behavioral, and regulatory issues.

In relation to obesity, a study conducted in China collected data on NDVI (greenness levels), BMI, and waist circumference. Operating in a similar fashion to the Massachusetts study mentioned in the Academic Outcomes section, the researchers paired the NDVI score for various schools with the biometric data of the students. The intention was to provide quantitative evidence to support claims that exposure to nature lowered the amounts of overweight and obese children.[27]

The results found support the hypothesis that higher levels of greenness are associated with lower BMI measurements and smaller waist circumferences. The results were potentially also impacted by air pollutant levels in the various areas in China, but not in a way that disqualifies the outcomes. Additionally, the study was not focused on the connection between exercise in nature and health, but rather exposure to nature and health. This further supports the idea that while full blown forest kindergartens may not be attainable for all programs, any exposure to nature is beneficial.

More directly connected to nature-based early education programs, is a 2020 study completed in Finland that focused on immune-mediated diseases (Multiple Sclerosis being a common example). The intention was to see how students in urban versus nature-based preschool programs were at risk for these diseases. The interest in this topic stems from a pattern of society, specifically urban populations, becoming more susceptible to immune-mediated diseases.

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[26] (Levi Wade, David R Lubans, Jordan J Smith, and Mitch J Duncan 2020)
[27] (Bao et al. 2020)

In this study, researchers added natural elements to the urban school yards to see how the children's T-cell and plasma levels would change. Ultimately, the results showed that introducing natural elements into the previously urban school settings led to positive results in respect to the student's immune system. The key to the "intervention" was the biodiversity in the environment, which was noted to have increased bacterial diversity in the students, which positively benefited their immunity.[28] This study again suggests that nature-based programs lead to better health, but also shows that urban programs can be adapted to benefit from the same biodiversity.

Finally, a 2019 review of adolescent green space studies covered a collection of physical health topics, including exercise, memory and attentiveness, and respiratory responses. While some of the findings were mixed, they all tell an important story in respect to early childhood development.

The physical exercise studies concluded that the increased exercise from spending time in nature led to lowered levels of obesity. Here there is some disagreement on whether the outcomes are affected by gender and whether the differences are apparent during childhood. One study specifically saw that the differences only became evident as the children age. Either way, these findings back up the traditional view that nature-based programs are healthy for the students based on the increased physical activity.

In a collection of five studies focused on neuro-behavioral health, studies found that the children exposed to nature had better memories, increased attentiveness, and better emotional wellbeing. One study specifically noted that the children experienced heightened brain development in areas related to memory. Finally, another study concluded that the benefits may only exist for children from lower income families, which could be used to further justify the need for nature integration into urban kindergarten programs. In fact, the idea that nature-based learning could benefit specifically lower income students means that, if nothing else, these programs have the ability to level the playing field for children of different income brackets.

The final topic covered in this review is respiratory health. This section had the most mixed findings, specifically in relation to asthmatic children. While some results showed that natural exposure for children in urban communities was beneficial for their overall respiratory health, specific pollen may trigger asthma for some children.[29] This finding may be the only physical health detriment of nature-based learning. That being said, the intention of this project and thesis is to help parents and educators choose the best program for each individual child, so an asthmatic student may be better suited in a different style program or might just need special considerations taken while participating in a forest kindergarten.

All in all, the physical benefits outweigh any detrimental effects. Throughout the academic, mental health, and physical health sections, the evidence indicates that there are real advantages to operating a class in a nature-based setting. There is also no evidence to show

[28] (Roslund et al. 2020)
[29] (Mohammad Zahirul Islam, Jessika Johnston, and Peter D. Sly 2020)

that children in forest kindergarten programs will suffer academically compared to their peers. Given the findings, one could ask the question, why not integrate nature into early childhood education?

Implementation

This project is designed to provide a comprehensive collection of information about nature-based learning and forest kindergartens in the hopes that it starts conversations about integrating the natural environment into the classroom (or vice versa). During the development process, there were repeated discussions about access to existing programs and the resources needed to start a new program. This section aims to begin to address those issues.

As it stands, 49 states (Washington being the exception) do not publicly fund nature-based learning programs. What this means is that the programs have to be funded through either fundraising or, more likely, tuition. Tuition is a barrier to entry for many students and means that without public funding, it becomes much more difficult for lower income students to access these programs. It is important to note that some already established programs do offer scholarships, but that doesn't totally eliminate the barrier.

In addition to financial barriers, location plays a large role in having access to biodiverse outdoor spaces. Students in urban areas, while possibly being those who will benefit the most from these types of programs, have less access to forested areas. This means that urban kindergartens looking to move outside will need to adapt the model to fit the resources available.

