Developing the Grade 6 Action Learning Lab for the New England Innovation Academy

An Interactive Qualifying Project
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"Education is not the learning of facts, but the training of minds to think"

Albert Einstein

Abstract

The New England Innovation Academy (NEIA) aims to promote hands-on learning with interdisciplinary aspects from standard academic subjects such as Mathematics, English, Social Studies, and Science. The research team's goal for the Interactive Qualifying Project was to create a curriculum plan compiled of outdoor, project-based, interdisciplinary activities for the sixth graders at NEIA. To complete these goals, the research team conducted various interviews, a few focus groups, and secondary research to learn more about active learning, the benefits and drawbacks of outdoor learning, and potential activities that they could incorporate into the sixth grade curriculum plan. After the findings were compiled, the research team found common themes from the various sources and used them in the design of the curriculum plan. This plan has been presented to the NEIA sponsor and faculty, who will implement it in Fall 2021 when the school officially opens.

Acknowledgements

The team's project's success would not have been possible without the contributions from various individuals over the past four months, and the team would like to thank them for their positive impact on the achievements of the team's Interactive Qualifying Project.

First, they would like to recognize the sponsor, Tom Woelper, and his colleagues, Allen Babcock and Sally Booth. Tom, Allen, and Sally provided the team with constant support throughout the project's timeline. This included references for interviews and focus groups, strategies for curriculum design, and even attending the weekly group conferences to give advice and feedback on the status of the project's completion. Additionally, they would like to thank Michael Carroll, Aimee Van Wagenen, Ayla Gavins, Brady Wheatley, Anna Oliviera, Laura Twohig, who all presented the group with valuable information during the conducted interviews. Furthermore, they would like to thank Kevin Ramos-Glew and Carol Crane, for helping to organize middle school students and their parents so the team could conduct an informative focus group.

Lastly, the research team would like to thank their WPI Faculty Advisors, Professor Joseph Sarkis and Professor Hansong Pu. Both professors were extremely helpful with editing the final report, and with responding to any writing questions or strategy inquiries the team had during the writing process. They also provided essential feedback at each conference meeting, and they provided guidance regarding the logistics of the Interactive Qualifying Project.

Executive Summary

Over the course of the last century, few changes have been made to strategies used to educate the youth. Traditional classrooms focus on analyzing academic excellence through tests and quizzes, rather than promoting hands-on learning activities and lesson plans that better prepare students for their future. The New England Innovation Academy (NEIA), opening in the Fall of 2021 in Marlborough, Massachusetts, aims to do just that. The goal of this Interactive Qualifying Project is to create a curriculum plan for sixth graders at NEIA, incorporating interdisciplinary labs that teach students about the impact that their actions can have on the environment, helping them to develop into empathetic individuals.

Methodology

In order to complete the goal of this project, the research team followed these four steps:

1. Identify the learning objectives for the Grade 6 Lab and NEIA curriculum in general.
2. Identify qualities of effective learning and learning environments.
3. Identify relevant lesson plans that can be adapted to fit NEIA's curriculum.
4. Analyze information and make the best recommendations.

Learning objectives for the Grade 6 Lab and general NEIA curriculum were identified with NEIA faculty interviews. The majority of information came from several members of NEIAs Founding Team, including Sally Booth, Ayla Gavins, Allen Babcock, and Tom Woelper. Interviews with them and supporting documents gave the research team a stronger understanding of NEIA's desired teaching methods and what they expect the Grade 6 Lab to entail.

To ensure that the research team considered effective learning and environments while designing the Grade 6 Lab, seven individuals were interviewed to gain knowledge on topics such as interdisciplinary learning, active learning, and grading strategies. The interviewees had varying roles at their respective schools or companies, which provided the team with unique ideas and opinions. The research team also gathered the stakeholder perspectives for the project through interviews and three separate focus groups. The three focus groups included a group of middle school students, and students from the Ross School, in East Hampton, New York, and the Keystone School, in Beijing, China. Anna Oliviera, a former student at the Island School, in the

Bahamas, was interviewed about her experiences at such a unique school, which helped the research team develop some ideas that could later be presented to NEIA faculty members. These focus groups and interviews provided the research team an opportunity to collect common themes and ideologies that could then be supported by academic research.

Secondary research was used to support the information gathered in interviews or focus groups. Primarily, this research focused on concepts of active learning and ability inclusive grading, and how to make learning outdoors effective. Conducting secondary research was essential in finding activities to include in the Grade 6 Lab, and also provided guidelines teachers can follow so these activities are completed correctly.

The interviews, focus groups, and secondary research were analyzed through discussion, categorization, and conversation with the project sponsors. This analysis allowed us to recommend the most useful suggestions to the NEIA staff. The research team organized the interviews, focus groups, and secondary research by categories that align with qualities of NEIAs unique culture.

In order to finalize the recommended curriculum, the research team incorporated all of the Grade 6 Lab activities into a calendar, and assessed each activity based on five qualities; Engagement, Interdisciplinarity, Feasibility, Connection to the Natural World, and Connection to NEIA's Mission. Each activity received a score of 1 through 5 for each category to determine the overall quality of the specific activity. After a teacher completes the Grade 6 Lab with their students, they will reevaluate the grades for each activity to see where the activity can be improved upon.

Findings

The project data collected through interviews, focus groups, and secondary research led the team to the following Grade 6 Lab development findings:

1. **Outdoor education enhances learning.** Incorporating outdoor learning into a school's curriculum can promote student engagement and provide an effective learning environment. Learning in an outdoor environment allows students to invest in their natural curiosity in ways that pertain to the real world. Nature also provides positive effects on a student's moods and lowering their levels of cortisol, a stress hormone. These

results compounded with the greater sense of freedom that being outside helps students to be more relaxed, focused, and creative (Samuel et al., 2014; Kuo et al., 2019).

2. **Interdisciplinary learning is more applicable to the real world.** Adults are required to pull from a well of skills and knowledge to solve problems and think critically. A 2013 study by researchers for Harvard Project Zero concluded that in order for students to thrive in the global world, students need new capabilities that can be developed through interdisciplinary learning. Education research by Conner and Sliwka (2014) shows that students are able to conceptualize complex issues better when they consistently learn concepts through an interdisciplinary lens.
3. **Factory Model grading styles must be updated.** A student's academic progress cannot be described with one singular letter. The use of letter grades should be reformed in 21st century education systems to understand what skills they need to enhance are being fairly assessed on their learning and learning the skills they need to thrive in the future. Determining whether a student has mastered a new skill can be analyzed with methods other than letter grades, such as using portfolios, benchmarks, or conversation based grading.
4. **Ownership of campuses can be developed through personal responsibility.** Outside of the classroom, students should be encouraged to get involved in extracurricular activities that have positive impacts on the campus and surrounding community. This develops a sense of ownership for the particular school's campus. As students feel more engaged in their learning, they are empowered to learn more, make sense of the information they have gathered, and develop new creative ideas from what they have learned (Edwards, 2015).
5. **Community building makes for a great learning environment.** Developing a trustworthy and welcoming relationship between students and teachers, and peers makes a healthier learning environment. When students and teachers feel comfortable around each other, student participation grows, resulting in complex discussions and peer learning opportunities (D'Souza, 2017).

Recommendations

Based on the findings that the research team identified, the following recommendations were developed.

Recommendations for Course Instructors. Sixth Grade Lab instructors who are going to teach the Lab should utilize the template tables and documents provided as deliverables in this project. These templates will allow them to make any changes to Lab activities or replace any recommended activities.

Recommendations for Potential Instructors. The research team also recommends that NEIA hire instructors who are able to connect with students and build a community with them. Developing a trusting relationship with their instructors allows them to learn better.

Recommendations for Future WPI Teams. Future Interactive Qualifying Project (IQP) teams should consider this research team's report and deliverables to get an understanding of the types of lessons that work best for NEIA. Future research can explore lesson planning and work with the dedicated and passionate NEIA faculty.

Deliverables

Activities Master Plan. The Activities Master Plan consists of activity name, objectives of the activity, time required to complete the activity, materials needed for the activity, preparation of both the instructors and the students, different subjects that intersect, a step-by-step on procedure on how to run the activity, and if applicable, a link provided to where the activity was adapted from. This Plan provides 32 activities and corresponds to the Activities Calendar. The Plan provides teachers an easy way for activity planning.

Activities Calendar. The Activities Calendar maps out activities for the academic year and gives the name and the number of the activity so teachers can track it using the Master Plan. Calendar activities are also grouped according to themes or topics. The calendar also organizes the activities in such a way that the teacher creates a scaffolding of skills, which allows students to build on previously learned skills to acquire new ones.

Curriculum Map. The Curriculum Map was based on Booth's template that she shared with the team. It lists the activities that the team researched and developed and categories that the activity fulfills. It is ready for use for NEIA faculty. The Map contains a general activity description, learning objectives, activity materials, interdisciplinary aspects (STEAM'D, Cultural Tapestry, and Being. Well. Skilled), NEIA's four learning objectives, how the activity is going to be assessed, the duration, and estimated total time to complete the activity.

Activities Rank. An Activities Ranking sheet and a rubric to correspond with the five qualities listed on the ranking sheet are included. The five qualities include Engagement, Interdisciplinarity, Feasibility, Connection to the Natural world, and Connection to NEIA's Mission and were ranked from a scale of 1-5 based on each of the 32 activities the team came up with or researched about. A Total column on the ranking sheet shows how the activity gets incorporated in the sixth grade curriculum based on the numeric value.

Contributions

Josh Alasso

Josh performed secondary research on the history of education within the United States focusing on the factory model and standardization within the school system. In addition, Josh helped write and edit numerous sections of the report including the findings, background, and recommendations. Josh played a large part in creating the deliverables and finding lesson plans to adapt for the activities master plan and the curriculum map.

Winnie Ly

Winnie performed secondary research on topics of active learning, outdoor learning, and community building between teachers and students. Along with research, she helped the team write sections of the report such as the Background, Recommendations, and part of the Findings as well as helped re-organize the Appendix. She was a major contributor in completing and finalizing the deliverables. Winnie also looked over the report to help the team know which parts need to be completed and edited any sections to make the report stronger. She provided technical support when needed.

Maggie Reiter

Maggie performed secondary research on topics related to outdoor learning, benefits of interdisciplinary learning, and Massachusetts Grade 6 science standards. Additionally, Maggie led the communication between the WPI team and the HDU team and organized the two focus groups. Maggie was the primary author of the Methods and contributed equally to all other sections. Along with the rest of the team, Maggie developed the deliverables. Finally, Maggie worked with the WPI team to finalize the report and deliverables.

Zach Stone

Zach performed secondary research on topics of promoting student engagement, the benefits of outdoor learning, and how to create healthy student/teacher relationships. In addition to research, Zach was a large contributor to the Findings section of the report, along with Background and Appendix. Furthermore, Zach assisted in revising the final report and made edits wherever needed.

Table of Contents

List of Figures

List of Tables

1. Introduction

The current education system needs to accommodate a changing world. As the climate crisis and social issues grow in magnitude, educators and policy makers need to rethink education to prepare children to become future innovative leaders. Traditional classrooms reward academic excellence and don't provide an opportunity for self-expression. Schools need hands-on learning opportunities and creativity outlets to provide students with the most robust education in preparation for the real world.

The New England Innovation Academy (NEIA) seeks to reimagine education through an innovative curriculum and mission that promotes hands-on learning and exploring curiosities. NEIA is an independent college preparatory school opening fall of 2021 in Marlborough, MA. Tom Woelper, the head of NEIA, has observed students treating their campuses with a lack of respect at other college preparatory schools he has worked at. He believes the future will be bright if students see thoughtfulness as second nature (Woelper, n.d.). The faculty of NEIA understand that a major goal of educators must be to develop youth into confident thinkers, not just accurate test takers. In addition to impacting students, NEIA hopes they can continuously and positively contribute to Marlborough and the greater community through outreach programs.

The principles, philosophies, and culture that NEIA hopes to operate under are uncommon. This makes it difficult to compare NEIA to other schools, especially within the local area. Most schools—public and private— around New England utilize the factory model of education to some degree, which rewards academic excellence and focuses on values of discipline and reliability. However, NEIA's *Founding Team* is designing their assessment model to holistically assess students in order to accurately evaluate the quality of teaching. By judging students on academic competency, this model fails to factor in creativity and individuality, both of which are underlying values within the NEIA curriculum (Sir Robinson, 2006).

The overarching goal of this project is to develop a curriculum for NEIA's Grade 6 Action Learning Lab. The themes of the Lab should contribute to the school's greater mission of creating empathic, innovative individuals. The Lab will cover topics related to ecology, urban development, energy, and the general importance of the natural world. The curriculum plan will provide teachers with inclusive methods of tracking their students' academic progress, through hands-on learning that can be applied to the students' world outside of school.

Following this introduction is the Literature Review which goes into further detail on NEIA's mission, and shortcomings of the traditional education system. The subsequent section outlines the methodologies that this research team will use to gather research and how the team's counterparts at Hangzhou Dianzi University will contribute to the project.

2. Background

2.1 Past School Systems Within the United States

To thrive in a world that is constantly changing, students in the 21st Century need to take part in educational curricula focused on skills and values that are relevant in today's world, as opposed to those relevant in the past. The United States' education system has evolved over time, however, the world has evolved faster. Instead of adapting to changes that have already occurred, educators must think ahead and utilize curricula that prepare students for the future. In the words of Tom Woelper, NEIA's Head of School, "most schools are stuck in last century's Industrial Model of schooling; our students sit in classrooms that look too much like they did for their parents and grandparents, learning from a curriculum that has evolved too little over the past several decades" (Woelper, n.d.). What Woelper means is that there needs to be change in the curriculum through innovative pedagogical methods rather than relying on the past curriculum and traditional teaching methods.

This relatively static and unevolved schooling curriculum referred to by Tom Woelper is often called the Industrial Model of education or, from a more physical standpoint, Factory Model school see Figure 1 for a graphical reflection of a factory model school. Although modern educational models differ in various aspects, the Factory Model set the foundation that many current educational models are based. At the turn of the 19th Century, school systems within the United States began applying this Factory Model of schooling which centered itself around the virtues of discipline and reliability.

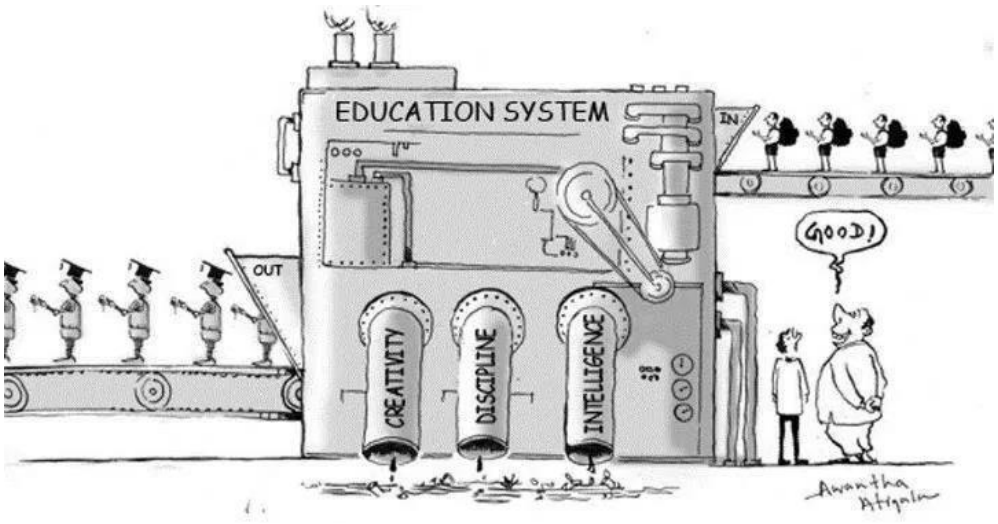


Figure 1: *The Factory Model of Education (Thompson, 2018)*

The Factory Model does provide students with basic skills in mathematics, literacy, history, and science, however, education in these subject matters was not the primary goal. Instead, the Factory Model of education aimed to sort students into predetermined parts of society. Thus, a primary goal of public education in the early 1900's was "to prepare young people for factory jobs that required them to perform some relatively simple task over and over again" (Leland, Kasten, 2002, p. 7). Hence the term Factory Model schools.

The goals set out by the Factory Model curriculum are less relevant in today's world, however, in the late 19th Century they did prepare students for the future. The way in which the Factory Model prepared students came at cost, primarily by rejecting creativity and well-rounded intelligence as shown in Figure 1. In order to achieve this goal, the curriculum trained students to follow specific step-by-step instructions in a repetitive and conscious manner. Placing emphasis on following rules and being obedient within the school system ensured that all students understood the value of knowing and then accepting one's predetermined place in society. In short, the Factory Model of education was "designed first and foremost to be the Great American Academic and Social Sorting Factory'' (Clinchy, 1993, p. 606).

After the Industrial Revolution in the United States, the philosophy of education began to evolve as evident by major education reforms. Earlier reforms focused on the inclusivity of education as the Factory Model facilitated a downward spiral of deep problems revolving around race, class, and inequality. In 1954, for instance, Brown v. The Board of Education required public schools to educate all children regardless of race. Although it was well intended, it did not guarantee equitable education (*Brown v. Board of Education*, 1972). Soon after in 1965, President Lyndon Johnson signed The Elementary and Secondary Education Act which provided federal funds as well as guidance to poorer children in public school systems (Wong, 2003). More recent legislation has also been passed to combat the racial and class inequalities that still exist within the United States' public education systems. The No Child Left Behind Act (2002-2015) and the subsequent Every Student Succeeds Act (2016) called for greater accountability of student academic performance. More specifically, The Every Student Succeeds Act requires all 50 states to test students in reading and math once a year in grades three through eight and once in high school. This act also requires every state to test students in science once in grade school, middle school, and high school (The Understood Team, 2020).

Although these pieces of legislation helped to combat inequalities within education, they also reinforced the Factory Model by placing emphasis on standardized tests. Instead of preparing students to work in factories, current school systems prepare students to take tests. The actual interest of students is lost because teachers focus solely on ensuring that their students memorize as many facts as possible in hopes that they remember these facts for the given test. The Every Student Succeeds Act does mention personalized learning, however, it does not provide guidance to help achieve it. In addition, schools who adopt personalized learning may struggle with the standardized test mandated by the Every Student Succeeds Act as they are largely based on the student's ability to memorize grammar principles and mathematical equations. Despite the limitations of these efforts, education reform legislation allowed for new models to emerge in the world of education.

2.2 Current School Systems Within the United States

Most innovative education models like project-based learning (PBL) and interdisciplinary learning can be linked back to the Dewey approach. Some would argue that John Dewey was the most significant educational thinker of the 20th Century. Dewey viewed the development of practical skills and "learning by doing", also known as the constructivist approach, as essential to children's education and not to put too much emphasis on teachers being the main source of their learning (Ültanır, 2012). NEIA's approach to education can be thought of as a redefined Dewey approach that emphasizes "hands on learning" that improves student engagement and performance otherwise known as active learning (Only a Teacher, n.d.; Freeman et al., 2014).

Active learning is a method where teachers are facilitators of the students' active engagement. Problems are solved through asking questions, discussing ideas amongst group members, making predictions, and then collecting and analyzing data. Many 21st Century educators believe that this self-directed learning strategy, which promotes both student engagement and motivation, is much more effective than typical teaching strategies in which the educator is the one in control of the student's learning. If students are solely focused on retaining what a teacher presents to them, there is no acknowledgement of an end goal. Besides the end goal being passing the standardized exams, the students have no sense of urgency to work

productively alongside their peers, acquiring skills from a variety of disciplines in the meantime (Lam et al., 2009).

With active learning, students are improving conceptual thinking, critical thinking, and interpersonal skills (DiYanni, 2020). Passive learning does have some effective points such as having the instructor be the one in control of presenting the information to students and its very structured format. However, it does not create a lasting learning experience for the students as they grow and develop. In an active learning environment, students are participating in the classroom by asking questions, problem-solving, analyzing and synthesizing research data they have gathered, and connecting what they have learned to the real world (DiYanni, 2020). In order to create lasting learning, students need to gain experience and be engaged intellectually, socially, and physically (Edwards, 2015).

