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# A Breath of Fresh Air

## *A Refreshing Initiative for Outdoor Learning in the Science Curriculum*

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### *Abstract*

What if someone said, there was a way to increase student attendance rate, engagement, participation, and test scores and at the same time, decrease Attention Deficit Disorder symptoms, anxiety and boredom? What if that same person followed up the question by saying, the answer is in your backyard? The solution is outdoor learning and truthfully, it seems too easy. With all of the educational strategies being offered, one might think this curricular shift is another program that has to be implemented with an all or nothing approach. The beauty of outdoor learning is that it takes many different shapes, is flexible, and looks different based on the instructor, the age of the students and the content. While the variables may change, the one constant is that outdoor learning gives students the skills and curiosity they need to become lifelong learners. Making students appreciate learning when they have the resource of a classroom and a teacher limits the reality of lifelong learning, but if students can foster a relationship with nature that provides endless information, the hope of instilling lifelong learning becomes a reality. While formal education will inevitably cease, people will always have access to the outdoors.

*Keywords:*
Outdoor learning
Student curiosity
Self-Efficacy
Autonomy

## 1 Introduction

The following article, based on a workshop presented at the *International Week 2018*, will convey the benefits of outdoor learning through both a collection of literature and empirical research. It will also recognize the current lack of outdoor learning in classrooms nationwide and propose reasons for its absence in school districts. While there are few professional development opportunities on the practice itself, the adoption of the Next Generation Science Standards (NGSS) have helped to shift instruction to become more student driven and inquiry based. Student survey results and state assessment scores support the ability of outdoor learning to increase academic achievement. Results from these studies and current initiatives will help gain interest in the important and effective teaching practice known as outdoor learning. The attitude towards outdoor learning in school districts nationwide must shift from a novelty to a staple in science education.

## 2 21st Century Learners and their Relationship with Nature

1.5. This is the average number of hours that adolescents spend outside each day. This statistic would not be so unnerving if teens were complacent with the minimal time they spent outside; however, that is not the case. In fact, when polled, 45% of eighth grade students said they are only outside when waiting for the bus and during physical education. Juxtaposing this prior statistic, 100% of students expressed that they enjoy and look forward to going outside for educational purposes.

Just like learning a language or the piano, there is much research that shows the importance of practicing outdoor learning at a young age. Taking advantage of a quickly forming brain, outdoor learning should be

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introduced at the lower grades and continued through the upper grades to avoid a break in routine. Rowe and Humphries state that children already have a good relationship with nature as they learn to first play in this environment. Continuing that positive relationship with learning will bring forth a sense of familiarity, thus making the environment comfortable enough to take risks. Pair this outgoing behavior with scientific content and learning is inevitable. Through Rowe and Humphries' experience of running the Coombes School since 1971, they found that *"the capacity for learning and teaching out-of-doors is strengthened in a variety of ways to make the outside come alive for children"* (2004, p. 17). Outdoor classrooms do not have to be fancy and equipped with expensive features. In fact, most campuses have a space that can be valuable for outdoor learning. Teachers are encouraged to use their campus, especially fields, for they serve as the largest classrooms. In addition to serving as a more holistic learning environment, the outdoors can verify the formal curriculum in many ways. Curriculums need to advocate for outdoor learning at all levels, especially for secondary schools because of their typically larger campuses; *"if older students moved into our premises, most of their study needs would be provided for at a very deep level by the school's environment"* (Rowe & Humphries, 2004, pp. 16–17). Throughout formal education, nature has the ability to strengthen learning; in the primary grades, nature can assist students in making observations and recognizing patterns and in secondary grades it can be used to supply experimental variables or a location to collect data. In many ways, nature stands the test of time.

With an endless list of benefits of outdoor learning, there is still hesitation adopting it as a standard practice. Many people have researched the effects of outdoor learning and there are several programs that teach solely outdoors. Considering the American school system, a traditional learning experience complemented with outdoor lessons is a practical yet effective method of science instruction. For example, Ferreira et. al., explored the field of outdoor learning and shares results in 'A Community Partnership to Facilitate Urban Elementary Students' Access to the Outdoors' (2012). In 2005, Richard Louv, the author of 'Last Child in the Woods', coined the term "nature deficit disorder." Experiences with nature are essential to a child's physical and emotional development and the lack of these types of experiences has led to an increase in child obesity, attention disorders, and depression. Researchers have found a correlation between environmental education and student outcomes, including achievement, motivation, and environmental literacy. Schools using environmental education programs performed better on standardized tests than those using traditional curriculum. Additionally reported were fewer behavior problems, higher attendance rate, and more positive attitudes toward school. Children who are disengaged and alienated from school find a sense of purpose when working with others in outdoor projects, developing a sense of belonging towards their school (Ferreira, Gruber & Yarema, 2012). Are these not the qualities teachers hope to instill in their students? Teaching outdoors is an integral part of this mission.