One way to approach this issue is to think of outdoor education as something that can exist on a spectrum, rather than an all or nothing idea. What this can do is lead parents and educators to thinking about simply increasing outdoor time in a current program, if making the switch to full blown outdoor education doesn't seem possible. A prime example of this, in a public school program no less, is the Forest Friday concept developed at the Ottauquechee School in Quechee, Vermont.

Forest Fridays is an idea intended to incorporate nature into the existing curriculum. The kindergarten educators, Eliza Minucci and Meghan Teachout, decided to designate every Friday as a day spent 100% outdoors. The day is a mix of student-led and teacher-led time, as the teachers work to integrate free form play time with curriculum-based skills. A 2014 article published through the Natural Start Alliance notes Minucci's observations of how the program is running.

> *She has found that she is able to meet many of the curricular goals and Common Core standards through the outdoor program. But of equal importance is the social growth she has seen in her students. "The opportunity for teamwork and the necessity of solving problems independently is not replicable in the close, controlled classroom setting. . . . Interpersonal relationships in the woods are more successful than in the classroom, despite (or because of) the increased freedom and decreased supervision. . . . The*

> *opportunity for some kids to be experts in a way they aren't in the classroom is very supportive of academic goals, because their confidence outdoors translates into effort indoors."*[30]

Another Vermont public school teacher took a less daunting approach to integrating outdoor time into her kindergarten curriculum. Elizabeth Feinburg, an educator from Bethel, Vermont, took what she described as "baby steps". These steps were focused on incorporating outdoor time into already established activities or units. Additionally, Feinburg decided to add in "Science Hike Mondays", where the class spends an hour or two hiking once a week.

Both of these implementations are successful variations on how to incorporate nature into a public school program and essentially make outdoor education more accessible to students whose family cannot afford tuition payments. While these examples are helpful and lay out a usable blueprint for public school educators, they both exist in rural areas and don't directly address how a teacher in an urban setting can adapt their programs to include nature.

This leads to the importance of The Trust for Public Land's City Park Facts dataset. The data is collected and published annually and covers, among other things, the park acreage available in the 100 most densely populated cities in the United States. The vital connection here is that while the programs in Vermont may seem out of reach for those in cities with fewer natural areas, even the most densely populated cities in the country have public land designated as open space. And that open space is the key to integrating outdoor education in an urban setting.

According to Lauren Roddick-Brown, founder and director of the Asheville Farmstead School in Candler, North Carolina, it only takes 1 acre to run a forest kindergarten program outside. The stipulations on that acre are that it has to be the "right acre" and would work for a small class of 10 or fewer children. That being said, programs looking to incorporate nature into their programs and not necessarily move their whole program outside, need less space to make that happen.

The TPL dataset includes a calculation of people per available acres in each city, with no city having more than 46 people per acre. That might not seem like a lot, but not every person in New York (the city with the highest population per acre), is attending kindergarten or spending the typical school day hours in the parks. These numbers indicate that the space is there, it just might be harder to find.

There are still some potential barriers here though. Location within a city is also important. Not every kindergarten program in New York is within an accessible distance to large parks like Central or Prospect Park. And not every park is a safe and welcoming environment for teachers to allow their students to explore. This is where the planning of a new program will need to extend beyond the narrative of this project.

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[30] (Patti Ensel Bailie 2018)

Methodology

Data Sources and Processing

The data used in this project comes from a variety of sources and aims to provide an all-encompassing overview of forest kindergartens. Many of the resources used were found in the collections hosted by various nature-based learning associations and programs. Each section of the project taps into different types of data to help build a profile of nature-based learning initiatives.

The origins section is populated with data collected from a few different sources. The first source is a blog post chronicling some of the more well-known origins of forest kindergarten programs, posted on the Growing Wild Forest School website.[31] The other major source used is the book "International Perspectives on Forest School: Natural Spaces to Play and Learn", edited by Sara Knight, which provides a compilation of experts from around the world discussing the forest school initiatives in their respective nations.[32] The information was primarily included to add diversity to the histories being referenced. Additionally, the Reggio Emilia and Montessori association websites were referenced to provide further information about the influential Italian pedagogies. The data processing for the origins section was minimal, as only the Country, Year, and Description were needed for the visualization.

The structure section is exclusively populated with data collected through interviews with current kindergarten teachers. Each subsection is split into Forest and Traditional sections. The Forest data, including approximate daily schedule, basic supply lists, and learning objectives/curriculum was gathered during a Zoom conversation with Lauren Roddick-Brown, the founder and director of the Asheville Farmstead School. She is also involved with The Cedarsong Way pedagogy, which is noted as being one of the first fully developed forest kindergarten pedagogies and programs in the United States. This means that many of the data points collected are loosely applicable to the structure used at other Cedarsong Way schools, and likely other forest kindergarten programs around the country. The Traditional program data was collected during a different Zoom conversation with Jane Mitchell, a kindergarten teacher at the Jamestown Melrose School, a public school located in Jamestown, Rhode Island. She has been teaching there since 2000 and the structure for her class is influenced by her experience and also by the guidelines and regulations at both the town and state levels. Due to the standardization of public schools, Mitchell's contributions operate as an approximate example of traditional Kindergartens throughout the country. Once again, not much data processing was needed for this section, as the data is represented in the same qualitative way that it was delivered.