Intellectual engagement offers opportunities for problem-solving and critical thinking skills. Through this type of engagement, students make sense of the data that they have gathered and present their synthesized findings. For social engagement, students can work together in groups to complete a task or a project. Collaboration between students can make them more comfortable around their peers as they share their ideas and experiences when completing a project together. By working together in groups, students are exposed to diverse perspectives which can result in various approaches to problem solving. Physical engagement is crucial in a students' education because it provides them with hands-on experiences that are more clearly relevant to the real world. Most hands-on learning activities can take place anywhere but are most effective in conjunction with out of classroom learning related to science (Eick, 2012).

Despite the evolution of education systems in the 21st Century, the underlying values created by the Factory Model are still instilled in students to some degree, especially within public school systems. In an interview with Woelper, who has worked at various schools, say: "... the long cultural history of these schools had them tied to that paradigm we've talked about, that industrial model paradigm," (T. Woelper, personal interview, Nov. 18, 2020). Values such as obedience, compliance, cleanliness, and punctuality are still prevalent and even emphasized in modern curricula. Together, these values uphold the overarching value of standardization.

Typically, every student in a given grade is expected to learn the same material in the same time frame by using recommended learning strategies, henceforth promoting this idea of standardization. Furthermore, students who retain required information at a slower rate than their

peers are seen as academically delayed, and in need of additional assistance, much like a rejected product on an assembly line (Leland and, Kasten, 2002). Ultimately, schools overlook the intellectual proficiencies and passions of students because schools receive more funding if they produce higher test scores. The problem with this is that achieving high test scores is not the preparation students need to thrive in the 21st Century. Some of the current academic models at the primary and secondary level in the United States, such as NEIA, are striving to address the skills and values required to be future innovators.

2.3 New England Innovation Academy Background

NEIA will call Marlborough, Massachusetts home upon opening in 2021. The physical building was once a Verizon Training Center on Locke Drive, at the end of an industrial park. The school will serve grades 6-12 and provide room and board to international students. NEIA officials selected Marlborough due to its rapidly expanding biotech sector. In addition, Marlborough and the surrounding area is home to a variety of multinational businesses and higher education institutions. The Marlborough location is essential to several aspects of NEIA's objectives. When Woelper was interviewed by Malachowski for the Metrowest Daily News, he emphasized that "NEIA really wants to make a difference locally ...we want to be more than a good neighbor" (Malachowski, 2020). NEIA aims to build connections with the surrounding colleges and businesses to provide its students with unique projects and real--world experience. Additionally, Woelper hopes that the diverse student body at NEIA will provide these colleges and businesses with unique perspectives by exposing them to the school's philosophies. The Founding Members are designing the curriculum and mission to promote hands-on learning and empathetic thinking.

One key aspect to NEIA's goal is to operate within principles of Human-Centered Design (HCD) as this will establish empathetic working attitudes in the students. HCD is a design process that uses the experiences of the target user to guide decisions. It can be applied to systems, services, or products. When a designer is guided by HCD they might complete extensive research and surveys on the target audience. (Cardella, et al., 2012).

Dr. Sally Booth, the Director of Teaching and Learning at NEIA, highlighted four key components of HCD strategy. These key components include hard products, digital components, social components, and services. Essentially, lesson plans must be hands-on and need to be

tracked and analyzed through different forms of technology. After this activity is complete, students are encouraged to share their acquired knowledge with their friends and family outside of school, teaching them about the importance of whatever topic the activity covered. Inevitably, this will improve both the surrounding community and the world as a whole.

NEIA (its brand image is seen in Figure 2) aims to help each student create their own Passion Driven Purpose, Idea to Impact, and a Next Generation of Innovators (P.I.N.) (neiacademy.org). Passion is essential in early education; understanding yourself and acknowledging that each student has their own potential. With passion comes purpose, motivating students to use the skills they acquire at NEIA to change the surrounding world in a positive manner. Idea to impact is the need to think of creative ideas and solutions to address real world problems.

Figure 2: NEIA's Pin

Throughout the time spent at NEIA, this next generation of innovators will come to see that they can be part of the solution to an endless variety of environmental, social, and economic issues, and thus be better prepared to thrive in the 21st Century.

2.4 NEIA Curriculum

As NEIA is an independent school, they have the freedom and power to design the structure of their curriculum in a way that they believe will be most beneficial to their students and the surrounding community. While NEIA does not need to be accredited, school officials still desire a curriculum that is applicable to students' futures. NEIA will have curriculum and sustainable practices that may not be present in traditional schools, and therefore may need to recruit a specific type of student. Woelper writes, "NEIA is looking to attract curious students that are interested in contributing to the world beyond themselves" (Kressy & Woelper, 2020). In other words, all students and staff at NEIA are encouraged to be dedicated to bettering themselves to positively influence the world as a whole. NEIA students will be equipped with the tools they need to venture into the world as innovators and problem solvers. The school aims to do this by filling their curriculum with real world, interactive projects and activities.

NEIA's curriculum will be strengthened by an interdisciplinary approach to lesson plans that will best prepare them for their future. Typical schools tend to separate their curriculum plans subject by subject. Interdisciplinary learning allows students to get a better understanding and achievements across different disciplines (Jones, 2009). NEIA believes that combining subjects with overlapping concepts is the most effective way to educate their students about the important ideas of each subject, and is the most applicable to the real world as well. History, English, geography, and other subjects will be taught through a section called Cultural Tapestry. Science, technology, engineering, art, mathematics, and design, otherwise known as STEAM'D, will be taught in another section. Finally, a section called Being. Well. Skilled. will be offered to educate students (See Appendix A for an example weekly schedule). These three sections can be represented as strands that intersect with each other, allowing students to learn a variety of topics that connect to more than one subject. That is the fundamental basis of interdisciplinary learning (See Figure 3).

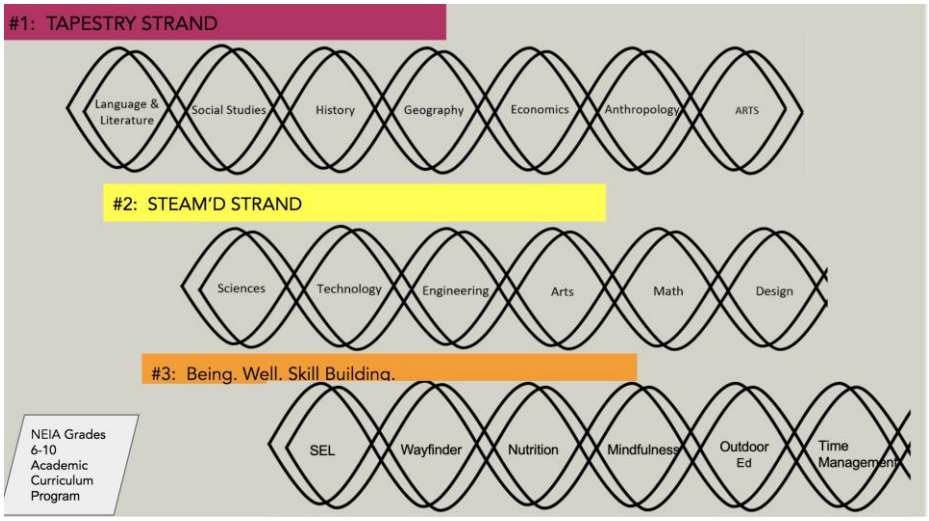


Figure 3: Topic of Interdisciplinary Approach

A section dedicated to hands-on applications of the information learned in other courses will bring these concepts together. This section, known as the Action Learning Lab (Lab), will meet twice a week but may extend into other sections. This lab will provide students with the ultimate opportunity to take an active role in their learning.

The Lab for grades 6 through 9 will pose real world questions such as what other alternative energy sources can be used to lower everyone's carbon footprint or what are some effective ways to help people become more environmentally aware of their surroundings - to

students through a hands-on course on four different topics. In general, the purpose of Lab is to connect the subjects of other classes to the scope of the Lab. This will require students to use the knowledge they learned in other classes to tackle new challenges, such as running the school store or measuring water quality. The interdisciplinary approach of Lab will strengthen students' understanding of the subjects taught in other classes.

The focus of this IQP is on the Grade 6 Lab, which will cover topics related to the environment, local ecology, energy, and the students' role in relation to those areas of study. The lessons of this lab will take the students outside to the neighboring Howe Pond Land (see Figure 4).

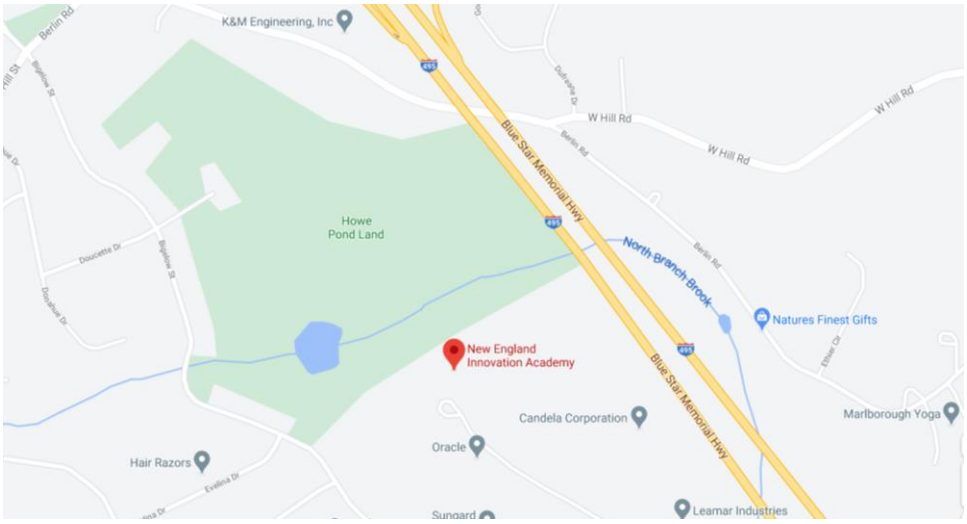


Figure 4: Howe Pond Land

Students will be encouraged to connect with nature in the classroom and on the campus to not only learn about science and history but also mindfulness and sense of self. NEIA wants their students to learn how to solve problems systematically and conventionally, using the resources surrounding the NEIA campus. Learning valuable skills through nature will give NEIA students an empathetic mindset, acknowledging that everything they do affects the surrounding community, whether this may be positively or negatively.

The goal of this Interactive Qualifying Project (IQP) is to provide the school with a plan for the sixth grade Lab that incorporates student-gathered data that NEIA can use to track sustainability efforts for the academic year which comprises about 33 weeks. In the next section of this report, the methods that will be used to make these recommendations are detailed.

3. Methodology

The goal of this project was to make recommendations to the sponsors for the Grade 6 Lab that provide students with the opportunity to connect and integrate topics from across disciplines to the outdoors. The steps that the research team used to achieve this goal includes:

1. Identify the learning objectives for the Grade 6 Lab and NEIA curriculum in general.
2. Identify qualities of effective learning and learning environments.
3. Identify relevant lesson plans that can be adapted to fit NEIA's curriculum.
4. Analyze information and make effective recommendations.

In this section, the methods that the research team developed to gather and analyze research on the subject and methods used to make recommendations are detailed.

3.1 Identify the Learning Objectives for the Grade 6 Lab

The first objective of this project was to understand NEIA's expectations for a successful class, including the learning objectives, and Lab logistics. The research team collected documents and completed a series of interviews with members of the Founding Team of NEIA to achieve this objective. The interviews between the Founding Team and the research team were semi-structured. This interview style is a combination of two other interview strategies, structured and unstructured. Semi-structured interview questions are about a predetermined topic, but are open ended and allow space for the flow of natural conversation. The research team used this interview style to gain information while working collaboratively with Founding Team members. Other interview styles, like structured, would limit the conversation and inhibit productivity. Similarly, unstructured interviews with no prepared questions would inhibit productivity (Horrell, 2019).

Through interviews with Sally Booth, Ayla Gavins, and Tom Woelper, the research team gained an understanding of the pedagogy of NEIA and expectations for the Grade 6 Lab. This included academic requirements and learning objectives of NEIA. As members of the Founding Team, Booth, Gavins, and Woelper were the most direct source of information as they were responsible for designing all other aspects of NEIA. The research team learned the four learning objectives that should be considered when designing any class at NEIA. These learning

objectives helped the IQP research team to learn what factors were important when recommending Lab activities. The team also was informed on how most subjects taught would be integrated into other subjects such as how English Language Arts and Social Studies are linked through the topic of the Industrial Revolution. This interdisciplinary nature of the academics at NEIA ultimately served as one of the major pillars of the research team's recommendations.

In addition to the interviews, the research team collected documents from Booth and Allen Babcock (Founding Member) including the academic year calendar and weekly schedule. The weekly schedule allotted two 45-minute-long periods to Lab each week. The activities proposed for the Lab could be completed during other periods due to the interdisciplinary aspects of the activities. The details learned through the interviews and documents informed the research team on decisions that would best fit the requirements of NEIA.

All interviews were conducted over online meeting platforms. Prior to the meetings, one member of the research team was designated to be the facilitator. The facilitator asked prepared questions and follow up questions to keep the conversation on task. Other members of the research team took notes by hand. All notes from interviews were compiled and organized in a shared document. The Interview Protocol for NEIA Faculty can be found in Appendix B and Interview Results for NEIA Faculty in the following appendices.

3.2 Identify Qualities for Effective Learning

The second objective of the team's project was to understand what types of qualities are effective for student learning. To accomplish this, they interviewed instructors and educators as well as students to gain both perspectives on what makes learning effective for them. The team also did secondary research to further investigate other qualities that may have not been mentioned from their interviews.

3.2.1 Instructor and Educator Inputs

In order to develop a curriculum plan for sixth grade students attending NEIA, seven individuals in the field of education were interviewed to gain knowledge about topics such as interdisciplinary learning, active learning, inclusion, and grading. Table 1 below lists the people interviewed. These interviewees were contacted by email and interviewed through online

meeting platforms. The interviews were recorded and at least one person on the team took notes. See Appendix E for Interview Protocol for Faculty at Innovative Education Institutions and Interview Results for Faculty at Innovative Education Institutions in the following appendices.

Table 1: Interviewees

Name	Position	Interview Protocol
Sally Booth	Director of Teaching and Learning at NEIA	Appendix A
Ayla Gavins	Head of Curriculum Development at NEIA	Appendix A
Tom Woelper	Head of School at NEIA	Appendix A
Aimee Van Wagenen	ELA, Psychology Instructor at Boston Green School	Appendix E
Mike Carroll	Sustainability Director and Instructor at Worcester Academy	Appendix E
Brady Wheatley	Head of Upper School at Rocky Hill Country Day School, former instructor at the Island School	Appendix E
Robert Mullins	Executive Principal of Hangzhou Wahaha International School	Appendix J
Laura Twohig	Regional Education Leader at Steelcase	Appendix E

The purpose of the first interview with Sally Booth was to learn from her perspective as the Director of Teaching and Learning what qualities and practices the research team should focus on when creating the curriculum. The team's interview with Ayla Gavins served a similar purpose. Both Booth and Gavins worked on developing all aspects of NEIA's curriculum so their input helped the research team recommend the most relevant curriculum. The protocol for interviewing Booth and Gavins appears in Appendix B. Tom Woelper informed the team on the mission and some core values of NEIA. As the Head of School and the sponsor of our project, understanding Woelper's perspective was integral to the project. Topics of discussion for all

three interviews included interdisciplinary learning and outdoor learning which contributed to establishing the focus of the Lab.

The purpose of the interviews with Aimee Van Wagenen, Brady Wheatley, Mike Carroll, and Robert Mullins were to gain the perspective of experienced instructors and administrators. In addition to leading the upper school of a progressive school, Wheatley previously taught at the Island School. This experience gave her a unique perspective from both an administrator of a private independent school and nontraditional school. The purpose of this interview was to learn how interdisciplinary learning could apply to the Grade 6 Lab. The facilitator asked questions about active learning, inclusivity, and grading. Van Wagenen, Carroll, and Mullins gave their perspectives on incorporating interdisciplinary aspects, especially those related to the environment, into teaching. As a representative from Steelcase, a company providing classroom designs and potentially furniture to NEIA, Laura Twohig was able to provide detail on how the NEIA classrooms may look. This understanding allowed the team to make decisions related to the curriculum that would fit the structure of NEIA the best. Additionally, she shared some research and ideas that she previously developed when she created a pond bug identification activity for seventh grade students.

The information gathered from these interviews gave the research team an understanding of which traits made a more engaging and lasting learning environment for students. That information also led the research team to define effective learning as thoroughly developed lessons that prioritize supporting diverse learning styles with expectations for the students explicitly communicated. One of the most important aspects of effective learning revealed through interviewing these professionals was student engagement. The experience and expertise of the educators the research team interviewed were essential to the research process, but could not provide the perspective of the stakeholders, students. The following section details how the research team gathered information from students to develop the best curriculum for NEIA students.

3.2.2 Student Information Acquisition Process

To gain the perspective of the student stakeholders of this study, the research team interviewed Anna Oliviera, a former student of the Island School, and completed two focus

groups with students. Table 2 provides some information of the parties involved in these qualitative research methods.

Table 2: Student Data

Name	**Method Type**	**Description**
Anna Oliviera	Interview	Former student at the Island School, current college student
Middle School Students	Focus Group	Nine student participants, middle school age, potentially applying to NEIA
Ross School	Focus Group	Five student participants, seventh grade students at the Ross School

The team's first interview was with Oliviera. She was contacted by email for scheduling with the interview being completed over Zoom. The purpose of the interview was to gain the perspective of a student that attended a school which focused its teaching and culture on sustainability. During Oliviera's interview, she declared the importance of passion and reflected on the ways her time at the Island School positively impacted her life. The protocol for this interview can be found in Appendix L and Interview Results for Students at Innovative Schools in Appendix M.

The research team conducted two focus groups with students to gain their perspectives. The first focus group interview scheduling was supported by Kevin Ramos-Glew, the Dean of Enrollment at NEIA. Ramos-Glew assisted the research team in gathering the student participants and distributing information to their parents prior to the focus group. Ramos-Glew asked for volunteers from a group of prospective NEIA families. The purpose of this focus group was to learn about the interests and learning preferences of some middle school students. Topics of discussion also included their experiences spending time outside and learning outside. The perspective of this group of middle school students was valuable to gather because as they may apply to NEIA in the future, they are potentially the types of students that will attend NEIA. See Appendix N for Focus Group Protocol with Potential NEIA Applicants and Appendix O for the results.

The second focus group was with students at the Ross School in East Hampton, New York. The research team's contact was Carol Crane, a middle school teacher and past colleague of Booth. Crane helped the team by gathering a group of students, obtaining parental consent, and organizing the Zoom call. The purpose of this focus group was the same as the focus group with prospective NEIA students. The protocol and results can be found in Appendix P and Appendix Q.

The interviews and focus groups were used to collect individuals' perspective on effective learning revealed common themes and ideologies that could be supported by academic research. The following section describes the methods used by the research team to complete this research.

3.2.3 Using Secondary Research

The results of the interviews and focus groups revealed ideas and topics to the researchers much of which can be matched to secondary academic research. In addition, the team used their definition of effective learning to guide the secondary research. The team focused on areas of education research including, active learning, ability inclusive grading, and effective outdoors learning. This research led the team to understand what qualities of lesson plans would improve the learning experience of the students. One of the most important aspects of effective learning revealed through this research was student engagement.

Additionally, the researchers used secondary research to collect lesson plans. The research team used information from Founding Members and Massachusetts Grade 6 science standards to identify topics of interest for the activities. Researchers also used phrases such as "Outdoor STEM activity", "6th grade outdoor lesson plan", and "Interdisciplinary outdoor lesson plan" to search Google for free, preexisting lesson plans. The Secondary Research Protocol can be found in Appendix R and the results in Appendix S.

3.3 Identify Relevant Lesson Plans for NEIA's Curriculum

After identifying the learning objectives of the Grade 6 Lab and the qualities for effective learning, the research team began identifying what lesson plans would be relevant for NEIA's curriculum. The common themes from the team's research methods were student engagement,

hands-on learning, student choice, and different grading styles. These themes helped the team determine which activities to include in NEIA's curriculum plan. The team also conducted research on the Science standards for the state of Massachusetts. Understanding the standards helped the team identify which lesson plans are more suitable for a sixth--grade curriculum.