## 3 Plugging into Outdoor Learning

Giving students technological tools and practical applications is an effective way to help them become lifelong learners. When outdoor learning space is available, it should be used for science instruction. Currently underused, the view of outdoor campus space has to shift from abandoned courtyards and spotty grass fields, to outdoor laboratories and field studies. Infusing technology into this experience allows for in depth exploration, more precise data collection and a deeper analysis of the results. *"In this process, students actively construct information from the environment, rather than passive absorbance of the information from teachers"* (Orion, 1997, p. 162). Many applications can advance the complexity of the outdoor lab yielding to differentiation and scaffolding embedded within the lesson plan. Students can readily use technology on their smartphone, which in most cases greatly decreases equipment fees. Smartphones and free applications have the ability to measure the GPS coordinates, elevation, angles, and compass direction. The accessibility of this tool makes it more likely that the student would use it again for the same method outside of the school day.

Introducing new uses of their already familiar technology increased anticipation and engagement. Students were excited when they learned they would be using their phones outdoors. What they may not have realized is that the presence of technology, in this case a cell phone, so often deterred from instruction, supported their learning. Place based learning allows for a tangible connection with the concept, and with the addition of technology, students have the ability to record observations from the experience. The permanence of these experiences allows for a concretization of the subject matter.

## 4 Outdoor Education and the Next Generation Science Standards (NGSS)

In terms of education, the United States ranks far below other first world countries. *"The 2012 Program for International Student Assessment (PISA) ranks the United States as 23rd in Science, 30th in Math, and 20th in Reading Literacy out of 65 OECD education systems"* (PISA, 2012). Scores from the NAEP Science Assessment administered in 2011, *"over a third of eighth grades scored below basic"* (NAEP, 2011) and in 2012, *"54% of high school graduates did not meet the ACT's college readiness benchmark levels in math, and 69% of graduates failed to meet the readiness benchmark levels in science"* (ACT, 2012). Statistics suggest the dire need of a shift in pedagogy and curriculum if the United States intends on keeping up with world leaders.

As states begin to adopt new science standards, an attempt for a formal push for outdoor education seems timely and appropriate. The Next Generation Science Standards (NGSS) have created a framework for meaningful student driven instruction that allows students to make connections with other content areas for a comprehensive education. NGSS suggests that much of the learning should be inquiry based, arguing that student's metacognition can be used as a measurable assessment. Due to the vastness of the outdoors and the open-ended nature of instruction, inquiry accompanies outdoor learning quite well.

NGSS is composed of three dimensions, which include, practices (see Table 1), crosscutting concepts and disciplinary core ideas. All three dimensions are combined in each standard thus guaranteeing lesson components of hands on activities grounded in real science (NGSS Lead States, 2013). With an emphasis on models, designs and investigations, students take an active role in their learning and express understanding through doing. Many lessons can be taught outdoors with the NGSS main ideas, which can be thought of as units: e.g. Interdependent Relationships in Ecosystems, Earth Systems and Weather and Climate (NGSS Lead States, 2013). These main ideas are visited more than once in the K-12 curriculum and the spiraling nature allows teachers to use the outdoors each time, but to a different degree of difficulty that is appropriate for the grade level.

Although NGSS main ideas strongly align with outdoor learning, there is still a lack of this type of instruction. Meals and Washburn research the reasons for the lack of outdoor education and present three barriers, which are *"curriculum demands, testing requirements and school district buy-in"* (2015, p. 10). Even with relevant standards, the persistent concerns of outdoor education is an outcry for meaningful professional development to shed light on the important potential relationship between outdoor learning and the NGSS.

Of the three barriers mentioned by Meals and Washburn, the factor that is most in teachers' control is school district buy-in. As stated with teacher efficacy, confidence in subject area can ease concerns from administration about the outcome of outdoor learning. NGSS and outdoor learning can take shape with the mindset of practicality and simplicity. Outdoor spaces may look different from school to school but they surround every campus. *"Learning experiences outside the classroom can help to enhance science lessons by making them more authentic and relevant"* (Fanning, 2016, p. 21). Professional development programs that put teachers in touch with this reality will help to advocate for school district buy-in.

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|---|
| **1 Asking questions and defining problems** |
| **2 Developing and using models** |
| **3 Planning and carrying out investigations** |
| **4 Analyzing and interpreting data** |
| **5 Using mathematics and computational thinking** |
| **6 Constructing explanations and designing solutions** |
| **7 Engaging in argument from evidence** |
| **8 Obtaining, evaluating, and communicating information** |

**Table 1:** The Next Generation Science Standards (NGSS) Science and Engineering Practices (NGSS, 2013)

## 5 Framework to transition lessons from indoors to outdoors

Both indoor and outdoor classrooms allow *"students to be managers of their own learning by taking charge of their responsibilities"* (Dhanapal & Lim, 2013, p. 5). Lessons presented in an inquiry-based format encourage students to take an active role in their learning. The open-ended nature of inquiry learning fosters differentiation and encourages students to take the lesson in different directions through collaboration and trial and error. These practices are rooted in science and are followed by professional scientists. The extent to which the concept is understood is contingent on student engagement, which is ultimately dependent upon the student himself. While the environment can persuade engagement, students' connections serve as self-validation.