The intention of the outcomes section is to provide a sense of how the programs compare in relation to the impact they'll have on a child's development in different areas. To support this, the data is collected from a selection of research papers each focusing on different studies

[31] ("A Brief History of Forest Schools Around The World" 2020)
[32] (Sara Knight et al. 2013)

related to nature exposure as it relates to child development and education. To extract and process the data for this section, one quantitative data point that supported the overall takeaway from the study was selected to represent the nature-based outcome, with a corresponding data point selected to represent the outcome for the group with less exposure to nature. The data is used to control the size of the "leaves" on the outcomes page. The actual quantitative value is purposefully not included, as it was decided that none of the studies could be reduced down to a single value. Instead, the data is scaled to be between 1.5 and 2 (or 1.42, in the case of the one negative value) and then applied to the scale attribute of the leaf svg path. The idea is to provide a visual clue as to the variation in the outcomes of each study, but to encourage the user to read through the research paper itself if they feel inclined to get more information. The formula used to scale the data points is as follows:
$1.5 + Value \div (2 \times Max)$, where the Value is the data point for the selected study and condition (nature vs. traditional) and the Max is the greater value between the two conditions. This output is essentially a value of 2 for the scale of the Max value, and a smaller value for the corresponding condition that is relative to the difference in outcomes reported by the research paper.

For the implementation section, two datasets were used. The first dataset is one that was compiled specifically for this project and involved working through the Nature Preschool Map provided on the Natural Start Alliance website.[33] It includes data for the US and each state on the number of forest kindergarten and Preschool programs currently in operation, as well as the average estimated number of hours that the programs spend outside per week. The hours were collected by visiting the websites of each listed program and calculating them based on the hours spent outside according to the daily schedule, and the number of days per week the program is active. The second dataset is sourced from The Trust for Public Land's 2020 City Park Facts resource.[34] Within the facts data tables is one that provides, among other things, the number of acres within city limits for the 100 most densely populated cities in the country. This dataset is used to calculate the theoretical amount of forest kindergartens that could exist within the city according to Lauren Roddick-Brown's 5 acre estimate for running a program fully outside. In reality, the number is much smaller as the total acreage is not broken into parks that are all 5 or more acres. That being said, the intention in calculating the number in this way is to emphasize the idea that there are options for integrating nature into the classroom and not to share the actual green space availability.

Design Decisions

In designing a digital project that is focused on programs intended to teach students in non-digital ways, it was important to work to integrate the natural setting into the aesthetic. To accomplish this, a selection of forest photos and a forest-inspired color palette were chosen. The green, brown, and grey attempt to emulate the plants, soil, and rocks a student may encounter in a forest kindergarten program. The green serves a double purpose of representing the natural elements as well as providing a calming effect, which mirrors one of the commonly reported benefits of teaching students in nature. In terms of navigation, the tabbed menu in the

[33] (Natural Start 2021)
[34] (The Trust for Public Land 2020)

top right allows the user to navigate to the pages they are interested in without having to comb through the entire project. This is important for the topic because some users may have more background information than others and may, for example, be specifically seeking out information on implementation and not need to know about the structure of the programs. Finally, it was important to have a strong overall aesthetic because one of the barriers that the forest kindergarten movement has been experiencing is not having visibility among those who aren't already aware of it. Hopefully, a strong aesthetic will help make the content more memorable for those who are learning about it for the first time.

Origins

The tree ring timeline in the origins section is designed to represent the history of various nature-based learning programs around the world. While the dataset includes both geographic and temporal information, the timeline is designed to focus on the temporal aspect and highlight a couple specific patterns. The first is the longevity of the history. By creating a timeline that runs from 1950 to present day, the visual reinforces the almost 70-year history of forest kindergarten programs. As mentioned earlier, this helps establish credibility for what some may consider to be a new concept. The second item of note is the concentration of programs starting in the mid-1990s and around 2010. While the selection of countries shown does not encompass all the nations worldwide that are developing these programs, these concentrations do mirror the times when the outdoor learning movement has made more progress in becoming mainstream. These highlights further establish the credibility and popularity of these programs, which can help to prove that forest kindergartens are a viable alternative to the Kindergarten structure that most parents are familiar with. For a UI perspective, the tree ring portion of the timeline aims to pay homage to the trees in a natural setting and tap into the already established arboreal time keeping system. Additionally, the hover feature serves to allow the user to learn more about the individual histories without crowding the tree ring visual.