3.4 Recommend a Plan for NEIA's Curriculum

The research team analyzed the results of the interviews, focus groups, and secondary research through discussion, categorization, and conversation with the sponsors to recommend the most applicable curriculum for the sponsors at NEIA. The results of the interviews with the Founding Members provided the research team with the information needed to build the foundation of what an excellent class for NEIA students would be. Qualities expressed by the NEIA faculty were supported by information the researchers gathered from secondary research. The researchers used these findings to guide the selection of lesson plans.

3.4.1 Organize Data

Following the researcher team interviews, they compiled their notes from the sessions into a single shared document. Through group discussion, the team organized the results by category. The team established these 11 categories:

1. Out of classroom learning
2. Outdoor learning tips
3. Student involvement
4. Grading ideas
5. Passion
6. Community building
7. Ownership of campus
8. Choice
9. Inclusivity
10. Takeaways
11. Interdisciplinary Academics

The team also used these categories to organize the results of the focus group. These categories aligned with the important qualities of NEIA's culture as determined by the Founding Team interviews. The team used these categories to guide further research.

After the completion of secondary research the team organized the information according to the question that the research answered. These questions include:

1. How can teaching be improved to better prepare students for climate challenges (and other global issues) in the future?
2. What makes outdoor learning successful?
3. How does exposure to the environment benefit learning?
4. How do Student/Teacher relationships contribute to the effectiveness of outdoor learning?
5. Which factors promote student engagement while learning outdoors and why?
6. What are the benefits of field trips/hands on learning experiences?

To organize the lesson plans that the research team collected, they used a curriculum map structure that was an expansion of a map sample provided by Dr. Booth (See Figure 5). This allowed the researchers and sponsors to clearly see the details of each lesson. A more complete example of the curriculum map is found in Appendix T.

	Activity 2: Trail Building
Description	Students create pathways through the woods surrounding NEIA campus
Learning Objectives	1. Learn how to explore in nature, while respecting it 2. Understand the history of the land 3. Make observations of the environment with their senses (feel, hear, smell, see) 4. Make solutions on how to conserve the trail 5. Become familiar with land
Needed Materials	Rakes, branch clippers, gloves, etc. Tick Spray.
STEAM'D	Science: Flora & Fauna Classifications. Biology. Technology: Engineering: Any structures needed to tranverse streams, etc. ? Art: Sketch out the pond, landscape, in a topological map. Add layers with some possible trail designs. Mathematics: Measure length, distance between points along the path. Geometry. Design:
Cultural Tapestry	Human Ecology: Adaptation to central Mass in history. History:

Figure 5: Curriculum Map

3.4.2 Analyze Data

Throughout the research process, the team was meeting with their sponsors regularly, so the team was constantly applying feedback and improving their direction. These discussions ensured that the team was on track to recommend the most applicable curriculum for NEIA.

May 2022						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
	Act 25: Effect of development on environment		Tree log update	Cinco de Mayo Fiesta		
8	9	10	11	12	13	14
	Act 26: Solution session on how to prevent		Take samples of pond			
15	16	17	18	19	20	21
	Trail Maintenance Day		Act 30: Nature Tower	Grade 6 Share Session		
22	23	24	25	26	27	28
	Act 31: Dew traps		Tree Log Class Reflection (Assessment)			
29	30	31				
	Memorial Day					

Figure 6: Activities Calendar

In order to finalize the recommended curriculum, the research team mapped the activities to a school calendar (see Figure 6) to ensure the timing of the activities. The team assessed the activities based on five qualities (see Appendix U). The five qualities and their definitions are:

1. Engagement - The activity is carried out in a way that is most suitable for the given conditions (i.e., weather, season, etc.)
2. Interdisciplinarity - The activity integrates multiple subjects and the four learning objectives established by NEIA. The connected disciplines need to have a purpose and the overlap must create a more authentic understanding.
3. Feasibility - Difficulty of gathering needed materials, resources, required preparation/collaboration, and location
4. Connection to the Natural World - The setting of the activity benefits students learning whether it takes place inside or outside of the classroom.
5. Connection to NEIA's mission - Does the activity promote P.I.N. and incorporate global perspectives, human centered design, purposeful interdisciplinary

approaches, and obvious real world learning aspects.

		Qualities (rated on scale of 1-5)					
Activity Name	**Theme**	Engagement	Interdisciplinary	Feasibility	Connection to the Natural World	Connection to NEIA's Mission	Total
Get to Know Your Campus	(Orientation idea)	Oreintation					0
Tree Log	Ecology	5	5	5	5	5	25
Solo Nature Walk	Environmental Awareness	5	2	5	5	4	21
Trail Building		5	4	1	5	4	19
Field Journaling	Ecology	4	5	5	5	3	22
Native and Invasive Species	Environmental Awareness	5	3	5	5	5	23
Endangered Species	Environmental Awareness	5	3	5	5	5	23
How Does Insects Contribute to the Ecosystem/Bug Collecting	Ecology, Environmental Awareness	5	3	5	5	5	23
Nature Photography	Environmental Awareness	5	3	4	5	3	20
Composting in Soil	Ecology	3	3	5	4	2	17
Forest Fires	Environmental Awareness	2	3	2	4	2	13

Figure 7: Numerical Justification of Recommended Activities

The researchers developed a rubric that included the five categories and scored the categories on a 1 to 5 scale, with 1 indicating that an activity did not meet any standard for effective learning, and a 5 indicating that the activity was ideal for effective learning. The process of ranking activities allowed the researchers to see which were the lowest, and should be replaced. The researchers decided that an overall total score across the five qualities of 19 to 25 meant the activity would be the most effective; a score between 15 to 18 was still acceptable. If the score fell between 10 and 14, the activity should be reexamined, and below 10, the activity should not be included. The complete protocol for the justification of these activities and rubric appears in Appendix V.

3.5 Ethical Considerations

Prior to collecting information from human subjects, the WPI team received approval from the WPI Institutional Review Board (IRB). To use minors as the subject of research, parental consent was required. The parental consent script can be found in Appendix W.

3.6 Deliverables

The research team delivered the results of the study to the sponsors at NEIA in this written report, and included explicit recommendations through the Activities Master Plan, Curriculum Map, Curriculum Calendar, and Curriculum Justification and Rubric which can be found in Appendices X, T, U, and V respectively. The Activities Master Plan is a complete compilation in common lesson plan format that explains in more detail the requirements of each activity (See Appendix X). An example of this format can be seen in Figure 8.

Activity 3: Solo Nature Walk

Objective: Students will practice mindfulness and sharpen their senses as they follow cue cards on the trail to navigate alone in nature.

Time: 45 minutes

Materials: Field Journal

Preparation: The instructor(s) will put up cue cards along the trail so students will be able to navigate alone without getting lost and asking for help on where to go next to reach the next checkpoint.

Interdisciplinary Aspects: Observational skills, Mindfulness

Procedure:

1. Students will individually follow the trail of cue cards that were set up by the instructor
2. Along with walking on the trails, the student should use their senses (smell, hear, see, touch) and write down any observations in their field journal
3. Have students find or write down a piece of nature that represents them

Assessment: Not graded, but hold a class reflection at the end of the period.

Adapted from:

https://cnps.org/wp-content/uploads/2018/03/cnps_plant-solo-walk_2017-1.pdf

Figure 8: Activities Master Plan

Ultimately, the documents that the WPI research team developed can be used by instructors of all classes to organize and assess activities. The Curriculum Justification should be used by instructors of the Lab so they can compare the realities of the recommendations to the intentions of the researchers. The Project Timeline can be found in Appendix Y.

4. Findings

4.1 Outdoor Education Enhances Learning

Incorporating outdoor learning into a school's curriculum can promote student engagement and provide an effective learning environment. The interviews with faculty from a variety of backgrounds provided evidence of a correlation between a student's academic performance and outdoor learning. In an interview with Michael Carroll, see Appendix G, he stated that learning in an outdoor environment allowed students to invest their natural curiosity in ways which pertain to the real world. If students spend very little time outdoors, it causes nature-deficit disorder in which they do not know much about the environment and it makes them not care about the issues revolving around it (Huff Sisson, 2017). He believes that the outdoors offers endless real--world connections which are essential to youth learning. Both Carroll and Anna Oliviera, the student from the Island School, claimed that learning about the environment should take place outside to benefit the students the most.

4.1.1 Learning Outside Reduces Stress

From secondary research, the team summarized that having students learn outside in the natural world improves their attention in learning, lowers stress levels, and enhances enjoyment in what they are learning (Kuo et al., 2019). With reduced stress levels and better concentration, students perform better academically, as they feel re-energized and ready to learn when returning to the classroom (Merritt, 2017).

Brady Wheatly supported that claim during her interview with the research team, noting that she observed that when students spend time learning outside, they are calmer when they return to the classroom. Research conducted by Ming Kuo, Michael Barnes, and Catherine Jordan, in 2019 also supports this. Their study found that nature has positive effects on a student's mood and lowers their cortisol levels, a stress hormone. This result compounded with a greater sense of freedom that being outside helps students to be more relaxed, focused, concentrated, and creative (Samuel et al., 2014; Kuo et al., 2019). This sense of freedom results from the lack of physical and mental restrictions outdoors, and students are not constrained or limited in the classroom, and not pressured to complete a task or take a test (Merritt, 2017). The

opportunities that result from learning outside allows for students to engage with their peers and teachers which is a component to active learning.

4.1.2 Learning Outside is Good for Engagement and Active Learning

Active learning, compared to passive learning, creates long lasting learning in students by empowering them to think critically instead of memorizing knowledge to prepare for a standardized test (Edwards, 2015). Wheatley also mentioned in her interview that having students complete hands-on projects allows them to be engaged in their learning which results in long lasting learning. Hands on learning is supported by outdoor learning as students have access to a larger space that has nature elements such as trees, shrubbery, sticks, leaves, stones, and other vegetation that they can observe and explore. These physical and natural elements foster longer engagement, more cooperation, and better behaviors in students compared to traditional materials (Merritt, 2017; Samuel et al, 2014). From the data gathered from the focus group of potential NEIA applicants, the students emphasized how doing hands-on projects was more helpful than sitting in a classroom and listening to a teacher lecture. They believe that learning in a classroom is important however, adding some exposure to it allows them to develop some essential skills. The physical engagement benefits students as they develop their skills in leadership, problem-solving, communication, teamwork, and analytics as they are learning (DiYanni, 2020).

4.1.3 Traditional Learning is Still Required

Some interviewed faculty mentioned that in some cases traditional indoor learning can be more effective. What is most effective for learning one topic may be listening to a teacher lecture for 45 minutes. As important as it is for students to be enjoying their learning, it is important for the mode of learning to be the most appropriate. Student participants in the Ross School Focus Group claimed that they enjoy a balance of student led learning and teacher led learning. These participants recognized that teacher expertise can help in guiding them to a point where they can take over. Ultimately, research does conclude that outdoor learning provides more benefits with student engagement and longevity in their learning. Students are more likely to perform better academically and make connections to real world problems when they are outside (Edwards, 2015; DiYanni, 2020). The outdoors provides an endless supply of issues such as climate change

and social injustice that needs to be solved, and working towards possible solutions not only teaches students valuable lessons and life skills, but benefits their surrounding community as well.

4.2 Factory Model Grading Styles Must Be Updated

A student's academic progress cannot be described with one singular letter grade. The use of letter grades should be reformed in 21st century education systems to ensure that students are being fairly assessed on their learning, and learning the skills they need to thrive in the future.

4.2.1 Mastery of Skill

Interview and focus group data collected by the research team aligned with characteristics of mastery of skill. Unlike comparative grading, mastery of skill focuses on the extent of success regarding the students' learning. Mastery grading systems do not require a fixed time period for determining a student's grade, so it supports different learning styles. If students learn at different paces, slower learners are not at a disadvantage (Juarez, 1994). Mastery of skill accounts for student development over time and in turn, requires effective feedback.

4.2.2 Portfolio

Aimee Van Wagenen, a teacher at Boston Green Academy, believes that documenting work is the most effective way to determine whether a student has made academic progress. This may include photos, drawings, journal entries, or anything that allows a student to reflect on how the quality of their work has progressed over a period of time. Brady Wheatley, former teacher at The Island School in the Bahamas, and now the head of Upper School at Rocky Hill Country Day School in Providence, Rhode Island, described various innovative means of grading during an interview. First, she presented the idea of skill based grading, where students are evaluated on four key themes: reasoning, speaking/listening, writing, and organization. This involves giving students two to four grades on each theme for each assignment, but does not provide an overall numerical grade. This allows the students to see the areas they need to focus on specifically.

4.2.3 Student/Teacher Collaborative Decision

Wheatley also presented the idea of a conference grading system, where students and their teacher discuss the quality of their work and agree on the grade the student should receive. This allows for a conversation circled around constructive criticism and acknowledgment of quality work as well, as compared to a letter at the top of an essay.

The method of conference grading systems could also be accompanied by a system where students create their own personal grading rubrics and get them approved by a teacher. This gives the students an opportunity to set goals for themselves and promotes self accountability as they know exactly what needs to be done in order to perform well on whatever their task may be.

In the HDU team's interview with Robert Mullins, the Executive Principle of the Wahaha International School in Hangzhou, China, he highlighted the school's use of a process similar to a conference grading system. When a teacher is planning an activity for their students, discussing the details of it with the students can allow them to grow as a learner. Discussing things like how the student will complete the activity, what resources they need to complete it, and what support they will need from the teacher gives students more control in their learning. The teacher's role should be to guide students while still leaving room for the students to explore independently.

4.2.4 Providing Clear Feedback is Important

Teachers must provide students with specific feedback on their assignments to give students the information they need for improvement. Douglas B. Reeves, founder of The Leadership and Learning Center, an international research and professional development organization, stated in an article that students cannot connect their teacher's feedback to their academic performance if the feedback is not clear. In addition, he expressed that to students, grades are an important form of feedback (Reeves, 2014). The data collected during the team's research revealed that the mode of grading is not too important, as long as students can best demonstrate what they have learned.

During the team's focus group with potential NEIA applicants, it became clear that the majority of students did not object to letter grades, number grades, or check grades as long as they understood what they got wrong. One student who was evaluated using a check minus, check, or check plus system explained that "With the check plus and check minuses it's random so check plus is 100 to 95 percent but that doesn't exactly tell you where you landed". Similarly,

a different student explained to the WPI research team that “On a math test, I prefer the percentage because with A, B, C you don’t really know how much you got wrong”. Students are not critical of the grading system used as long as they understand why they got that grade and what they can do to improve it.

4.2.5 Benchmarks are an Effective Way to Document Growth

In order to determine whether a student has progressed academically, they should be evaluated on their skill level prior to the learning period. An effective method of doing this is through benchmarking. This can be done through surveys, essays, or skill evaluations. Benchmarking makes a structured, repeatable system to share experiences and ideas. This can clearly show those involved the strengths and weaknesses of the institution (Burquel, 2014).

Schools can see how their students’ performances compare to each other, how successful a course is, and how the whole school compares to other schools. In the interview with Mike Carroll, he explained how throughout his teaching career, he has utilized benchmarks to assess his classes. He described using an exam, once at the beginning of the year and once at the end. The exams include a variety of material and skills that were covered throughout the year. Carroll went on to describe the variety of forms the benchmark assessments could come in and the variety of skills the benchmark assessment could require. For example, a final presentation or reflective essay. Benchmarks not only serve the instructor of the course, but future instructors of the course and the school as a whole. Woelper and Booth expressed their interest in benchmarks that measure the impact and quality of courses, in addition to other areas.

4.3 Interdisciplinary Learning is More Applicable to the Real World

In the team’s interview with Woelper, he stated that “The key challenges that students are going to face in the workforce and the world don’t come at [students] through disciplinary silos”. Wheatley echoed this in her interview. As adults, you will be required to pull from a well of skills and knowledge to solve problems and think critically. A 2013 study by researchers for the Harvard Project Zero, a research center focused around deep understanding and ethics within education, concluded that for students to thrive in the global world, they need new capabilities that can be developed through interdisciplinary learning. Wheatley stated that sectioning learning into separate parts erases the links between the different disciplines that exist in real life.

Education research by Conner and Sliwka further supports this claim. Their study (Conor & Sliwka, 2014) found that students are able to conceptualize complex issues better when they consistently learn concepts through an interdisciplinary lens. This skill shapes students into stronger critical thinkers and problem solvers.

4.3.1 Interdisciplinary Teaching Requires Intentional and Collaborative Planning

Relating the concepts of one subject to others taught by different instructors can be complicated and time consuming. However, to achieve the most success with interdisciplinary learning educators need to collaborate when planning lessons (Conner & Slikwa, 2014). Van Wagenen expressed similar concerns to the researchers in her interview. An interdisciplinary curriculum often uses projects for students to apply new concepts and these complex projects can take time to develop. Additionally, an interdisciplinary approach to teaching can push educators outside their areas of expertise, so collaborating with colleagues is important for the success of the curriculum. Wheatley stated in an interview that it is important for instructors to be explicit about what their course does not cover. Some students may feel that after taking a class for a year, they have learned everything they needed to. However, this is not the case, especially in the context of topics related to the environment. Wheatley expressed that failing to acknowledge this can unintentionally promote negative outcomes for the students. If students feel they have mastered the environment after one year of learning, they could have a negative impact on their community.

4.3.2 Interdisciplinary Learning is Especially Valuable for Effectively Educating Students on the Reality of the Climate Crisis

In an interview with the research team, Woelper claimed in order to truly understand the effects, climate change must be taught through an interdisciplinary focus. Feinstein and Kirchgasler (2015) say if students are taught about topics related to the changing environment through science and technology, this can erase the social and economic components of the issue. In fact, learning about the climate crisis through science is more likely to be viewed as part of a political agenda by the community and administration. Teaching sustainability and climate change this way may oversimplify the complexity of the issue as well. To combat this potential bias, educators should teach topics related to the environment alongside the social and economic

components. Students should be taught about all parties affected by the changing climate and the political drive behind some decisions so they are prepared to face the realities of the climate crisis; in addition to other environmental crises.

4.3.3 Allowing Students to Learn What They Want is Effective

Aside from the physical learning space, teachers need to present their classrooms as a place where students can learn about topics they have an interest in or passion for to result in better student engagement and motivation to learn. A Phi Kappa Alpha International article entitled *The ABC's of Student Engagement*, explains that "the academic tasks teachers assign are the central aspects influencing student engagement". The article continues by highlighting several characteristics that are shared between truly engaging tasks. One of the three characteristics of an engaging activity is choice. Providing students with some degree of choice within an activity allows them to experience control over their own learning (Parsons, A. et al., 2014). The opportunity to choose also encourages the exploration of academic passions and even social and moral dilemmas of a small or large scale; an overlooked aspect of active learning (D'Souza, 2017). Interview data collected by the research team supports this concept while providing more insight into the meaning behind choice and how it can be incorporated into a classroom.

In interviews, Michael Carroll and Aimee Van Wagenen, both emphasized the power of choice and its capability to promote student engagement. As teachers decide which topics to include in their academic plans, they should build off a core curriculum and reserve time to learn about what their students are interested in. Teachers cannot assume that, year to year, each group of students will have the same interests, as interests often intersect with current events and real world issues. This can pertain to a singular student's interest, or the group's interests as a whole. When determining majority interests, teachers must acknowledge that not all students come from the same cultural and economic background. This will ensure that each additional lesson can be a real world connection for each student, not just the ones who are brave enough to voice their opinions. According to Brady Wheatley, the amount of choice given to students should be determined based on the age of the student. At younger ages, students often choose to do what their peers do and they would feel like an outcast to do otherwise. As they grow older, they develop their own interests and seek to pursue more knowledge in the pertaining field.

In his written response to the research team's questions, Mullins elaborated on allowing students to explore their areas of interest as an extension of the core lessons. His belief is that it does not matter what the students decide to learn. What's important is that they see that their education revolves around them and their interests, not just on what their teachers believe they should learn. He elaborated on allowing students to explore their own areas of interest as an extension to a core lesson. It does not matter what the student decides to learn more about, it is important for them to see that their education revolves around them and their interests, not solely what their teacher believes they should learn.