The following framework can be applied to a pre-existing lesson that is traditionally taught in the classroom. By using these 5 steps, the teacher will be able to effectively teach the lesson outdoors.

| Area of Focus | Intended Outcome |
|---|---|
| **Content** | **Become familiar with curriculum and standards** |
| **Vocabulary** | **Present vocabulary to promote language acquisition** |
| **Questioning** | **Pose meaningful questions to support discourse** |
| **Materials** | **Collect tools and resources necessary to acquire skills** |
| **Location** | **Identify and locate accessible spaces on campus** |

**Table 2:** Framework to build an outdoor lesson (Danz, 2018)

## 6 Summary of Results

This chapter will share student feedback from the 2016-17 school year exit survey, which is given to each student in science class. Standardized test results will be shared and compared from 2015-16 to 2016-17 school years with the acknowledgement of an instructional shift to a larger emphasis on outdoor learning.

The end of the year survey asks students a variety of questions to get feedback on how the course was taught and how it can be taught better next year. When asked about the best part of the year, the majority of the students mentioned outdoor labs. When asked about practices that should be continued next year, students collectively responded, "More outdoor labs!".

When surveyed, students very much look forward to the prospect of going outside throughout the school day. 57% of students said that they were very excited about going outside during school and only 4% said that they were not excited at all to go outside. Going outside in the prior question may have been interpreted as leisure or unstructured time. A follow-up question was asked regarding going outside specifically for learning, which elicited an even greater response; 67% of students stated that they are excited when told they are going outdoors for science class. For many, it is the change of pace that brings forth excitement. More than half of the students polled stated that they preferred to have class outdoors compared to in the classroom and computer lab. They supported this choice with reasons like, "it gives us a chance to experience a real life example and really interact with what we are learning" additionally, students alluded to having more space to think and focus and to work with their hands. While enthusiasm for working in the computer lab (22%) or classroom (37%) was considerably lower, students stated that these locations are more comfortable and less distracting. Feedback of learning environment preference had a strong correlation with the ideal frequency to learn science outdoors. Most opted for a hybrid format and preferred that these lessons take place once a week because it allowed students to work in "different places ... instead of staying in one place everyday."

The following student is in accelerated earth science and stated that "We are inside all day and it's nice to learn in a different environment. Also, earth science is not an easy subject for me so being able to see examples of what we are doing in class in the real world is a great way to connect to what we discuss in class." Many other students expressed similar feelings that confirmed a benefit from learning outdoors. When asked to check off all

that applied, students acknowledged many positives of outdoor learning including, it is energizing (66%), hands on (71%), easy to relate to (39%), easier to understand (65%), and promotes thinking (41%).

In 2014-15, 66% of students who took the Earth Science Regents (n=50) achieved mastery by scoring an 85% or higher on the exam. In 2015-16, 75% of students who took the Earth Science Regents (n=52) achieved mastery. Additionally, out of those respective class sizes, two students failed the regents in 2014-15 and there were no failures for the 2015-16 students.

## 7 Conclusion

The sources mentioned throughout this article advocate for the implementation of outdoor learning. The benefits to outdoor learning include increased attendance, engagement, meaningful connections, and decreased behavior problems, anxiety and ADHD symptoms. Even with a list of benefits, outdoor learning lacks a strong presence in K-12 education. This can be attributed to low teacher efficacy and a shortage of professional development programs that focus on outdoor learning. Failure to teach science outdoors is a misuse of resources. Every school campus has a space outdoors that can be effective for science instruction. Outdoor spaces provide invaluable opportunities for students, giving them tangible observations to draw connections between lessons learned in and out of the classroom. The Next Generation Science Standards present a set of standards that call for student driven and hands on activities. In the midst of states adopting the Next Generation Science Standards, there needs to be a focused effort on outdoor learning professional development programs with a focus in raising teacher confidence to teach outdoors. The success of outdoor learning is reliant on buy-in from entire school community; equally invested should be curriculum writers, administration, teachers and students.

As the United States adopts a new set of science standards, it faces a deficit of environmentally related careers coupled with an expedited warming atmosphere. Education systems across the country need to take a stance and support outdoor learning. If one aspect of the world stands the test of time, it is nature. Nature and education share the same foundational beliefs, they are steadfast, accessible and complex. While it is in the core of every educator to provide students with the tools to become lifelong learners, formal education expires anywhere from the age of eighteen to typically the mid-twenties. Resources like teachers, textbooks and curriculum wane, but the accessibility and allure of nature will forever remain present. The answer to becoming a lifelong learner lies just beyond the window.

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