Structure

The intention of the structure section is to provide side-by-side comparisons of various aspects of the different Kindergarten programs. Ideally, the three subsections (schedule, supplies, and curriculum), provide visual cues that highlight the different experiences a student might have in a forest kindergarten versus a traditional kindergarten. The schedule subsection provides a color-coded view of the day-to-day activities, with the colors distinguishing how active each item is. While the actual activity labels are important, the notable difference is how active a day at a forest kindergarten is compared to the traditional program. The supplies subsection supplements the schedule by providing icon visuals for the items needed to participate in these activities. By using the icons, the two sections provide a look into what the contents of a student's backpack may look like, and what the items in the parent's shopping cart at the beginning of the year might be. Finally, the curriculum subsection is designed to highlight the overall objectives and, more specifically, the unstructured nature of the forest kindergarten program. The visual cue of having two elements on the left compared with the nine elements on the right aims to provide the initial hint at the difference. Then, the bold white action terms provide more information as to what the educators are looking to teach the students. The

difference in the terms used drives home the point that the forest programs are more about being explorative rather than learning specific academic skills.

Outcomes

The outcomes section is intended to briefly introduce the findings from various nature-based learning research papers. Here, all three subsections take the same visual form, with the only change being the labels and data behind them. The design here, in a similar way to the origins section, is designed to pay homage to the natural elements seen in a forest. Broken again into a "Forest" section and a "Traditional" section, each "leaf" is designed to resemble a speech box, which is used to contain the text about the relevant outcome. These leaves are then stacked in such a way to build a plant-like image. Each one also has a matching one on the other plant. For instance, an outcome about math scores, has one leaf on the Forest plant, and one on the Traditional plant. The size and color of the leaves are then data driven based on the selected quantitative value from the appropriate group. The difference in size and color between the leaves is designed to represent how much of a difference there is in the quantitative results. Here, the "healthier" (greener) the plant, the better the outcome. In relation to size, larger is not always better, and is instead tied to the first descriptive term in the label (i.e. higher, lower, increase). Finally, each leaf has an external link to the original research paper, which allows the user to learn more about the study, if interested.

Implementation

The implementation section is the most typographic heavy of all the sections. It's designed to be read as an answer to questions about program availability and the options for implementing new programs. There are three standout elements included in the text. The first is the green highlighted numerical values, which are providing the key information about a variety of topics including availability, hours, and acreage. Four of these values are dynamic and controlled by the second standout elements, the dropdown menus. These menus allow the user to customize the text based on their location or any specific location they are interested in. This aims to provide the user with a specific version of the page that they can then share with other people in their area with interest in forest kindergartens and nature-based learning. The last standout element is the icons, which are intended to provide some more visual cues to help the information be more relatable for the user. A key example of this is the city block icon, which aims to provide a common example of what 5 acres really looks like. The final elements on the page are the buttons at the bottom, which provide external links to sources that any user interested in learning more or starting their own program might find helpful.

Conclusion

Nature + Nurture is intended to help spread awareness about the forest kindergarten movement. While there already exists lots of information about these programs, it is very rarely connected in a narrative that both introduces the idea and begins to answer some of the questions people have about it's viability. The project aims to help fill this gap and support the idea that nature is a key element to success in early childhood education.

Education is a complex topic, and this project should not be taken as an all knowing document on kindergarten programs. Rather, it should be used as a jumping off point for interested parties. It notably does not touch on some of the issues that larger scale rollouts will likely face.

Currently, there are barriers to access in relation to income and availability. Since forest kindergartens are not part of the public school system or licensed by any state except Washington, they are ineligible for public funding. This means that programs are forced to charge tuition, which renders them unavailable to some families. Much more work is needed to secure funding for these programs before they will be truly accessible.

The other barrier is availability. Most programs have low student to teacher ratios, which while generally seen as a good thing in relation to education, means that spots in these programs are limited. The low ratios are likely a necessity since the students are exploring a much larger area rather than being grouped in a classroom. Additionally, the COVID-19 pandemic led more parents to seek outside options for education, which increased the demand for the already limited class slots. In order to make them more available, educators would have to look to the widely established programs in other nations, Germany being a prime example, to scale them accordingly.

Finally, this project hopes to inspire people to rethink the educational practices that have become common in the United States. Given the proven benefits of an alternative program like forest kindergartens, it becomes hard to justify not incorporating at least some of these ideas into the existing systems. And, if nothing else, remember to allow children to be children and play to be an important part of their lives.

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