In the focus group with potential NEIA applicants, they were asked about the power of their own choice in the classroom. Two students spoke on the idea of selecting material to learn about, and then being given options on how they could be assessed on the material. This could range from a presentation, project, photograph, poem, song, exam, or even a theater production. Another student followed with the concept that if a student is given this choice, they will select the form of assessment they are the most comfortable with, resulting in them demonstrating what they learned in the most effective way possible.

4.3.4 Student Passionate About a Topic Increases Driven to Learn More About It

Anna Oliviera, who attended The Island School in the Bahamas, elaborated on her previously developed passion for environmental science, which sparked her interest in attending The Island School. This unique school offered Olivera the opportunity to learn a variety of methods to preserve and care for a surrounding environment. This excitement for having a long lasting impact urged Oliviera to work persistently during her time in the Bahamas.

Not all students will have previously. developed a passion, so it becomes the teachers' responsibility to help them find it. In an interview with Aimee Van Wagenen, she presented an idea that helped her students develop passions. She explained that giving students the opportunity to experience something new. This may be a field trip, in-class activity, or a project about a random topic. When students take part in a new activity, visit a new place, or learn something new, and they find pleasure in whatever they have done, a sense of curiosity arises. This curiosity is what drives them to learn more about the topic and develop a passion for it.

4.4 Ownership of Campuses Can Be Developed Through Personal Responsibility

Students should be encouraged to get involved in extracurricular activities that have positive impacts on the campus and surrounding community. This develops a sense of ownership for the particular school's campus. Throughout the research, the four interviewees spoke about different opportunities for students to get involved. Van Wagenen, Carroll, and Wheatley all mentioned student led clubs. These clubs can be recycling teams or even a group dedicated to campus beautification projects. Carroll described the balance between student initiative and the necessity for actual impact; is measurable impact more important than the learning experience? This depends on characteristics like the ages and abilities of the students or the intentions and goals of the club.

Anna Oliviera had a unique experience with ownership at the Island School. During her time there, she was assigned to various daily jobs. Her main job was working in the bike shop, repairing the students' form of transportation, but she also had the opportunity to wash dishes in the kitchen and clean classrooms as well. Oliviera knew that if she did not put in effort to her jobs, she wouldn't let the people who relied on her down. Through working in the bike shop, she developed a genuine interest in fixing her peer's bikes. She knew that these bikes were preventing large amounts of carbon from being emitted into the environment, and saw her job as her contribution to improving the environment.

Kuo et al. (2019), illustrated that when students are involved in activities that directly impact the community, they feel a sense of ownership in the positive change they are making. Sense of ownership motivates students to engage in what they may be doing. Outdoor learning is associated with intrinsic motivation in students, meaning that there are no obvious external rewards at the end of the lesson. Intrinsic motivation allows students to enjoy and be interested in various topics, which develops longevity in their learning and engagement. This finding relates back to and supports the research team's research on active learning benefits. As students feel more engaged in their learning, they are empowered to learn more, make sense of the information they have gathered, and develop new creative ideas from what they have learned (Edwards, 2015).

4.5 Community Building Supports a Better Learning Environment

Developing a trustworthy and welcoming relationship between students and teachers, and peers makes for healthier learning environment. When students and teachers feel comfortable around each other, student participation grows, resulting in complex discussions and peer learning opportunities (D'Souza, 2017**)**. When Aimee Van Wagenen was asked about community building in her interview, she discussed the idea of restorative justice circles and how she utilizes them in her classrooms. Justice circles can solve any sort of in-class conflict through discussion rather than punishment, allowing participants to strengthen relationships and increase accountability, all while dismantling power constructs (XQ Institute). One tool justice circles use to create equal opportunities to voice opinions is a speaking object, which is passed within the circle.When Brady Wheatley was asked the same question related to community building, she elaborated on some activities that could unite any school as a whole. Some examples include camping, backpacking, or kayaking trips. Essentially, any non-academic bonding between students and teachers can help develop stronger connections and promote a productive classroom experience.

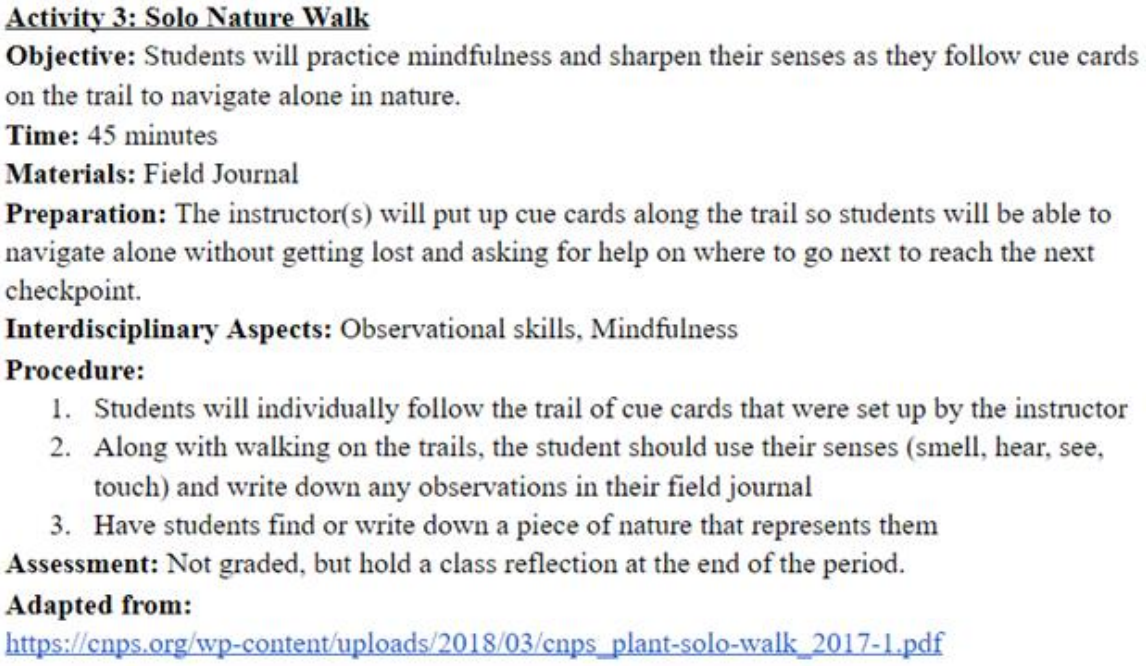
5. Conclusion

5.1 Deliverables

After analyzing the data gathered from interviews, focus groups, and secondary research, the research team compiled several deliverables for NEIA to use in their Grade 6 Lab. These deliverables consist of lesson plans, spreadsheets, and documents that detail what each activity does and the justifications for them.

5.1.1 Activities Master Plan

The research team developed an Activities Master Plan that consists of the activity name, the objectives of the activity, time required to complete the activity, the materials needed for the activity, the preparation of both the instructors and the students, the different subjects that intersect, a step-by-step on procedure on how to run the activity, type of assessment, and if applicable, a link provided for additional activity information (see Appendix X). This Master Plan provides 32 activities and that are included in an Activities Calendar. The document provides teachers an easy way to track which activity they are planning to do or what the next activity is going to be.



Activity 3: Solo Nature Walk

Objective: Students will practice mindfulness and sharpen their senses as they follow cue cards on the trail to navigate alone in nature.

Time: 45 minutes

Materials: Field Journal

Preparation: The instructor(s) will put up cue cards along the trail so students will be able to navigate alone without getting lost and asking for help on where to go next to reach the next checkpoint.

Interdisciplinary Aspects: Observational skills, Mindfulness

Procedure:

1. Students will individually follow the trail of cue cards that were set up by the instructor
2. Along with walking on the trails, the student should use their senses (smell, hear, see, touch) and write down any observations in their field journal
3. Have students find or write down a piece of nature that represents them

Assessment: Not graded, but hold a class reflection at the end of the period.

Adapted from:

https://cnps.org/wp-content/uploads/2018/03/cnps_plant-solo-walk_2017-1.pdf

Figure 8: Activities Master Plan

5.1.2 Curriculum Calendar

The Curriculum Calendar maps out when activities should be planned throughout the academic year. The calendar provides the name and the number of the activity so teachers can track it using the Master Plan (See Appendix U). The activities on the calendar are also grouped according to the themes or topics they are associated with. For example, near the beginning of March of 2022, most of the activities listed there are under the topic of water. The research team organized the activities on the calendar by these themes and if the weather or season is suitable for them to be accomplished. The calendar also organizes the activities so that each activity build on the previous ones. The calendar also plans for a scaffolding of skills, where easier activities are done near the beginning of the year while challenging ones are done near the end of the year.

May 2022						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
	Act 25: Effect of development on environment		Tree log update	Cinco de Mayo Fiesta		
8	9	10	11	12	13	14
	Act 26: Solution session on how to prevent		Take samples of pond			
15	16	17	18	19	20	21
	Trail Maintenance Day		Act 30: Nature Tower	Grade 6 Share Session		
22	23	24	25	26	27	28
	Act 31: Dew traps		Tree Log Class Reflection (Assessment)			
29	30	31				
	Memorial Day					

Figure 6: Activities Calendar

5.1.3 Curriculum Map

The Curriculum Map was based on Booth's template that she shared with the team. This map lists activities that the team researched or developed and notes the categories the category each activity falls under. It is ready for use for NEIA faculty (see Appendix T). This map contains the general description of the activity, the learning objectives, materials needed for the activity, interdisciplinary aspects (STEAM'D, Cultural Tapestry, and Being. Well. Skilled.), NEIA's four learning objectives, how the activity is going to be assessed, the duration of the activity (short or long term), and the estimated total time to complete the activity.

	Activity 2: Trail Building
Description	Students create pathways through the woods surrounding NEIA campus
Learning Objectives	1. Learn how to explore in nature, while respecting it 2. Understand the history of the land 3. Make observations of the environment with their senses (feel, hear, smell, see) 4. Make solutions on how to conserve the trail 5. Become familiar with land
Needed Materials	Rakes, branch clippers, gloves, etc. Tick Spray.
STEAM'D	Science: Flora & Fauna Classifications. Biology. Technology: Engineering: Any structures needed to tranverse streams, etc. ? Art: Sketch out the pond, landscape, in a topological map. Add layers with some possible trail designs. Mathematics: Measure length, distance between points along the path. Geometry. Design:
Cultural Tapestry	Human Ecology: Adaptation to central Mass in history. History:

Figure 5: Activities Map

5.1.4 Curriculum Justification

When the research team compiled the activities to fill the academic year, they created a Curriculum Justification sheet and a rubric to correspond with the five qualities listed on the ranking sheet (see Appendix V). The five qualities were Engagement, Interdisciplinary, Feasibility, Connection to the Natural World, and Connection to NEIA's Mission and were ranked on a scale of 1 to 5 based on each of the 32 activities the team developed or researched about. The total column on the ranking sheet is the sum of the scores from each quality. The sum for each activity can be used as a score that demonstrates the overall quality.

Scores that ranged from 19 to 25 represent that the activity has incorporated all or most of the qualities and is effective to include in the curriculum plan. Scores that ranged from 15 to 18 have incorporated most of the qualities but not all and are acceptable to be included in the curriculum plan. Scores that range from 10 to 14 have incorporated some of the qualities and it is up to the instructors whether they include the activity. Activities that received a score of less than 10 incorporate few or none of the qualities and should not be used in the Grade 6 Lab.

		Qualities (rated on scale of 1-5)					
Activity Name	**Theme**	Engagement	Interdisciplinary	Feasibility	Connection to the Natural World	Connection to NEIA's Mission	Total
Get to Know Your Campus	(Orientation idea)	Oreintation					0
Tree Log	Ecology	5	5	5	5	5	25
Solo Nature Walk	Environmental Awareness	5	2	5	5	4	21
Trail Building		5	4	1	5	4	19
Field Journaling	Ecology	4	5	5	5	3	22
Native and Invasive Species	Environmental Awareness	5	3	5	5	5	23
Endangered Species	Environmental Awareness	5	3	5	5	5	23
How Does Insects Contribute to the Ecosystem/Bug Collecting	Ecology, Environmental Awareness	5	3	5	5	5	23
Nature Photography	Environmental Awareness	5	3	4	5	3	20
Composting in Soil	Ecology	3	3	5	4	2	17
Forest Fires	Environmental Awareness	2	3	2	4	2	13

Figure 7: Numerical Justification of Recommended Activities

5.2 Recommendations

This section lists the recommendations that the research team made when they analyzed the data and reflected on the project. These recommendations would benefit both NEIA and future student applicants who apply there.

The following recommendations are categorized as:

1. Recommendations for Course Instructors
2. Recommendations for Activities
3. Recommendations for Potential Instructors
4. Recommendations for Future WPI Teams

5.2.1 Recommendations for Course Instructors

The research team recommends for the instructors teaching the Grade 6 Lab use the tables and documents provided as deliverables as templates. The Curriculum Map should be used by instructors to add, remove, or edit any activities for the Lab (See Appendix T). As an activity is in progress or is completed, the instructors should update the map so other relevant parties can stay informed on skills and topics covered in the Lab. The Activities Master Plan should be updated with the Curriculum Map for the instructors' personal use (See Appendix X). The research team recommends this map for use because this is the format used by the Founding Team to develop other areas of the curriculum for the school. The research team's interviews with the Founding Team illustrated the importance of organizing the curriculum this way.

The instructors of the course should refer to the Curriculum Calendar to learn the intended order of activities (See Appendix U). The activities are ordered by the skills required and the weather requirements for the activity. The order of the activities is important because of the scaffolding of skills that occurs within the activities. The Curriculum Calendar is an important tool for the instructors to use due to the interdisciplinary aspects of the activities. For the Lab to be most successful, the activities must be planned in conjunction with topics in other classes. The Curriculum Calendar clearly displays the order of activities and can be cross referenced with the calendars for other courses to ensure the best plan for the year.

Finally, the instructor should assess the quality of the activity using the Curriculum Justification and Rubric (See Appendix V). According to the definitions in the Curriculum Justification Rubric, the instructor should assign a number and determine if it should be altered or removed from the curriculum. By ranking activities based on their experience, instructors can compare their techniques to learn how to improve the activity.

The team's deliverables are provided through Google applications (Google Docs and Sheets), which allows instructors to easily update, change, remove, or pass the completed templates down for future instructors to use, essentially making it a living document. The interviews with the Founding Team informed the research team on the importance of tracking the curriculum at NEIA. The Founding Team expressed interest in positive growth and these deliverables provide the school with the templates to do so.

5.2.2 Recommendations for Activities

As Finding 4.1 describes, outdoor learning has numerous benefits for students. Learning outside reduces stress and promotes active learning through visual and physical exposure to the topics of the lessons. This research guided the research team when deciding what activities to select for the Lab. Additionally, the research team examined the interdisciplinary aspects of each activity to ensure it fit in with Massachusetts' State Standards for Grade 6 Science. Though NEIA is not bound by these standards, the research team used them as general guidelines for topics that may be covered. Instructors of the course should use these activities (or activities with similar qualities) to ensure the Lab is as hands-on and nature focused as the research team intended.

5.2.3 Recommendations for Potential Instructors

The research team also recommends that NEIA should hire instructors who are able to connect with students and build a community with them in which they trust both their peers and instructors. From the team's findings, having students develop a trusting relationship with their instructors helps them to learn better. To develop this trusting relationship, instructors should be on the same level with the students and show that they also have vulnerabilities. Instructors for

this course should function as facilitators so they can coach students and provide any feedback that the students may need to know what areas they can improve on. Having instructors who are passionate and connected with students allows the students to foster students to learn more about the world and develop skills that they need in the future.

5.2.4 Recommendations for Future WPI Teams

After working through this project, the team believes that there could be further research that can be done to strengthen their propositions. For the past seven weeks, the team has conducted interviews and focus groups and done secondary research to understand more about outdoor learning and effective learning environments to develop a curriculum plan for the sixth grade Lab for NEIA.

Future WPI research teams should be passionate and motivated to work on a project related to education as the sponsors of this project have the same qualities. To continue developing curriculum plans for NEIA's Labs, future WPI Teams should also look over this research team's report to gain an understanding of what kinds of lessons should be made for NEIA. When designing a new curriculum plan, the team should conduct more research on other aspects that can be incorporated when deciding what kind of educational activities students can do. While working on the project, the research team should regularly meet with the sponsors to ensure the curriculum can be easily integrated. The research team recommends continuous feedback from NEIA faculty to confirm that the project will have a lasting impact on the school.

Some additional topics for projects include developing metrics for NEIA to measure environmental impact, campus organizations to foster environmental awareness, developing Action Learning Labs for other grade levels.

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Appendices

Appendix A: Example of Weekly Schedule

Weekly Schedule. GRADE 6. Alternative B.

Week 1	Monday	Tuesday	Wednesday	Thursday	Friday
7:30-8:00	Breakfast, Social Time, Meditation, Wellness, Exercise. OPTIONAL				
8:00-8:40	Online Language Acquisition. OPTIONAL TIMING				
8:40-10:10	STEAMD STUDIO Science Math Art, Design	AMERICAN TAPESTRY Lang & Lit Humanities Social Studies	STEAMD STUDIO Science Math Art, Design	AMERICAN TAPESTRY Lang & Lit Humanities Social Studies	STEAMD STUDIO Science Math Art, Design
10:10-11:10	HCD Workshop	Fine Arts or Digital Tech Workshop	HCD Workshop	Fine Arts of Digital Tech Workshop	STUDY SUPPORT or LIFE SKILLS
11:10-11:30	Passing Time #1. SNACK				
11:30 – 12:15	LIFE SKILLS	Real World ALL	LIFE SKILLS	Real World ALL	ASSEMBLY
12:15-1:15	Lunch, Recess.				
1:15-2:45	AMERICAN TAPESTRY Lang & Lit Humanities Social Studies	STEAMD STUDIO Science Math Art, Design	AMERICAN TAPESTRY Lang & Lit Humanities Social Studies	STEAMD STUDIO Science Math Art, Design	AMERICAN TAPESTRY Lang & Lit Humanities Social Studies
2:45-3:05	Passing Time #2. SNACK				
3:05 – 4:00	Sports #1 or After School Program(s) or Lifeskills – ASP@N				
4:00 – 5:00	Sports #2 or After School Program(s)or Lifeskills – ASP@N				

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Appendix B: Interview Protocol for NEIA Faculty

The process for conducting interviews with NEIA faculty will be as follows. The first interview was with Sally Booth, the Director of Teaching and Learning at NEIA with all team members present. This interview led to subsequent interviews with other members of the staff. Electronic notes were recorded and if the topics of discussion deemed it necessary, and with the consent of the interviewee(s), the Zoom interviews were recorded for further analysis.

The interviewees were invited to participate in advance via email. The email explained the purpose of the interview and nature of the questions. The content of the email is detailed below.

Email Script

Dear [NEIA Faculty member(s)],

Are you available to talk for about an hour about your expectations for our project? We would like to know more about the details of the Action Learning Labs and the 6th grade ALL specifically. Let us know if you have any questions.

Thank you,

WPI Research Team

Interview Content

Introduction: The purpose of this interview is to gain an understanding on the logistics of Labs and requirements of NEIA's curriculum in general. This will include the specific topics that should be covered in the Grade 6 Lab and any requirements for assessments.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Can we use your name to reference you as our source?
- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?

Interview Questions

- Tell us about your position and what that entails?
- Does NEIA follow any curriculum guidelines set by the state or country?
    - What is the structural framework of the NEIA curriculum?
    - What are the specific standards the school's adopted to help guide the teachers in creating the content and instructional approaches for the different subjects? Especially in the two integrated threads?
- Can you describe the purpose of Labs?
    - What will be the common themes throughout all Labs?
- Can you walk us through the topics of the Labs for each grade level?
    - Can you share more specifics about the themes and topics in the sixth grade Lab?
- Should a well designed Lab incorporate every subject area the student is currently learning?
- What do you already have planned for this Lab?
    - Which disciplines do you think will be most important in anchoring the academic knowledge embedded in this Lab?
- Is there a certain way students need to be assessed?
- What are your thoughts on overlap between Labs to strengthen bonds between grades?
- How often will students participate in Labs? Are they year long? Do they happen daily? How long are the class periods?
- Does one instructor teach the Lab?
    - How are teachers involved? Which teachers specifically?
- Does NEIA need to follow any standards/guidelines for academics?

Appendix C: Result of Interview with NEIA Faculty: Tom Woelper

Date: 11/18/2020
Present: Josh Alasso, Winnie Ly, Maggie Reiter, Zach Stone, Tom Woelper
Facilitator: Josh Alasso
Note taker: Winnie Ly, Maggie Reiter, Zach Stone

Question: How have your previous experiences shaped your vision for NEIA?

- Traditional, well acknowledged schools. Had been looking to evolve and change, but the traditional values limited desire to be more progressive
- Tough time reimagining what schools should be to prepare them for today's world

Question: In your opinion, what aspects of school systems have remained the same for an overextended period of time?

- Most high schools have their diplomas divided up into credits for each school
    - "What to think and how to think" is what the Factory Model focused on

Question: How is NEIA moving away from these aspects?

- Students will need to have the core skills, but NEIA wants to move away from "you earn credits in each discipline" mentality
- Different styles of classroom- standing areas, soft seating areas, (move away from lined up seating all aimed at the teacher)

Question: What are your thoughts on Interdisciplinary learning? How does PBL tie into interdisciplinary learning?

- Disciplinary learning- this is how academics have been run throughout history. Wants students to master core content.
- Interdisciplinary- engage in project based learning and tackle problems that require many disciplines. Present NEIA students with problems that do not have a singular lens.
- Many young employees need to retrain new hires who have come from traditional learning environments as they do not have the project based experience
- Education should be better aligned with the workforce that they are entering afterwards

Question: What is your opinion on the use of nature in learning / outdoor learning in general? Do you see any benefits from using outdoor space? Any drawbacks?

- Part of being healthy. Allows students to be more connected to the environment and allows students to be more grounded
- If you can regularly get outside in nature, it can be distressing and detoxifying. If the learning can have a stronger basis in a natural environment, it can have better context.
    - Helps promote nutrition, and how anything you put in your body could come from the environment.
- Drawbacks- does not see any drawbacks. “Not the weather outside but the clothes we wear to go outside”
- Financial support to students who cannot afford proper attire- adopting a “flexible tuition model”. Different from financial aid. Assign different tuition price points. Reserving different spots at different price points they can achieve socioeconomic diversity. Looking to make NEIA affordable while taking materials and supplies to consideration
- Physical abilities of students- many long established schools see diversity, equity, and inclusion as an add-on. NEIA believes that diversity promotes innovation. Have to put in some work to promote intermingling between students with different racial, economic, and physical backgrounds. Do not want to design the core part of education around something that may not be accessible to each student participating.

Appendix D: Result of Interview with NEIA Faculty: Ayla Gavins

Date: 11/20/2020
Present: Josh Alasso, Ayla Gavins, Winnie Ly, Maggie Reiter, Zach Stone
Facilitator: Zach Stone
Note taker: Josh Alasso, Winnie Ly, Maggie Reiter

Question: Can you describe how you see Cultural Tapestry, STEAM'D, and Life Skills subjects intersecting in the Grade 6 Lab?

- Humanity is what ties everything together.
- Want to make sure that the STEAM'D is not just about acquiring a skill but to be intentional about it and to hold all the history behind it. So you won't create something that will harm the community or world surrounding.
- Want to make sure that students can respectfully engage with people who are different.

Question: Do you have any opinions on outdoor learning?

- When kids are separated from nature they are more likely to destroy or disrespect it
- As kids encounter people and learn from them they can make connections they wouldn't have made elsewhere

Question: What is your thought process when deciding which activities to include in a curriculum plan?

- Like to choose open ended activities so there are a lot of entry points so there are no assumptions on what a kid is capable of. Have a big overarching question that anyone can approach. Multiple ways of having kids show what they know (a menu of options to display knowledge). Have lots of ways for people to engage around the project.

Question: What is the profile of a teacher who would be running the sixth grade Action Learning Lab?

- Someone who is coaching oriented. Great facilitation (bring all the voices of the kids together) and communication skills because the teacher is going to have to bring in experts. Someone who can be really clear on what the students have to achieve

(organized and a great planner). Once kids understand the end goals the teacher has to coach them along. Feedback should be kind, specific and helpful. Kids need to know where they need to improve.

Question: Are there benefits to having long term projects integrated within a curriculum?

- In previous school, there was 4 themes and they felt there wasn't enough time
- Long term studies allow you to achieve a level of depth
- Short term is really satisfying
- SO, she likes that we are using both
- Maybe make some activities optional through an independent study or through a club

Question: Do you have any opinions on grading or any unique grading ideas?

- No to grading but yes to evaluation
- Criteria for success. Do they stick with it through a challenge, ask great questions, did they engage with their teammates, did they use the language associated with the task, etc.
- Make sure kids know the criteria for success. Mid-way through and at the end they get to do a self-evaluation. At the end, the teacher gives a final report. It is also a good talking point and provides the teacher with an opportunity to have an honest discussion with the kids.
- Language like "proficient"

Appendix E: Interview Protocol for Faculty at Innovative Education Institutions

The process for conducting interviews with faculty of innovative schools was as follows. The research team interviewed seven professionals in the field of education. Though the positions and experience of the interviewees varied, the protocol for interviewing them was the same. Depending on the specialty of the interviewee, some additional questions were asked. The details specific to each interview can be found in their respective results appendix. Electronic notes were recorded and, with the consent of the interviewee(s), the Zoom interviews were recorded for further analysis.

The interviewee(s) were invited to participate in advance via email. The email explained the purpose of the interview and nature of the questions. The content of the email is detailed below.

> *Dear [Faculty name],*
>
> *I am writing to you on behalf of my research team at Worcester Polytechnic Institute. We are working on a seven week project required for our graduation called, Interactive Qualifying Project. Our project is sponsored by the New England Innovation Academy (NEIA), a private independent boarding school opening in Marlborough next fall. The goal of our project is to develop a hands-on lab for the 6th grade that revolves around the students' impacts on the natural world around them.*
>
> *We would like to invite you to talk with us about your thoughts on the intersection of environmental awareness and student engagement and interdisciplinary learning and what makes the best learning environment. The interview should take around one hour.*
>
> *The purpose of this interview is to learn your perspective on effective learning and how grading and the classroom culture contribute to a student's experience. The information we gain will be analyzed and hopefully used in our final recommendations for the course to NEIA.*
>
> *Please let us know if this is something you, or any other faculty you know, would be interested in. Your expertise would be invaluable to us, so we hope you consider. Looking forward to your response.*

Interview Content

Introduction: The purpose of this interview is to gain an understanding on how interdisciplinary and outdoor learning can be incorporated into a hands-on learning lab for Grade 6 students regarding the local ecology and environment surrounding the newly-

opened school in Marlborough. The goal of this study is to develop a curriculum plan for what this future focused school calls “Action-Learning Lab”. The sixth grade lab will be centered around the Howe Pond Land and teach concepts related to ecology.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Can we use your name to reference you as our source?
- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?

Interview Questions

- Can you describe your position at [organization’s name] and any relevant experience?
- What role do students play in [school’s name] sustainability efforts?
- How have you seen sustainability intersect academics at your school?
    - Can you tell us about those situations?
- How do you see sustainability awareness intersecting with a hands-on lab for sixth graders that will use the conservation land the school neighbors?
    - Do you have any ideas on how this might be accomplished?
    - Can you suggest any specific learning activities that we might investigate?
- How do you see building a connection to the natural world intersect with a 6th graders education?
- Do you have any experiences in the classroom or lessons learned from teaching that are relevant to this topic, especially outdoor learning?
- How do you build trust with students?
- Do you have any suggestions for grading?
- How can we develop this course in a way that supports students of varying learning abilities?
- Do you have a personal philosophy you want to share that is relevant to this topic?
- Do you have any other suggestions for people we might contact or schools or areas we might research?
- Would it be okay if we contact you again in the future should we have any follow up questions?

Appendix F: Result of Interview with Faculty at Innovative Education Institutions: Aimee Van Wagenen

Date: 11/5/2020
Present: Josh Alasso, Winnie Ly, Maggie Reiter, Zach Stone, Aimee Van Wagenen
Facilitator: Josh Alasso
Note taker: Winnie Ly, Maggie Reiter, Zach Stone

Question: Can you describe your position at BGA?

- Aimee was hired as an English teacher and a Special Education English teacher. She also teaches three English classes, an AP Psychology class for seniors, and is a Special Education teacher in both of those classes.

Question: What metrics does your school use to gauge sustainability efforts?

- Pre and post test knowledge
- Sustainability triangle. Isn't just about green and environment issues. Equity, Economy,
- Most students come in with some vague notion of sustainability
- Once reach 11th grade this becomes more advanced and relating personal issues to the pillars above
- Are they able to talk about issues of sustainability aside from the green side
- Exhibition- long term interdisciplinary project. Present on a green issue. By 11th grade they relate to the pillars. These exhibitions (a couple weeks to two months), are divided by grade level. Earlier grades have less choice and the topics are assigned (same set of resources), once they are in 11th the students get to pick their own topics. Own research and then own reporting of what they learned. Some are individual, some are team based.

Question: What is your opinion on interdisciplinary academics? Specifically, the intersection of social studies and science (science focused on the environment, climate change, urban development).

- Teachers need time to organize these project based learning projects. Teachers get stuck in trying to relate work to curricular standards as well. Brainstorming together on how different pieces of the projects can integrate together. Each of them have specific tasks from each class that contributes to the exhibition project as a whole. Teachers have to let go of normal everyday teaching.

Question: How can you develop student/teacher connections?

- Field trips with community partners. Good kickoff for interdisciplinary projects. Having partnerships through field trips build community before research and academics start
    - Overnight on Thompson island
- Restoring Justice Circles

    - Practice that comes out to commitment to solving conflicts with discussion rather than punishment. Restoring the harm that was committed on the community or the person. Focus on thinking about what you are doing to harm others in the learning space rather than "how do I be more of a disciplined person". Go around in a group taking turns talking one by one. Helps promote equal class participation. Saying what YOU want to say. Takes a little getting used to but helps to establish the "everybody's voice matters" mentality.
    - Agrees that they could work well outside
    - Include mindfulness moments into the circle
    - Making these circles outside would align well with the evangelists true intentions for restoring justice circles .
- Project week (no grades)
    - Cancel all regular classes and work on nonacademic topics.
        - Outdoor club (hike), photography
        - All are designed to be outside in nature
        - Lots of ways to integrate the outdoors into things that you didn't think were directly related to the outdoors.
        - More fun and community building than academic

<u>Question:</u> What enhances outdoor learning or what prohibits it?

- The weather
- Logistics (expenses, transportation possibilities)
- Faculty missing the value
- No change in student behavior
- The older they get, harder a challenge to keep track of location of students because they are familiar with MBTA
- Rules do not necessarily translate outside from inside
- Seniors
    - Legacy project, work on something together that has a positive impact on the schools, usually connected to sustainability
        - Ex. Enhancing the environment within the school, bringing in paintings involving the environment.
        - Gets them thinking "how can I leave a green impact"
    - Severe Disabilities Club
        - Only students in separate special ed classrooms
        - Run the recycling club at BGA
        - More recycling than a traditional BPS
        - Student driven- Plastic bag recycling (how to collect the bags, instructed teachers on where to collect bags in classrooms, collected the bags bi weekly, and then brought the bags to the drop off center on a "field trip".

        - Same thing happened with magic markers
    - Have a garden outdoors where they have held classes and based projects off of

Question: Do you have any grading ideas to share with us?

- Teachers felt that the point of project week was not to grade
- Portfolio based, present this portfolio at the end of the year
    - Reflection on work thus far and where you want to go in the future.
    - Pictures of them in action, written reflections feel antithetical to the hands on activities

Question: Do students have a preset passion for the climate and related topics?

- Students begin to feel urgency about issues as they learn about them, just like any other people in 2020

Question: Is there a way to build passion to help preserve the environment?

- Urban, 96% black and hispanic. These populations are somewhat distant to the environmental movement. All live in a concrete world, do not have a lot of access to green spaces. Many students are limited to their block, their schools, and anything in between. Doing something really different than what students are used to is a good way to spark initial interest.
- Choice is more limited with the younger grades but choice is a very good way to promote engagement in a learning project.

Question: Can you talk about designing curriculum with inclusivity in mind?

- Adaptive sports, making outdoor activities inclusive
- Being on MBTA and urban environment are already accessible for students with disabilities
- Can make any project accessible
- Adult science fair - research poster presentation to community members
    - Give presenting experience
    - Students who you may not typically be able to do this are capable in the end
    - Giving students with different abilities the help that they need to be successful, can still connect with the core skill that the teachers are trying to build.

Appendix G: Result of Interview with Faculty at Innovative Education Institutions: Michael Carroll

Date: 11/5/2020
Present: Josh Alasso, Michael Carroll, Winnie Ly, Maggie Reiter, Zach Stone
Facilitator: Maggie Reiter
Note taker: Josh Alasso, Winnie Ly, Zach Stone

Question: Can you describe your position at Worcester Academy?

- Sustainability director for 12-13 years. Teaches some classes. Shares same philosophies as NEIA. Focusing on institutional alignment. Multiple projects at different paces. Teachers at each course level adopt one question or more for a three year time period which is connected interdisciplinary to sustainability. Articulating questions explicitly. All social, technologic, and ecological complexity. Well positioned to be a dynamically engaged citizen once leaving WA. EX. math problems related to glacier melting rising sea levels.

Question: What efforts to reduce the negative impacts on the environment does your school use?

- Identify metrics and stay with them
    - Electricity and water usage in dorms
    - Carbon neutrality goals, keeps carbon inventory
    - Standards and benchmarks, extanciate whenever you can. Set goals, have reporting. Have paired with the solar power ***
    - Solar installed in 2010
    - Low flow faucets, sinks, LEDs, electricity used per square foot
    - Took standards from university level and attempted to recreate
    - Tap into green school alliance
    - Sustainability to become as normalized as any other department

Question: What role do students play in WA's sustainability efforts?

- Always changing and trying to find other adults
- Green team, normal teenage environmental club
    - Decide between how impactful or how much you want it to be students driven
    - What's more important? Actually being sustainable or offering learning opportunities?
    - They're not employees, at WA to learn
    - When students engage with questions at a legitimate level, it creates more competency and sophistication. Could be used in Senior projects. Most of the education happens in the classroom, and a few students are especially interested in sustainability efforts.

    - Designed curriculum plan related to light exposure and was intended to be service based and taught in AP statistics
    - Possibilities change with which type of students are coming through the school

Question: Does WA incorporate outdoor learning at any level? If so, can you describe the activities?

- Environmental science…. Outdoors is the classroom. Major accomplishment if students can make connections between the outdoors and what they are learning precisely.
- Trees to catch basins to utility meters, all is the environment and is approached as such
- AP biology has a unit that is outdoors driven

Question: What can make outdoor learning super effective?

- Combination of individual natural curiosity and relevance to the bigger world. Everything links to key topics worldwide.
- If something doesn't spark for a students they are at least getting structures integrated approach
- Be aware of privilege (kids from city, kids from rural area)
    - Try to find a midpoint between kid with different outdoor interest levels
- Framed up to global level of concern
- Give the best story that can be told with the available resources
- Students who don't have that spark, does taking them outside promote interest? Any ways to induce passion?
    - Highest common denominator and diversity
    - Core curriculum and some offspring (projects) where students can work with their passions (graduation projects, individual projects)

Question: Can you describe the grading system at WA?

- If want to analyze how well the outdoor activities work
    - Test in the beginning and the end to see if any improvement happened
        - How can articulate and frame hypothetical project, lab reports, etc.
        - Present to adult representatives or fellow students
            - Being able to present what they learned shows how effective the activities was
        - Prove, show what you learned had relevance. It's not just symbolic, its meaningful (just doing a presentation for a grade, vs. presenting work to town)

Appendix H: Result of Interview with Faculty at Innovative Education Institutions: Brady Wheatley

Date: 11/9/2020
Present: Josh Alasso, Winnie Ly, Maggie Reiter, Zach Stone, Brady Wheatley
Facilitator: Winnie Ly
Note taker: Josh Alasso, Maggie Reiter, Zach Stone

Question: Can you summarize the previous positions that you've held in education?

- Student Affairs manager for study abroad program in Mexico. In charge of community outreach and protection. Taught history of the Bahamas at the Island School, dean of students at Island School, Dean of students and history leader at PCD

Question: Can you tell us about what you learned from your experience at the Island School?

- Both in Mexico and Bahamas, saw strategies used. Most effective were when the students were excited and inspired. Stop using depressing facts about the truth about the environment to promote learning. Leaves students depressed. Solution based environmental education is much more exciting for students. Since boarding school will help promote community sense. Since students were not from Bahamas, community relations were lacking, and makes students question maybe it is their place to implement change. Environmental learning that is only focused on the environment can affect other systems not related to the environment. Flight to the Bahamas used just as much carbon as they saved during their time at island school. Anything with an environment that isn't interdisciplinary will be harmful. Any true sustainable work must include the social science part. Used the opinions of the Mexican community to develop a project that benefitted both the community's needs and the environment. If you want students to care about the environment, you need to incorporate non-science portions of the lesson. (Ex. creative writing about "their" tree before learning about how trees work). Systematic change cannot be done at a Sixth Grade Level. Noticed a clear difference between the focus of the grade who did the Tree Project and the grades who did not.

Question: Have you applied any practices from the Island School to RHCD?

- Collected phones at the beginning of the class

Question: How do you see social studies intersecting with science (Grade 6)? With environmental studies and awareness specifically?

- Biology, English art project
- Creative writing on trees

Question: How do you take the individual interests of your students into consideration while lesson planning?

- Seminars helped engaged students
- Walk to town beach

Question: How do you build trust and make a welcoming space?

- Build more professional development for teachers
- Camping, backpacking trip, kayaking
- Ropes course
- Integrity
- Holding yourself to the same [ethical] standards (don't be hypocritical)
- Be open and honest
- "Students are Watching" book

Question: Have you utilized outdoor learning?

- Outdoor classrooms built:
    - Small tents, folding tables, built outdoor white boards
    - Teachers complain that students can't balance [no tables was an issue for some]
    - Noise concern was a big issue, ex. Construction, how close is the class next to you
    - Sitting on chairs vs sitting on grass
    - Individual camp chairs

Question: Do you have any tips on making outdoor learning effective? Or anything specific to avoid?

- Dressed appropriately, physically uncomfortable [ex. Winter camping trip]

Question: Do you have any ideas about how a Grade 6 hands-on lab on environment and sustainability can be strengthened by interdisciplinary links?

- Island's school's new curriculum
- The real world is not separated in different "subjects"
    - Project/problem based learning is where interdisciplinary learning thrives
    - Ex. Statistics AND Social justice class (taught by math and social studies teacher)

Question: Do you have any grading ideas to share with us?

- Skill based grading (Reasoning, Speaking/Listening, Writing, Organization). Students would get 2-4 grades on each assignment, but the students didn't know what these grades were. Helped them see where they were successful and where they needed help. "My organization in math is good but my reasoning isn't". Mastery Transcript. Lower school uses "See Saw".
- Conference grading system [collaboration between the student and teacher]
- Student-made rubrics

Question: How does student choice incorporate into effective learning?

- Balance between student choice is a lot to ask an adolescent. Social pressure to do what is "cool" or socially acceptable. Believer in mandatory, structured fun.
- Phone collecting? Students want teachers to create structure and pressure them.
    - "Were going for a walk" vs "Do you want to sit here or go for a walk"

Question: Can you tell us about your perspective on students taking ownership?

- When students have initiative getting out of the students' way, but supporting them along the way, the student will have the best chance of being successful. Having a sense of community ownership is common in boarding environments.

Appendix I: Result of Interview with Faculty at Innovative Education Institutions: Laura Twohig

Date: 11/25/2020
Present: Josh Alasso, Winnie Ly, Maggie Reiter, Zach Stone, Laura Twohig
Facilitator: Maggie Reiter
Note taker: Josh Alasso, Winnie Ly, Zach Stone

Question: Can you describe your research/work experiences in the past/current position?

- Been with Steelcase for 22 years
- Teaching in adjunct role for 15 years
- Undergraduate in Civil/Environmental Engineering
- Graduate in Statistics

Question: What physical qualities make a learning environment effective? How can these qualities be applied to outdoor learning?
Question: What non-physical qualities make a learning environment effective?
Question: How can we ensure students of all physical abilities are included in these learning spaces? Especially if the majority of classes are held outside of the classroom.
Question: Do you have any peer-reviewed articles that are relevant to the project that you could share with us?

Question: Why active learning?

- Students have higher expectations
    - Relevant to them
    - Engaging experiences
    - Develop 21st century skills
    - Global competitiveness
- 21st century skills
    - Critical thinking, communication, creativity, collaboration

Space Design:

- “Factory of students”, “very passive”

    - Rows and columns, anchored desks, small workspace
- Looking at the rhythm: looking at students throughout the day
    - Individual focus, instructor led, informal collaboration, social
- Design principles
    - Minimize transition times moving from one mode to the next, offering different modes, changing sightlines so students can see teacher and other students
    - Analog technology: white boards
- Posture
- Different types of seating
- Art gallery (I feel like what I did makes a difference), home (feeling comfortable, being mindful authentic, feel of belonging), workplace (this is where students will end up one day), Playground(stuff to touch and feel that they can create something new)
- Library Learning Commons, student spaces: private, alone, together, public

Pedagogy:

- Teachers need to know/adapt rather than just lecture
- Find this picture to use to better explain active learning

Outdoor Learning Spaces:

- Put together because of the pandemic
- Similar to indoor classrooms

Sample Activities:

- Field identification tying into pollution
- Landfill design
- Water consumption & preserving water
- Ground water

Appendix J: Interview Protocol for Faculty at Innovative Education Institutions at Hangzhou, China

The process for conducting interviews with faculty of innovative education institutions at Hangzhou, China was as follows. The research team asked the Hangzhou Dianzi University (HDU) research team to interview professionals in the field of education at Hangzhou. Though the positions and experience of the interviewees varied, the protocol for interviewing them was the same. Depending on the specialty of the interviewee, some additional questions were asked. The details specific to each interview can be found in their respective results appendix. Electronic notes were recorded and, with the consent of the interviewee(s), the Zoom interviews were recorded for further analysis.

The interviewee(s) were invited to participate in advance via email. The email explained the purpose of the interview and nature of the questions. The content of the email is detailed below.

Dear [Faculty name],

I am writing to you on behalf of my research team at Hangzhou Dianzi University. We are working on a seven week project required for our graduation called, Interactive Qualifying Project. Our project is sponsored by the New England Innovation Academy (NEIA), a private independent boarding school opening in Marlborough next fall. The goal of our project is to develop a hands-on lab for the 6th grade that revolves around the students' impacts on the natural world around them.

We would like to invite you to talk with us about your thoughts on the intersection of environmental awareness and student engagement and interdisciplinary learning and what makes the best learning environment. The interview should take around one hour.

The purpose of this interview is to learn your perspective on effective learning and how grading and the classroom culture contribute to a student's experience. The information we gain will be analyzed and hopefully used in our final recommendations for the course to NEIA.

Please let us know if this is something you, or any other faculty you know, would be interested in. Your expertise would be invaluable to us, so we hope you consider. Looking forward to your response.

Interview Content

Introduction: The purpose of this interview is to gain an understanding on how interdisciplinary and outdoor learning from outside the United States can be incorporated into a hands-on learning lab for Grade 6 students regarding the local ecology and

environment surrounding the newly-opened school in Marlborough. The goal of this study is to develop a curriculum plan for what this future focused school calls "Action-Learning Lab". The sixth grade lab will be centered around the Howe Pond Land and teach concepts related to ecology.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Can we use your name to reference you as our source?
- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?

Interview Questions

- Can you describe your position at [organization's name] and any relevant experience?
- What role do students play in [school's name] sustainability efforts?
- How have you seen sustainability intersect academics at your school?
    - Can you tell us about those situations?
- How do you see sustainability awareness intersecting with a hands-on lab for sixth graders that will use the conservation land the school neighbors?
    - Do you have any ideas on how this might be accomplished?
    - Can you suggest any specific learning activities that we might investigate?
- How do you see building a connection to the natural world intersect with a 6th graders education?
- Do you have any experiences in the classroom or lessons learned from teaching that are relevant to this topic, especially outdoor learning?
- How do you build trust with students?
- Do you have any suggestions for grading?
- How can we develop this course in a way that supports students of varying learning abilities?
- Do you have a personal philosophy you want to share that is relevant to this topic?
- Do you have any other suggestions for people we might contact or schools or areas we might research?
- Would it be okay if we contact you again in the future should we have any follow up questions?

Appendix K: Result of Interview with Faculty at Innovative Education Institutions in Hangzhou, China: Robert Mullins

Question: Does the WIS use sustainable practices or environmental friendliness in the school? If so, what are these sustainable practices?

- Sustainable practices
- The school as far as possible to adopt paperless, electronic. For example, schools communicate with parents and send them some important documents and notices in electronic format. Parents can choose to print them by themselves at home to minimize the use of paper.
- Secondly, when the school is communicating with teachers and students, if they need to go out for coffee, they will bring their own cups. Save paper as much as possible in school, use less as much as possible, try not to use disposable items, such as disposable cups, plates and so on.

Question: Does WIS collect any metrics and/or measurements of their sustainable efforts. If so, does the WIS display these metrics? Who do they display the metrics to (students, staff, government)? How do they display these metrics (on their website, on screen in school, etc.)?

- At present, there is no such thing, but the school has been working hard on it. One of the problems schools are facing now is that they waste a lot of lunch. There are a lot of leftovers. So we hope that schools and students can work together to solve the problem of leftover food.
- At the same time, the school itself will refer to the United Nations Sustainable Development Goals. Our next curriculum development goal is to integrate the 17 Sustainable Development Goals of the United Nations with the school curriculum. For example, some of his goals are poverty alleviation, gender equality, economic development, and we will incorporate those goals into the development of our curriculum. In terms of environmental protection, when we teach children the knowledge of geography and history, we will tell the students about Marine environmental problems and ask them to think about how we can protect the environment and reduce the impact and damage of

human activities on the natural environment.

- Will be on the school's website, brochures, courses, the screen, will be constantly present.

Question: How does WIS teach their students to be future innovators?

- There are two key words, one is future, and one is innovation. These two questions are very broad, but if you want your child to be a competitor in the future, you have to first equip him with the ability to innovate in the future. Future innovation ability of the each country has its own standards, such as the core of Chinese with Chinese students accomplishment, Europe has the core of the European quality, America has his core literacy in the 21st century, all of which some quality are our children's future ability to innovate, are all countries for children to become innovators a requirement in the future.
- The cultivation of these innovative abilities is also an important part of our curriculum and teaching. Teaching in our school children's ability to give priority to, rather than test is given priority to, that is the school the teacher's teaching and lesson plan is based on cultivate their ability, so we use the IB diploma in international, the IB international diploma in itself to ensure the course of children's ability, including emotion, attitude, values. Then, through knowledge and curriculum, these abilities and such training objectives, such as communication ability, thinking ability, research ability and so on, then when these abilities are available, innovation ability is one of them. These skills are taught through the integration of content within the framework of the IB International Baccalaureate program.

Question: Is there anything unique about the structure of WIS? Different from an ordinary/"factory-model" school?

- It's not the traditional factory model, which is the exam-oriented model, where all the kids learn the same thing, and if I'm going to use a metaphor, I think we're the garden model. It is that our teacher and school are like a gardener, there are different flowers in the garden, it is impossible to be one kind of flowers each one such as roses, in the garden, there are all kinds of flowers, there are all kinds of grass. Then the role of our school is to provide these flowers and grasses with enough nutrition and fertilizer to make

you grow into the flower you want to be. So our curriculum is to make sure that children are nourished enough to have the ability to grow into the person that they want to be.

- To this end, the school will pass a variety of courses, a variety of extracurricular classes. Allow children to explore their own areas of interest. For example, what about our unit? The concept is the ocean. When we talk about the ocean, I have my own teaching goals. There are concepts that students need to learn in this unit. Take the idea of a loop. Including the concepts of migration and evolution. Children can learn by studying different subjects. It is up to the child to choose what to study. Under the broad framework of Marine environmental protection, children's learning content can be diversified. It doesn't matter what you learn, as long as you finally understand the concept of the ocean. The most important thing is to understand that his communication skills, thinking skills and other abilities can be improved during this process.

Question: How are ideas of collectivism taught in school (if at all)?

- Should schools is to teach students how to cooperate with others to solve the problem, ability to work in school is a very important ability, more emphasis on how to cooperation, we put forward a question of course, for example, let the children spontaneously to collaboration, let them learn how to play in the work team in the characteristic that each person is different, how to allocate tasks, how to bring their advantages into play how to complete the task within the allotted time, how to solve the problem.

Question: Do students participate in activities that teach group priority? Do students complete school work in teams? Or do they work by themselves?

- Not necessarily, we will respect the attitude of children when students participate in activities, but if the activity is a big project, it must include groups of two, one, three or four people, all kinds of forms. It depends on the scale of the task itself and the willingness of the students themselves. In what form do they want to finish their homework? Our school hopes that students can work in teams. Team cooperation mode is said from the beginning to the end together to solve the problem, not only need ten steps such as do the homework, that is not all the ten steps are all of you are doing, is likely to

be completed all personal independence among a step or two to complete a step, and so on many forms, but in the end the whole operation is presented in the form of the team.

Question: How can educators use ideas of collectivism to better their students? Or are assignments individual? Do professors use team-based lesson plans to educate their students?

- Do educators communicate with children according to this task? What do you think is the best way to accomplish this task? Do students tell us that it is best done individually or together or both? In this process, what do you need the help of teachers to solve? Like what resources are needed. The teacher's role is to guide you and give you the appropriate help, ultimately making the student a person who can work independently and make a significant improvement in the whole activity. If the task is personal, there must be individual small tasks, but the whole big task is for your team. When a teacher is planning an activity for their students, discussing the details of it with the students can allow them to grow as a learner. Discussing things like how the student will complete the activity, what resources they need to complete it, and what support they will need from the teacher gives students more control in their learning. The teacher's role should be to guide student's while still leaving room for the students to explore independently.
- Does the professor use a team-based curriculum plan? It's possible, and a lot of it is all team-based, and a lot of times now we encourage students to collaborate. But at the same time of cooperation, does not equal to completely abandoning the individual. Individuals and groups are inseparable. Let's say there are five people in a team. Five people have different advantages, which can make the team more distinctive. If everyone is the same, then the team is meaningless. So the team comes from the individual, the individual also depends on the team.

Appendix L: Interview Protocol for Students at Innovative Schools

The process for conducting interviews with a student was as follows. The research team interviewed a student who went or is currently in an innovative school and is of age to not have to fill out a parental consent form. Depending on the specialty of the interviewee, some additional questions were asked. The details specific to each interview can be found in their respective results appendix. Electronic notes were recorded and, with the consent of the interviewee(s), the Zoom interviews were recorded for further analysis.

The interviewee(s) were invited to participate in advance via email. The email explained the purpose of the interview and nature of the questions. The content of the email is detailed below.

Dear [Student name],

I am writing to you on behalf of my research team at Worcester Polytechnic Institute. We are working on a seven week project required for our graduation called, Interactive Qualifying Project. Our project is sponsored by the New England Innovation Academy (NEIA), a private independent boarding school opening in Marlborough next fall. The goal of our project is to develop a hands-on lab for the 6th grade that revolves around the students' impacts on the natural world around them.

We would like to invite you to talk with us about your thoughts on the intersection of environmental awareness and student engagement and interdisciplinary learning and what makes the best learning environment. The interview should take around one hour.

The purpose of this interview is to learn your perspective on effective learning and how grading and the classroom culture contribute to a student's experience. The information we gain will be analyzed and hopefully used in our final recommendations for the course to NEIA.

Please let us know if this is something you, or any other faculty you know, would be interested in. Your expertise would be invaluable to us, so we hope you consider. Looking forward to your response.

Best Regards,

WPI research team

Interview Content

The purpose of this interview is to gain an understanding on how sustainability can be incorporated into a hands-on lab that teaches appreciation for the natural world to sixth graders. This may include understanding the students' perspective on sustainability and whether they practice eco-friendly behaviors. The researchers will ask questions about the students' experiences in the classroom and in the natural world.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?
- Do you know you can choose to stop participating at any time?

Interview Questions

- Can you tell me about what you like to do outside?
    - Do you think being outside is boring? How so?
    - What is the coolest thing you know about nature?
    - Tell me about the types of animals you see outside.
- What does the word "sustainability" mean to you?
    - How about "eco-friendly"?
- Can you tell me what you know about...
    - Recycling?
    - Food waste?
    - Compost?
- What have you learned in school about the environment?
- Do you remember any class activities about nature or the environment that you liked?
- Have you ever learned outside?
- Can you tell me about a time you volunteered or helped someone?
- What does "make the world a better place" mean to you?
- Is there anything else you would like to share with the research team?

Appendix M: Result of Interview with Students at Innovative Schools: Anna Oliviera

Date: 10/29/2020
Present: Josh Alasso, Winnie Ly, Anna Oliviera, Maggie Reiter, Zach Stone
Facilitator: Josh Alasso
Note taker: Winnie Ly, Maggie Reiter, Zach Stone

Question: Can you tell us what attracted you to the Island School?

- Anna wanted to be a marine biologist and wanted a relatively less expensive way to experience marine biology. She learned about tourism and how to be a responsible tourist without deteriorating the land in which promoted community based learning.

Question: Can you walk us through a typical day?

- Wake up at 6:15, ready in morning exercise clothing at 6:30 (big on punctuality), physical penalties for punctuality, chores (Anna was in the bike shop also, recycling, classroom cleaning), then cleaned the room before breakfast, only allotted the necessary quantity of food. Classes, lunch, more class, free time (explore island), homework time (quiet), lights out at 1030, occasional dorm meetings (gender specific)

Question: What did they do differently compared to the other school you attended (PCD)?

- Food waste, water use, other systems that minimize environmental impact
- Both schools emphasized community and teamwork. PCD had earth day, environmentally conscious campus club, island school promoted community based environmentally friendly activities and also eco-friendly class discussions. Island school needed environmental friendliness to work.

Question: While there, how did students contribute to the community?

- Only allowed 60 seconds of fresh water per day, compost foods after meals (pigs, decomposition bugs), used bikes for transportation, chores rotate in the 100 day semester, chores

Question: What was the ratio of classroom learning to outdoor learning?

- Wasn't in classrooms for a lot of classes. Tourism class- road trip during class time, went and visited developments meant for tourists, discusses how all income comes from American tourists, camped in different sites all through the island. Find grassy areas and have a discussion based class. Better than instructors telling what is correct and what is not. Teachers are college or recently developed college students. They do not have a teaching degree. Students are expected to come with questions/concerns. Learning based on the questions/concerns of your peers.

Classes related to the environment need to take place in this environment. Could not learn US history outside (however lacked interest in US history)

Question: What helped you learn effectively outside?

- Every day was extremely exciting since this was foreign land. So different from a typical school in the US. Wanted to learn because she cared.
- Can you list the outdoor learning activities that you participated in?
- Everything learned about was related to a real work issue or life, which motivated students to learn more about it and get involved.

Question: Can you remember an activity or lesson that has had the greatest impact on your life?

- Cruise ships port and island school takes the oil and turns it into biodiesel (vehicles run on that) (chemistry)
- Tourism and development, each student did a solo trip to a beach for 24 hours with limited food and water. Could not reach out to other people, learned independence and how to live life on your own.
- Learned how to camp, fire start, cook food
- After each dinner, certain kids had dish duty. No dishwasher. Listened to music during, showing that typically boring activities can be made fun and engaging if executed properly.

Question: What do you do differently in your day-to-day life as a result of your time at the Island School?

- Do not use single use water bottles, do not use plastic bags, switched beauty products to biodegradable, vegan products, vegetarian, try hardest to not buy new clothes, recycle used clothes, NOT good at limiting driving, minute showers,
- Journal keeping to ensure reality, diversity training (I'm not a native, must be conscience while travelling, have respect for other people's cultures)
- More of a leader, Caseek for a day (leader for a day), lead a lot of stuff senior year, finding the voice about things that you are care about
- Living in a community that thrives on supporting each other, it removed fear of being a leader, confidence in yourself

Appendix N: Focus Group Protocol for Potential NEIA Applicants

The process for conducting interviews with students will be as follows. Students who are going to apply to NEIA will be asked questions regarding sustainability awareness and the presence of sustainable practices within their school. This focus group will take place over Zoom with five students at a time. Responses of the students will only be recorded by transcription by two of the researchers.

In order to find students willing to participate in an interview, faculty at NEIA will be asked to locate potential student interview participants. If they agree, this faculty member will help distribute consent forms to guardians and facilitate the focus group. All student participants will change their name on Zoom prior to the call to de-identify the data. The faculty will be sent an email with information related to their student's involvement in an interview and how their perspective on the topic at hand will be useful in developing a Lab plan for NEIA. The content of the email can be seen below.

Dear [Faculty Name],

We are a group of four students from Worcester Polytechnic Institute working on a seven week long project. We have great interest in facilitating a focus group with some of your students with questions pertaining to their perspective/knowledge of environmental awareness and eco-friendly practices that take place at your school. The information we gain will be used to help us design a sixth grade level Action Learning Lab for New England Innovation Academy, an innovative school which will be opening in 2021 in Marlborough, Massachusetts.

We understand that we will be interviewing minors, and we plan on taking all legal precautions necessary. Please let us know if this is something you, or any other faculty you know, would be interested in. Looking forward to your response.

Best Regards,

WPI research team

Focus Group Content

Introduction The purpose of this interview is to gain an understanding on how sustainability can be incorporated into a hands-on lab that teaches appreciation for the natural world to sixth graders. This may include understanding the students' perspective on sustainability and whether they practice eco-friendly behaviors. The researchers will ask questions about the students' experiences in the classroom and in the natural world.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?
- Do you know you can choose to stop participating at any time?

Interview Questions

- Can you tell me about what you like to do outside?
    - Do you think being outside is boring? How so?
    - What is the coolest thing you know about nature?
    - Tell me about the types of animals you see outside.
- What does the word "sustainability" mean to you?
    - How about "eco-friendly"?
- Can you tell me what you know about...
    - Recycling?
    - Food waste?
    - Compost?
- What have you learned in school about the environment?
- Do you remember any class activities about nature or the environment that you liked?
- Have you ever learned outside?
- Can you tell me about a time you volunteered or helped someone?
- What does "make the world a better place" mean to you?
- Is there anything else you would like to share with the research team?

Appendix O: Focus Group Results with Potential NEIA Applicants

Facilitator: Josh Alasso
Note taker: Maggie Reiter
Participants: Cyan, Silver, Red, Lime, Blue, Green, Magenta, Purple, Orange
Date: November 24, 2020 7:00pm EST

Josh: Hi everyone, my name is Josh and I'm a college student at WPI. My team and I are doing a project about learning outside and we are super excited to talk to everyone today. I want to introduce everyone to my teammate Maggie.

Maggie: Hi everyone, I am Maggie. I will be taking some notes on our discussion today with my camera off while Josh talks with you guys.

Josh [Icebreaker]: How's school been? Raise your hand if you like staying home. It would be great if everyone could share what grade they are in. (~5 minutes)

Josh: When we did research back in October, we noticed that some students really enjoy learning outside. As real students, you guys are the experts, and we'd like your thoughts about outside learning so we can help make school a better place for everyone.

Josh: Before we start I just want to let you guys know that there are no right or wrong answers to any of the questions that I ask. I am just looking for your opinions and, of course, sharing your opinions are optional. Not everyone has to agree with each other, but all opinions are welcome and it is really important for everyone to respect the others' opinions. Give me a thumbs up if that sounds good!

Question: Can you tell me about a time you had a lot of fun outside?

Cyan: Gymnastics. Accomplishing a new trick is awesome

Lime: Nature's Classroom

Question: What else do you like to do outside?

Red: In English class, we go outside a lot. When I have my class that's two periods back to back, we get to do a lap around the school. It can be really nice to have a break. And it is really nice to go outside for classes.

Purple: I like outside reading time

Cyan: At the beginning of the year, probably half the classes are outside. I like reading outside and having science outside.

Silver: I have class outside with an outdoor tent.

Magenta: Wouldn't something like an amphitheater be awesome? An outdoor space like that would be really cool. It would be like a classroom, but outside. I enjoy learning outside as long as it's a comfortable setting. It is important to me to be able to sit down and write things. Sometimes, when you go outside I'm like "oh where can i put my books". I do like writing better than typing so I need a writing surface. It can be really nice to be outside because it's something different.

Lime: I just went out for math on the courtyard in elementary school.

Question: Have you guys ever had a class outside? Can you guys share your experience of having class outside? At home vs at school? What interested you the most about it?

Blue: I got to do some projects in science and physics. Like we got to pull a tablecloth off a table while there was stuff on top. That was a lot of fun!

Red: Anything hands on is more fun, and getting to decide how to do it makes me enjoy it more too.

Lime: Hands on is awesome. I don't enjoy class as much when just the teacher is talking.

Magenta: Lecture style learning is helpful but for students to really grasp the material, hand-on is very helpful and positive because it's exciting!

Silver: Hands-on is easier to learn that way. Especially for kids who have trouble sitting still during lectures.

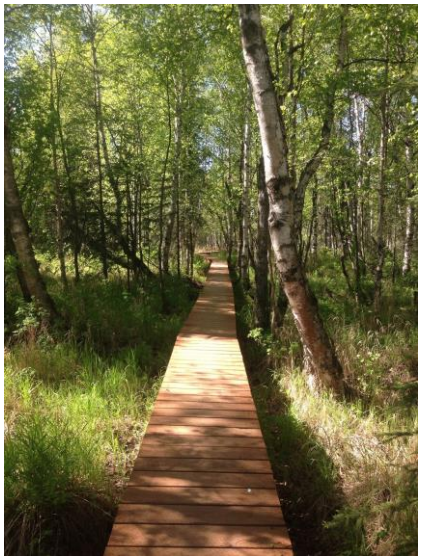
Red: Kids who don't put in maximum effort would try harder because they know they would take it home.

Blue: I agree with that

Magenta: Building life skills is better. Learning in a classroom is great but adding on to that other skill is also awesome because when you move out of your house into the real world you will be more prepared. Hands on it awesome

Question: What would you think about building a wooden trail with your classmates at school? Have you ever done anything like that?

Showed this picture to participants



All: That would be awesome, sounds like fun.

Orange: I like the idea of making a path through the woods. You could learn different types of plants and animals too.

Blue: I haven't built any trails, just a few things but with leaves and stuff. My school had a sugar shack so we could tap trees.

Green: Every year we tap trees in our woods for maple syrup high school my dad used to work at used to help. Doing it at NEIA would be fun and hands-on

Question: Can you tell me about some things you would like to learn about? Are you interested in animals? How does a tree log sound to you?

All: Tree log sounds awesome

Magenta: We could even tap trees!

Silver: I think that would be cool to learn about trees and plants

Red: Then you could draw, write, learn about them in different ways.

Magenta: I would love to have a psychology centered class. Learning about development about the human mind, how to process emotions, and other stuff like that.

Question: What kind of life skills would you be interested in learning?

Magenta: Wood working, a program that allows people to discover things they're interested in like cooking class!

Purple: Building things that would help you in your future…

Navigation

Outdoor class , hiking

Cyan: Learning how to start fire or build a shelter

Lime: Cooking basics know how

Question: Can you tell me about a time you got to choose your assignment type of what you wanted to learn?

Red: Last year during remote learning, with our final projects you could choose how to do it. Slide show, video, essay.

Blue: This year in science, we had a project and could build a scale model or write something about it. And most people went with the scale model.

Cyan: For me, I have homework assignments and you get to choose out of 6 things.

Red: If it's a project you're not excited about, having more choice could make you more interested

Purple: Having an option is good because depending on your level and what you feel more comfortable with you might want different things.

Question: How would you guys feel about going outside in the winter?

Magenta: Yes!

Purple: It would be fun to explore in the winter.

Red: It depends on what you're doing...

Silver: For something like doing work, staying still outside wouldn't be good in the winter.

Blue: I would be fine doing activities outside because I like the cold.

Cyan: I like being outside during the winter.

Red: If it was an activity and not a class that would be more fun.

Silver: I agree. Moving around and not being still outside in the winter could be fun.

Purple: If there's a reason for being outside then yes.

Cyan: If it's a PE class or science, some activity class, being outside in winter would be fun. Not if it's reading or math though.

Question: How are you graded now?

Cyan: My school doesn't do A or C in the report card. We do 1-4. Math is graded by percent correct, not letter.

Lime: Check plus, check minus. So, it's still a letter grade .

Blue: A, B, C and also percentage of each class.

Red: Yeah, same.

Purple: Number grades, but it's still the same as A, B, C.

Question: How do you like the way you are graded?

Red: It's a pretty good system how it is, for me at least.

Green: I've always been graded 1-4. I don't mind it, and have no complaints. But, I would prefer A, B, C, D.

Cyan: On math tests prefer the percentage.

Magenta: I prefer percentage grade

Question: Do you wish you were graded on things other than percentage right?

Cyan: The whole report card is not only how you did on a test but also behavior about how well you are participating

Purple: Normal classes will have the grades from the test and separate part of the report card with participation and behavior. Not sure if this part counts towards my final grade though.

Red: In math once, asking questions and being part of the conversation was a big part of the grade. I have mixed feelings about it because you felt like you had to ask questions even if you didn't need to ask it.

Magenta: It could be good to have some percentage beyond effort to accommodate all students. Test taking isn't best judge for everyone and asking questions is not the best judge for everyone.

Question: What would you think about solo relaxing time?

All: Yes! That would be awesome!

Magenta: It would be good to be able to think through things in a peaceful way, learning about different social situations, and be able to be alone. To be able to think through things is good.

Appendix P: Focus Group Protocol for Ross School Students

The process for conducting interviews with students will be as follows. Students who attend Ross School in East Hampton, New York will be asked questions regarding sustainability awareness and the presence of sustainable practices within their school. This focus group will take place over Zoom with five students at a time. Responses of the students will only be recorded by transcription by two of the researchers.

In order to find students willing to participate in an interview, faculty at the Ross School will be asked to locate potential student interview participants. If they agree, this faculty member will help distribute consent forms to guardians and facilitate the focus group. All student participants will change their name on Zoom prior to the call to de-identify the data. The faculty will be sent an email with information related to their student's involvement in an interview and how their perspective on the topic at hand will be useful in developing a Lab plan for NEIA. The content of the email can be seen below.

Dear [Faculty Name],

We are a group of four students from Worcester Polytechnic Institute working on a seven week long project. We have great interest in facilitating a focus group with some of your students with questions pertaining to their perspective/knowledge of environmental awareness and eco-friendly practices that take place at your school. The information we gain will be used to help us design a sixth grade level Action Learning Lab for New England Innovation Academy, an innovative school which will be opening in 2021 in Marlborough, Massachusetts.

We understand that we will be interviewing minors, and we plan on taking all legal precautions necessary. Please let us know if this is something you, or any other faculty you know, would be interested in. Looking forward to your response.

Best Regards,

WPI research team

Focus Group Content

Introduction The purpose of this interview is to gain an understanding on how sustainability can be incorporated into a hands-on lab that teaches appreciation for the natural world to sixth graders. This may include understanding the students' perspective on sustainability and whether they practice eco-friendly behaviors. The researchers will ask questions about the students' experiences in the classroom and in the natural world.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?
- Do you know you can choose to stop participating at any time?

Interview Questions

- Can you tell me about what you like to do outside?
    - Do you think being outside is boring? How so?
    - What is the coolest thing you know about nature?
    - Tell me about the types of animals you see outside.
- What does the word "sustainability" mean to you?
    - How about "eco-friendly"?
- Can you tell me what you know about...
    - Recycling?
    - Food waste?
    - Compost?
- What have you learned in school about the environment?
- Do you remember any class activities about nature or the environment that you liked?
- Have you ever learned outside?
- Can you tell me about a time you volunteered or helped someone?
- What does "make the world a better place" mean to you?
- Is there anything else you would like to share with the research team?

Appendix Q: Focus Group for Ross School Students Notes

Facilitator: Maggie Reiter
Note takers: Josh Alasso, Zach Stone
Participants: Diamond, Star, Crescent, Cloud, Hexagon
Date: 12/7/20, 5:30 pm EST
Objective: Gain students' perspective on outdoor learning.

Maggie: Hi everyone, my name is Maggie and I'm a college student at WPI. My team and I are doing a project about learning outside and we are super excited to talk to everyone today. I want to introduce everyone to my teammate Josh.

Josh: Hi everyone, I am Josh. I will be taking some notes on our discussion today with my camera off while Maggie talks with you all.

Maggie [Icebreaker]: How's school been? Raise your hand if you like staying home. It would be great if everyone could share what grade they are in. (~5 minutes)

Maggie: When we did research back in October, we noticed that some students really enjoy learning outside. As real students, you guys are the experts, and we'd like your thoughts about outside learning so we can help make school a better place for everyone.

Maggie: Before we start I just want to let you guys know that there are no right or wrong answers to any of the questions that I ask. I am just looking for your opinions and, of course, sharing your opinions are optional. Not everyone has to agree with each other, but all opinions are welcome and it is really important for everyone to respect the others' opinions. Give me a thumbs up if that sounds good!

Question: Can you tell me about a time you had a lot of fun outside?

> **Crescent:** We went back to a little train and there were ice sheets, and it was really fun. We got to break them and pick them up. We were seeing who could get the largest ice piece.
>
> **Star:** We got to walk through the ice puddles.
>
> **Cloud:** We got to walk around and talk to our friends. Usually during breaks me and my friend walk around campus.
>
> **Diamond:** I think it's fun because Ross has a very beautiful campus so it's fun to go outside, but not when it is really cold.

Crescent: We have specific masks breaks.

Diamond: We have a field so we do a lot of outdoor activities. We have also been focusing on mindfulness.

Hexagon: We learned a little bit of mindfulness

Question: Can you tell us what mindfulness is to you?

Cloud: Being peaceful.

Question: What other activities do you do for mindfulness?

Diamond: After our walks, we sit in our classes and stay still.

Crescent: It was weird at first and it was easier the more we did it.

Question: Do you ever have classes outside?

Diamond: Sometimes we sit in a circle and sometimes we like to take a break from being inside all day.

Crescent: We have our daily announcements outside, sometimes we have science too. They have tables and chairs outside under the tents.

Question: Anything bad about being outside?

Cloud: Sometimes it gets really cold outside.

Hexagon: Sometimes the bees are distracting.

Question: What Are you learning about science?

Cloud: We had to make a podcast about what we learned about space. We got to write our own scripts and record our own podcast.

Diamond: sometimes I like group work but sometimes I like to work by myself. We studied a Mandarin city and we wrote about the culture and the food in that city.

Question: Do you like group work?

Star: I like group work.

Crescent: I made an accordion style book with a bunch of Mayan recipes.

Cloud: My essay was about the Mayan government and I wrote a little book about Mayan rituals and ceremonies.

Diamond: I did a drawing about a Mayan goddess and did a presentation too. I liked learning about the goddesses.

Question: Do you guys often get to choose the topic you do a project on? Do you prefer that or do you like it when the teacher assigns?

Diamond: I like to do both sometimes.

Question: Are there some good things about teacher instruction?

Cloud: You immediately know what you need to be researching.

Question: What do you like about choosing a topic?

Star: It is what we are interested in and it is nice to choose.

Question: Are you more interested to learn when you choose what you learn about?

…

Question: How do you guys get graded on these projects?

Cloud: We get graded on the level of research and the amount of work you put into it.

Crescent: We get graded on the quality of presentation, quality of work, and what you did.

Question: Could you change or add something you get graded on would you?

Diamond: I have a bad habit of procrastination. When it came to choosing my topic, I chose something I really liked.

Question: Would you guys all say you knew beforehand what you were being assessed on? Is the final grade ABC, 123, check, check plus?

All: We got a percentage out of 100

Question: Can you tell me about life skills and some things that you learned?

Cloud: We talked about future careers and did a test thingy where we answered questions about if we became this person would you like it or not. Based on the answers it gave us a bunch of different things we could do.

Star: We talk about what we want to be when we are older.

Crescent: Some were about goal setting, but most were about career setting but one was about self regulation. I would really like to learn about cooking.

Cloud: I would like to learn about woodworking like the high schoolers do.

Statement: Do not get graded on life skills. Three different trimesters that incorporate different styles of life skills that are not graded.

Diamond: This teacher we only had one lesson with, he was reading us a story about organization and we had to answer questions in the chat about organization skills.

Crescent: I don't know what I liked but it was really fun how we got to interact about it. We all got to see each other's answers but we also had to private chat to him about things we didn't want to say to the whole class.

Question: How would you guys feel if you collaborated with your teacher on a choice heavy project?

Diamond: I think that would help for me, but we also have advisory at Ross and different groups. We mainly talk about how to submit everything virtually. We don't really do one on ones. Maybe for a topic they might help you choose a topic and find what you are interested in. Also, if you already started it they could help you expand on what you are talking about.

Cloud: Maybe like you sent out an email or Google form asking if they wanted to do this. Sometimes I would want to do this but not all the time.

Question: Before you start a project, are you guys given a rubric or do you create the rubric with the teacher in a collaborative setting?

Star: Both, she posts the rubric and talks about it.

Question: Would you like a say in the rubric?

Diamond: I think it is good with the rubric with just being given to us. It allows us to focus on what we need to do. For some rubrics, she gives certain directions for a specific grade range.

Question: Have you ever got an unfair grade back?

Crescent: When we did the Maya project I transferred my essay to a team Word document and it wouldn't let me do double space and I got points taken off for that.

Diamond: In the beginning of the year, we were writing essays and it was our first time working with it and it was definitely a learning experience on how to write an essay. If we didn't indent or double space we would get points of.

Question: When you guys get your grades back, are you guys happy with the feedback. Do you know how to improve for next time?

Cloud: In science, she gives us the grades. But one time the grades were given back late so it ruined my grades for the rest of the trimester.

Crescent: I talk to the teachers after I get a grade.

Question: Do you guys like when there is a lot of feedback? Why do you like a lot of feedback?

Cloud: It helps you know whether you got something wrong or right and why.

Question: If you could change one thing about school what would it be?

Cloud: I would like to have a printer in the classroom because my printer isn't good.

Appendix R: Secondary Research Protocol

The process for doing secondary research is as follows. The research team used peer-review sources and WPI Databases to get an understanding on active learning, effective learning environments for outdoors, and various ways for assessment on students. After gathering this research data, the team put together their sources and analyzed as well as categorized them to determine which sections they go to strengthen their report. The team also used sources that the sponsor gave to support the claims made in this report.

Secondary Research Content

The purpose for secondary research is to have the research team understand what are the quality of lesson plans that they should include when developing the curriculum plan for the Grade 6 Lab for NEIA. This research also led the team to decide what lesson plans to include that can have student engagement and utilize most of the campus resources.

Secondary Research Search Terms

- Active Learning Benefits in Middle School
- Benefits to Outdoor Learning
- Effective Learning Environments
- 6th Grade Outdoor Lesson Plans
- Community Building
- Student and Teacher Relationships

Appendix S: Secondary Research Results

Theme	Source	Results
Active Learning	Edwards, S. (2015). Active learning in the middle grades. Middle School Journal, 46(5), 26-32. Retrieved October 26, 2020, from http://www.jstor.org/stable/24342232	The source is focused on different elements that go into active learning in middle grades. It distinguishes three types of environments for active learning: intellectual, social, and physical and gives examples from four teachers from different schools that teach different subjects and how they went about using active learning compared to passive learning.
	Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014, June 10). *Active learning increases student performance in science, engineering, and mathematics*. Proceedings of the National Academy of Sciences of the United States of America. https://www.pnas.org/content/111/23/8410?lipi=urn%3Ali%3Apage%3Ad_flagship3_pulse_read%3B5ujlJ92ZQgC6PXO%2BbkuCcQ%3D%3D&utm_source=SwitchUp&utm_medium=Blog	Active learning increases student performance in Science, Engineering, and Mathematics.
	Longo, C. (2016). Changing the instructional model: Utilizing blended learning as a tool of inquiry instruction in middle school science. *Middle School Journal*, *47*(3), 33-40.	The source focuses on how to make students start thinking about the global issues that the world is facing and how educators teach them about it. The article goes into detail about how one teacher proposed critically thinking

	Retrieved October 26, 2020, from http://www.jstor.org/stable/44135232	questions to get her students thinking about not only about themselves but about what others may feel and how the world may be impacted. It is similar to NEIA's empathetic culture in which the students are responsible for their own actions.
	Gallou, E., & Abrahams, P. (2018). Creating space for active learning: (Opportunities from) using technology in research-based education. In Tong V., Standen A., & Sotiriou M. (Eds.), *Shaping Higher Education with Students: Ways to Connect Research and Teaching* (pp. 165-175). London: UCL Press. Retrieved October 27, 2020, from http://www.jstor.org/stable/j.ctt21c4tcm.27	The source focuses on how technology can be applied to active learning. The article was mainly focused on university students' education and examples on how technology can be implemented during lecture and out of lecture. Other examples included using social media to get professors connected to their students and vice versa.
	Box, C., Myers, R., Poland, R., W. Bowen, C., Effects of active-learning experiences on achievement, attitudes, and behaviors in high school biology. Journal of Research in Science Teaching. Retrieved October 26, 2020, from https://onlinelibrary.wiley.com/doi/abs/10.1002/tea.20183	Effects of active learning experiences on achievement, attitudes, and behaviors in high school biology.
Community Building	Schonert-Reichl, K. (2017). Social and Emotional Learning and Teachers. The Future of Children, 27(1), 137-155. Retrieved October 26, 2020,	This article highlights the importance of healthy student/teacher relationships. Without an emotional connection and trustworthy relationship between a teacher and a student, the student's

	from http://www.jstor.org/stable/44219025	behavior and academic success will plummet. The article also touches on the stress that comes with being a teacher, and how it can be difficult to continuously have a positive attitude while teaching.
Lesson Plans	Jennifer, F. (2020, January 23). Try These 20 STEM Outdoor Activities for Some Fun Learning. Retrieved October 29, 2020, from https://wabisabilearning.com/blogs/stem/20-stem-outdoor-activities	This source doesn't seem incredibly reliable, however, it provides 20 outdoor activities that incorporate STEM. Some of the activities are super cool and can definitely be used in our curriculum plan. The activities each have a plan detailing the materials required and how to perform them which makes our lives a lot easier. Great starting point for brainstorming what activities to incorporate in the Lab.
	The Nature Conservancy. n.d.. *Youth Education Resources for Grades 6-8*. The Nature Conservancy. Retrieved October 05, 2020, from https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/middle-school-lesson-plans/	This website contains teacher guides for eight nature based lesson plans. These guides by the Nature Conservancy cover topics like the declining bee population, impact of reforestation, and natural water filtration. Some aspects of these lesson plans could be applied to the Lab at NEIA. This organization is a nonprofit with the goal of uniting people with nature. These guides and others on this website, like building a school garden, will be useful for the research team to take advantage of.
	https://www.nationalgeographic.org/activity/in-your-watershed	This activity introduces kids to watersheds. Comes with a worksheet to fill in and suggests the students make clay models of mountains/runoff/watershed and pour water down it to see how it flows. This could be related to pollution (science),

		agriculture (history), and engineering design. Could teach a **Life Skill** of map reading
Interdisciplinary Learning	Conner, L., & Sliwka, A. (2014). Implications of Research on Effective Learning Environments for Initial Teacher Education. European Journal of Education, 49(2), 165-177. doi:10.2307/26609211	New learning programs understand that the students are the main concern, not using the student's success as means of deciding whether teachers are doing their jobs. These environments must promote "Horizontal Connectedness" which essentially related anything the student does to the surrounding community, or professions they could potentially hold in the future. There must be specific feedback given to each student based on the quality of their work; stray away from number/letter grades, and focus more on improvement rather than highlighting mistakes.
	FEINSTEIN, N.W. and KIRCHGASLER, K.L. (2015), Sustainability in Science Education? How the Next Generation Science Standards Approach Sustainability, and Why It Matters. Sci. Ed., 99: 121-144. https://doi.org/10.1002/sce.21137	Sally Booth shared this source with us so you know it's good. "...Explores how sustainability is embodied in the Next Generation Science Standards (NGSS)..." This information could be used to further support the team's background section, if needed. The team can use this information with what they have about using HCD to better prepare students for the future. This article covers "new" approaches to teaching sustainability so students are best prepared and the topic is seen less politically.
Outdoor Learning	Ernst, J. & Stanek, D. (2006). The Prairie Science Class: A Model for Re-Visioning Environmental Education within the National Wildlife Refuge System, Human Dimensions of Wildlife, 11:4,	This source is an analysis of using an outdoor learning environment i.e. a case study. It explains how the organization in question was able to integrate traditional subjects into an outdoor learning space and the effects it had on students.

	255-265, Retrieved October 29, 2020, from https://www.tandfonline.com/doi/full/10.1080/10871200600803010?scroll=top&needAccess=true	
	Kuo, M., Barnes, M. and Jordan, C. (2019). Do Experiences With Nature Promote Learning? Converging Evidence of a Cause-and-Effect Relationship. *Frontiers in Psychology. 10:305.* Retrieved October 29, 2020, from https://www.frontiersin.org/articles/10.3389/fpsyg.2019.00305/full	This source provides research pertaining to the effects of outdoor learning. This source can be used as evidence to back-up why outdoor learning is beneficial. It also lays out specific cause and effect relationships of utilizing outdoor learning and explains several benefits.
	Marchant E, Todd C, Cooksey R, Dredge S, Jones H, Reynolds D. (2019). Curriculum-based outdoor learning for children aged 9-11: A qualitative analysis of pupils' and teachers' views. Retrieved October 29, 2020, from https://doi.org/10.1371/journal.pone.0212242	This source provides research on outdoor learning from both teacher perspectives and student perspectives. This research is very similar to the research we are currently conducting and may be helpful if the team has a gap in their data from the interviews and case studies we are conducting. It also discusses the way in which the researchers analyzed information gained from interview participants which will definitely help the team towards the end of the term i.e. it gives them an idea/example of how to analyze their data.
	Samuel F. Dennis, Jr., Alexandra Wells, & Candace Bishop. (2014). A Post-Occupancy Study of Nature-	This source is a study that tested the effects of learning in an outdoor classroom on elementary students academic performance. The results

	Based Outdoor Classrooms in Early Childhood Education. Children, Youth and Environments, 24(2), 35-52. doi:10.7721/chilyoutenvi.24.2.0035	section of the report highlighted that the outdoor students were more relaxed and well behaved. They were not pressured to use "indoor voices" and were not forced to remain seated at their desks. The outdoor classroom also offered a variety of new learning topics. For example, students were able to see the effects of changing seasons on wildlife right before their eyes, not simply pictures in a textbook. To the students, these outdoor hands-on activities were engaging and exciting, which often relieved built up energy that can be found in rowdy classrooms.
Student Engagement	Parsons, S., Nuland, L., & Parsons, A. (2014). The ABCs of student engagement. The Phi Delta Kappan, 95(8), 23-27. Retrieved October 26, 2020, from http://www.jstor.org/stable/24374604	This resource speaks on the importance of student engagement in an ordinary classroom. These principles can still be used at NEIA; they will even be more useful as the school has a previously established interactive culture. Student engagement is "malleable" meaning that it is somewhat the teacher's responsibility to include all students in class discussions and activities.

Appendix T: Curriculum Map

	Activity 1: Getting to Know NEIA Campus	Activity 2: Trail Building
Description	On the first day of the lab, students will walk around campus and explore areas, flora, and fauna that are in the local area.	Students create pathways through the woods surrounding NEIA campus
Learning Objectives	1. Learn what natural elements are around campus 2. Be comfortable with the outdoors in preparation for future classes 3. Respect nature when exploring	1. Learn how to explore in nature, while respecting it 2. Understand the history of the land 3. Make observations of the environment with their senses (feel, hear, smell, see) 4. Make solutions on how to conserve the trail 5. Become familiar with land
Needed Materials	N/A	Rakes, branch clippers, gloves, tick spray, etc.

STEAM'D	N/A	Science: Flora & Fauna Classifications. Biology. Technology: Take a picture everyday with a camera to document progress Engineering: Any structures needed to tranverse streams, etc. Art: Sketch out the pond, landscape, in a topological map. Add layers with some possible trail designs. Mathematics: Measure length, distance between points along the path. Geometry. Design: Students imagining various ways on how to build a trail
Cultural Tapestry	N/A	Human Ecology: Adaptation to central Mass in history. History:
Being. Well. Skilled.	Being mindful of their surroundings as they explore. Helps develop obseravtion skills and self-reflection	How to read a compass. Orientation.
Hard Product	N/A	The trail that the students made
Digital Component	N/A	N/A
Social Component	Access to Campus areas and environment while students get to know their peers and instructors	Access to the woods for students
Services	Promoting exploration as students walk around campus.	Access to nature, to the woods for students and thecomunity. Link to the town pathway through the conservation area.
Assessment	Not Graded	Not Graded
Duration/Season	Short Term (First Day of school)	Long Term, Beginning of year so students can use trails ASAP, Warmer weather is preferred
Total time estimate	45 minutes	
Link to lesson plan		

Appendix U: Curriculum Calendar

End of August/September 2021						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	31	1	2	3	4
	Matriculation Ceremony aka first day of school	Universal Student Onboarding Experience	Student Onboarding			
5	6	7	8	9	10	11
	Labor Day (No school)		Get to know the campus	Start trail building in engineering time		
12	13	14	15	16	17	18
	Begin tree log. Can adapt cue card solo walk		Begin trail building unit			
19	20	21	22	23	24	25
	Act 5: Field Journal		Trail build day	*Back to school night*		
26	27	28	29	30		
	Act 6: Native/invasive spp		Trail build day			

October 2021						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
	Act 7: Endangered spp		Tree log update			
10	11	12	13	14	15	16
	Indigenous People's Day / Fall Break					
17	18	19	20	21	22	23
	Act 8: Insects contribution		Trail build			
24	25	26	27	28	29	30
	Act 9: Nature Photography		Trail build		Halloween Festival	
31						

November 2021						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
	Act 10: Composting, other soil related	Civic Responsibility Universal Engagement Day (Election Day)	Tree log update		Diwali Celebration	
7	8	9	10	11	12	13
	Act 11: Forest fires	Land use, human impact	Act 12: Changing landscape			
14	15	16	17	18	19	20
	Act 12: Changing landscape		Connect land use to Indigenous ppl history			
21	22	23	24	25	26	27
	Thanksgiving Holiday					
28	29	30				
	Act 13: Build a Stick Maze					

December 2021						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
			Tree log update			
5	6	7	8	9	10	11
	Act 14: Exploring the Impacts of		Act 14: Exploring the Impacts of			
12	13	14	15	16	17	18
	Act 9: Nature Photography		Act 15: Snowshoeing			
19	20	21	22	23	24	25
	Winter Break					
26	27	28	29	30	31	
	Winter Break					

January 2022						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
	Act 16: Green house gas	Learning about energy in other classes	Tree log update			
9	10	11	12	13	14	15
	Act 17: Art Project with UV Beads		Act 18: Sunscreen Print Art Project	Share Sesion		
16	MLK Jr Day 17	18	19	20	21	22
	I.D.E.A.S. Cultural Responsibility Universal Engagement Day		Act 19: Dirt Battery			
23	24	25	26	27	28	29
	Introduce Act 20: transportation		End of Semester 1			
30	31					
	Act 21: Phases of the Moon					

February 2022						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
			Tree log update		Lunar New Year Celebration	
6	7	8	9	10	11	12
	Transportation log reflection		Act 15: Snowshoeing			
13	14	15	16	17	18	19
	Act 22: How Our Actions Affect the		Act 23: Creating Sinkholes			
20	21	22	23	24	25	26
	EXPLORE Week					
27	28					
	Act 24: Learning the scientific					

March 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
			Tree log update			
6	7	8	9	10	11	12
	Act 25: How Filtering Can Affect Water		Act 25: How Filtering Can Affect Water		Community Color Run	
13	14	15	16	17	18	19
	Activity 26: Watershed		Activity 26: Watershed			
20	21	22	23	24	25	26
	Act 27: How pH Affects Soil		Weather depending: Trail clean up			
27	28	29	30	31		
	Spring Break / Global Trips					

April 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
	Spring Break / Global Trips					
10	11	12	13	14	15	16
	Solo time reconnecting with nature	Learning about watersheds in engineering class	Begin Act 28: Pond Salinity		Community March for Elephants and Rhinos	
17	18	19	20	21	22	23
	Take samples of water		Act 29: Pond Ecology		Environment Action Universal Engagement Day	
24	25	26	27	28	29	30
	Act 29: Pond Ecology cont.		Tree log update			

May 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
	Act 25: Effect of development on environment		Tree log update	Cinco de Mayo Fiesta		
8	9	10	11	12	13	14
	Act 26: Solution session on how to prevent		Take samples of pond			
15	16	17	18	19	20	21
	Trail Maintenance Day		Act 30: Nature Tower	Grade 6 Share Session		
22	23	24	25	26	27	28
	Act 31: Dew traps		Tree Log Class Reflection (Assessment)			
29	30	31				
	Memorial Day					

June 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
			Outdoor celebration		Last day of school?	
5	6	7	8	9	10	11
	Act 32: Solar Oven		Act 32: Solar Oven		Community Focused Universal Engagement Day	
12	13	14	15	16	17	18
	Act 9: Nature photography		Tree Log	Leaving ceremony	End of Semester 2	

Appendix V: Curriculum Justification and Rubric

		Qualities (rated on scale of 1-5)					
Activity Name	**Theme**	Engagement	Interdisciplinary	Feasibility	Connection to the Natural World	Connection to NEIA's Mission	Total
Get to Know Your Campus	(Orientation idea)	Oreintation					0
Tree Log	Ecology	5	5	5	5	5	25
Solo Nature Walk	Environmental Awareness	5	2	5	5	4	21
Trail Building		5	4	1	5	4	19
Field Journaling	Ecology	4	5	5	5	3	22
Native and Invasive Species	Environmental Awareness	5	3	5	5	5	23
Endangered Species	Environmental Awareness	5	3	5	5	5	23
How Does Insects Contribute to the Ecosystem/Bug Collecting	Ecology, Environmental Awareness	5	3	5	5	5	23
Nature Photography	Environmental Awareness	5	3	4	5	3	20
Composting in Soil	Ecology	3	3	5	4	2	17
Forest Fires	Environmental Awareness	2	3	2	4	2	13
How Has This Landscape Changed?	Ecology, Environmental Awareness	3	5	5	4	4	21
Build a Stick Maze		5	3	5	3	3	19
Explore the Impacts of Feeding the World	Environmental Awareness	3	4	3	4	5	19
Snowshoeing in the Winter		4	2	1	5	2	14
Understanding Greenhouse Effects	Environmental Awareness	5	4	4	4	5	22
Art Project with UV Beads	Energy	5	4	5	4	3	21
Sunscreen Print Art Project	Energy	5	4	5	4	3	21
Build a Dirt Battery	Energy	4	4	4	4	5	21
Transportation Log	Environment Awareness	3	3	5	4	4	19
Phases of the Moon (At Home Activity)		4	2	5	4	2	17
How Our Actions Affect the Environment	Environmental Awareness	4	3	5	4	5	21
Creating Sinkholes	Environmental Awareness	4	3	4	4	5	20
Learning the Scientific Method with Paper Rockets		5	5	5	3	3	21
How Filtering Can Clean Water	Water	4	4	4	3	5	20
Watershed	Ecological, Water	4	3	5	2	5	19
How Does Soil Affect the pH of Water?	Ecology, Water	5	4	3	3	5	20
Measuring Pond Salinity	Environmental Awareness, Water	5	5	3	5	5	23
Pond Ecology	Ecology, Water	5	4	4	5	5	23
Nature Tower Building Challenge	Ecology	5	3	5	4	2	19
Experimenting with Dew Traps	Ecology	4	5	3	5	5	22
Solar Oven	Energy	4	4	4	4	5	21

Key	
	=19-25
	=15-18
	=10-14
	=<10

	Definition	1	2	3	4	5
Engagement	The activity is carried out in a way that is most suitable for the given conditions (i.e., weather, season, etc.)	This activity utilizes campus resources, physical spaces, learning styles, assessment types in the least effective way.	Minimal campus resources are utilized, majority of educational value comes from in class lecturing and demonstrations	A mix of both teachers presenting to students and students engaging in their learning. Utilizes some of the indoor and outdoor spaces. Mixed modality of the activity adds some value to the learning experience of the students.	Student driven with little teacher involvement evaluations and observations and utilizes some of the campus resources in the activity.	This activity utilizes campus resources, physical spaces, learning styles, assessment types in the most effective way. The mixed modality of the activity adds value to the learning experience of the students.
Interdisciplinary	The activity integrates multiple subjects and the four learning objectives set up by NEIA. The connected disciplines need to have a purpose and the overlap must create a more authentic	Only one discipline incorporated or Students do not need to use skills acquired in other classes to succeed in this activity. There is no connection between the natural world and other topics.	Students might be able to apply skills from other classes but the connected disciplines are relatively arbitrary.	Students have to use some skills from other classes. Though different disciplines are incorporated, they don't necessarily contribute to the main objectives of the activity	This activity requires some skills from other classes and challenges students to do so. The interdisciplinary aspects of the activity are mostly meaningful.	The activity requires students to use skills acquired in other classes to succeed in this activity. This activity makes a strong connection between the natural world and other class topics. The interdisciplinary aspects of the activity are meaningful to the students' learning and the value of the lesson may diminish without

	understanding.					all the incorporated disciplines.
Feasibility	Difficulty of gathering needed materials/ resources, required preparation, and location.	The materials, preparation, and/ or required location make the activity difficult for either the students or teacher. This activity is time intensive for planning and requires heavy collaboration between instructors.	It is somewhat difficult for students to participate in this activity, and also requires a moderate amount of teacher planning and collaboration.	Mild complexity in getting materials and preparing the activity. Location may be undetermined and teachers need to do some additional research, planning, and collaboration on the activity.	Some preparations are needed like gathering materials, scouting locations. Little to no effort research needed for knowledge or teacher planning is needed.	Little to no effort required to prepare for this activity. The instructor should have access to required materials, knowledge, and physical space required. The time required for this activity for students to participate and teacher planning is minimal to no effort.
Connection to the Natural World	The setting of the activity benefits students learning whether it takes place inside or outside of the classroom.	The activity does not make any connections to nature and adds little to no relevance to student's learning.	Students can make some connections between the activity and the natural world.	The activity makes mild connections to nature and has some impact/immersion to students.	This activity is clearly connected to the natural world but does not fully immerse students.	This activity fully immerses the student in the natural world. Students can clearly relate the topics of this activity to their lives.
Connection to NEIA Mission	Does the activity promote P.I.N. and incorporate	This activity has little to no relation to NEIAs	The activity has a couple relevant	The activity includes about half of NEIAs missions. It	The activity includes the majority of NEIAs missions. It	The activity inspires Passion Driven Purpose, Idea to Impact, Next Gen of

	global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.	mission and barely includes any global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.	aspects related to NEIA's mission and makes little connection to global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.	shares about 2 or 3: global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.	shares most but not all: global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.	Innovators. Also shares global perspectives, human centered design, purposeful interdisciplinary approaches, and obvious real world learning aspects.

Appendix W: Parental Consent Form

Informed Consent Agreement for Participation in a Research Study

Investigator(s): Josh Alasso, Maggie Reiter, Winnie Ly, Zach Stone

Contact Information: gr-newenglandinnovationacademy_a20@wpi.edu

Title of Research Study: Designing the Sixth Grade Action Learning Lab for the New England Innovation Academy

Sponsor: Tom Woelper (New England Innovation Academy (NEIA))

Introduction: Your child is being asked to participate in a research study. Before you agree to allow your child to participate, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that your child may experience as a result of their participation. This form presents information about the study so that you may make a fully informed decision regarding your child's participation.

Purpose of the study: The purpose of this study is to gain insight and ideas from current students regarding environmental awareness in school. The information gained through this study will be used to help the WPI team design an hands-on lab that covers the importance of the natural world and how humans contribute to it for Grade 6 at the New England Innovation Academy (NEIA). NEIA is an independent college preparatory school opening in Marlborough, MA in 2021.

Procedures to be followed: Your child will be accompanied by their teacher in a group discussion with the team members. The team members will ask questions pertaining to the topic at hand. This discussion will take place via Zoom, an electronic conversation platform, and will last approximately 45 minutes.

Risks to study participants:

This study has minimal risk. Participants may feel anxious or overwhelmed as the interview is conducted, however, that is unlikely given the friendly nature of the interviewers and the simplicity of the scripted questions.

Benefits to research participants and others:

The subjects involved may become more aware of the importance of sustainability and the positive effects eco-friendly behavior can have on the surrounding environment.

Record keeping and confidentiality:

The conversation will be transcribed by two team members while the others lead the discussion, no audio or visual recording will take place. Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury:

This research involves minimal risk so there is little risk in the event of injury. Still, you do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

The research team's email address is listed at the top of the form:

gr-newenglandinnovationacademy_a20@wpi.edu

For additional information, contact:

IRB Manager (Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu)

Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu)

Research team advisors (Joseph Sarkis, jsarkis@wpi.edu), (Hansong Pu, hpu@wpi.edu)

Your child's participation in this research is voluntary.

This interview will only be conducted with the consent of parents/guardians and the agreement of their student. You may withdraw your consent at any time and the student may withdraw at any time or ask that a statement be discarded. There is no penalty or loss of benefits for declining to participate or for withdrawing at any time. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, *you acknowledge that you have been informed about and consent to your child being a participant in the study described above. Make sure that all your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.*

_____ ***Date: _____***

Participant Parent Signature

_____

Study Participant Name (Please print)

_____ ***Date: _____***

Signature of Person who explained this study

Focus Group Content

Introduction The purpose of this interview is to gain an understanding on how sustainability can be incorporated into a hands-on lab that teaches appreciation for the natural world to sixth graders. This may include understanding the students' perspective on sustainability and whether they practice eco-friendly behaviors. The researchers will ask questions about the students' experiences in the classroom and in the natural world.

The interview is voluntary and participants can choose to stop participation at any time. Before the interview begins, the facilitator of the interview will ask the interviewee some questions to establish consent.

- Are you comfortable with this interview being recorded?
- Do you have any questions before we begin the interview?
- Do you know you can choose to stop participating at any time?

Interview Questions

- Can you tell me about what you like to do outside?
    - Do you think being outside is boring? How so?
    - What is the coolest thing you know about nature?
    - Tell me about the types of animals you see outside.
- What does the word “sustainability” mean to you?
    - How about “eco-friendly”?
- Can you tell me what you know about...
    - Recycling?
    - Food waste?
    - Compost?
- What have you learned in school about the environment?
- Do you remember any class activities about nature or the environment that you liked?
- Have you ever learned outside?
- Can you tell me about a time you volunteered or helped someone?
- What does “make the world a better place” mean to you?
- Is there anything else you would like to share with the research team?

Appendix X: Activities Master Plan

Activity 12: How Has This Landscape Changed?

Objective: Students will survey the land around the campus and learn how agriculture and city development changed the local landscape.

Time: 90 minutes

Materials: Field Journal

Preparation: Instructor(s) should be familiar with the surrounding areas of campus so students know which areas are off-limits when they survey the land.

Interdisciplinary Aspects: Industrial Revolution, Observation and exploration skills,

Procedure:

1. Have students dressed appropriately for the weather and have them bring their field journal with them
2. Let students walk around the campus but still being within line of sight as they make observations on any factors that may have changed the land
3. After making those observations, students can draw a topographical map of the land around the campus

Assessment: Students turn in their topographical map of the campus and hold a class discussion at the end of the period to have students share their observations and findings.

Adapted from:

Appendix Y: Project Timeline

Task	Week							
	PQP	1	2	3	4	5	6	7
Understand details of NEIA's curriculum and ALLs								
Investigate qualities and requirements of effective learning environments								
Collect lesson plans and plan calendar of activities								
HDU team collects data and ideas								
Use secondary/interview data from innovative schools to inspire aspects of recommendations for NEIA								
Create and recommend curriculum for sixth grade ALL								
Writing final report								