

EFFECT OF ENVIRONMENT AS INTEGRATING CONCEPT METHODOLOGY ON
LIVING ENVIRONMENT STUDENTS WITH LEARNING DIFFERENCES

by

Janine Melillo

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2015

©COPYRIGHT

By

Janine Melillo

2015

All Rights Reserved

DEDICATION

I dedicate this paper to my family, Ingrid, Charlotte and Kiersten. Without their love and support I could not have made it through the process of producing this paper and completing my courses for this degree. For all of the emptied sinks full of dishes, cat feedings, shopping trips, chauffeuring, and so much more that was done while I was preoccupied, I am truly grateful. Thank you. You have my love and devotion always.

ACKNOWLEDGEMENT

I would like to acknowledge the exceptional teaching and guidance of John Graves throughout the research project process and my MSSE coursework. He has been a model of excellent teaching. I am also grateful for his patience and understanding in helping me to produce this paper in the face of many challenges.

I would also like to acknowledge and thank all of the MSU faculty and staff that have made this learning experience such a positive one for me. I have always encountered helpfulness, friendliness and competence in all of my dealings with the MSU organization and that is a testimony to your work ethic and teamwork.

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND	1
CONCEPTUAL FRAMEWORK	5
METHODOLOGY	11
DATA ANALYSIS.....	20
INTERPRETATION AND CONCLUSION	43
VALUE.....	46
REFERENCES CITED.....	49
APPENDICES	53
APPENDIX A Melillo Baseline Exam	54
APPENDIX B Melillo Pre-treatment Student Interview	62
APPENDIX C Melillo Teacher Outdoor Education Survey.....	64
APPENDIX D Melillo Post-treatment Student Outdoor Education Survey.....	69
APPENDIX E Melillo Outdoor Education Engagement Level Chart.....	72
APPENDIX F VARK Learning Styles Inventory	74
APPENDIX G Glossary of Special Education Terms	78

LIST OF TABLES

1. Distribution of Participants in Grade Level, Age, Gender, Disabilities and Learning Styles.....	12
2. Data Triangulation Matrix	18
3. Student Pre and Post-treatment Exam Scores in Percent.....	20
4. Combined, Non-treatment and Treatment Students' Exam Results	22

LIST OF FIGURES

1. Pre and Post-treatment Class Mean Exam Results	20
2. Longitudinal Class Mean Exam Results	21
3. Treatment and Non-treatment Class Mean Exam Results	23
4. Treatment and Non-treatment Class Mean Exam Results Without Zero	24
5. Treatment and Non-treatment Class Mean Lab Grades.....	25
6. Treatment and Non-treatment Exam Scores According to Disability	26
7. Treatment and Non-treatment Exam Scores According to Learning Style Strengths	26
8. Melillo Post-treatment Student Outdoor Education Survey Mean of Responses	29
9. Melillo Teacher Outdoor Education Survey Frequency of Outdoor Experiences	30
10. Melillo Teacher Outdoor Education Survey Frequency of Responses to Questions Six, Seven and Eight	31
11. Melillo Teacher Outdoor Education Survey Likert Scale Scores According to Content Area and Grade Level	33
12. Melillo Outdoor Education Engagement Level Behavior Chart Class Mean Results.....	35
13. Melillo Outdoor Education Engagement Level Behavior Chart Student Mean Results.....	36
14. Student #2 Demonstrates Deer Feeder to Other Students.....	39
15. Students #4 and 5 Cooperatively Engaged in Trip Objective.....	40
16. Students #2 and 3 Labeling Water and Soil Samples	41

ABSTRACT

Hastings High School is a small high school of approximately 600 students. As a special education teacher specializing in the sciences, the engagement level and academic success of students with learning differences was a concern for me. The general disconnect of students from nature and the practical, real-life applications of scientific knowledge was also a concern. I introduced elements of outdoor education to my special science classes over the last five years and the impact of these experiences on my students was dramatically positive. This research project was designed to determine the impact of outdoor education on students' assessment results and engagement level. It was important to prove that the time investment of outdoor education would have a negligible or positive impact on high stakes, high school exit exams. Students were exposed to Environment as Integrating Concept methodology from December to April of the school year. Students had one to two outdoor education experiences each month in local environments and related to local environmental issues. They were exposed to one treatment/outdoor education unit and the results of this unit was correlated with the results of one similar, non-treatment/traditional unit and a unit that incorporated both teaching methods. Longitudinal data was also collected. The results of the study indicated dramatically improved engagement and motivation levels among the students, and limited improvement in content understanding. Students without executive functioning disabilities benefitted more from the outdoor experiences.

INTRODUCTION AND BACKGROUND

My evolution as someone who loves the outdoors has been a life-long process. As a child, I spent virtually all day outside riding bikes with my friends and playing imaginative games in the woods. As a teenager who could not drive, I walked everywhere and made use of trails through the woods to get where I needed to go. Once I did drive, I loved to go to various parks along the Hudson River and just sit on its banks, and later in college I did the same along the Potomac River. The calm, the joy, the transcendence that being in natural settings brought to me was critical to my sense of well-being. As a teacher, I initially worked at a non-traditional school with beautiful, natural grounds, and I frequently took my students outdoors. As my career progressed, I taught in public high schools, and the climate of education became more highly regulated. Also, technology in the forms of desktop computers, and then cell phones, became part of our daily, hourly and minute to minute lives. Eventually, I realized I was becoming increasingly divorced from the natural world in both my personal and professional life. I missed the sense of well-being I drew from it, and I knew most of my students were even more distanced from nature than I had become. In response, I set goals for reconnecting with the outdoors. During a special event at my high school, I took groups of students out for a walk in the local woods. The only requirement for the walk was that the students be *unwired*. I introduced the walk by talking to the students about research that has proven the psychological benefits of interacting with nature. This class experience was met with a very positive response. I hoped that these students recognized the sense of well-being nature gifts to us when we interact with it, and realized something

vital was missing from their lives without it. In Robert Louv's book (2008), "Last Child in the Woods," he documents the detrimental impact children's disconnect from the outdoors is having on them. As a parent and teacher, I can attest to this anecdotally, and one of my goals as a teacher is to acquaint young people with the natural world.

New York has long had statewide educational standards which, prior to a phase out period beginning in 2003, included a safety net for classified students. The term *classified* refers to a student who has received special education status through the Committee on Special Education. The student needs to qualify under one of thirteen possible disability designations recognized in the state of New York. That safety net allowed them to take different graduation standards tests based on a modified curriculum. The Regents Competency Test in science provided an alternative route for classified students to receive a diploma. The last class to be allowed access to this safety net was the class of 2013. After 2013, the safety net was changed and these students were required to learn the same curriculum and take the same exam as all other students, although passing requirements were modified. The rigor of these new standards leaves me with far less flexibility and professional discretion when teaching my parallel science classes. I now must attempt to present the entire state proscribed curriculum in ten months.

The topic of my classroom research project was an outgrowth of my commitment to engage young people with nature and my imperative as a teacher to find an effective and meaningful way to achieve the educational goals set by the state. Theories of outdoor education (OE) offer promise for accomplishing both of these objectives, simultaneously.

I teach at the Hastings-on-Hudson High School in New York State. The District serves approximately 1600 students K-12, and the high school serves approximately 600 students (Hastings on Hudson, 2013). We are a predominately white community with 86.7% reporting as white in the 2010 Census. The minority populations of Hastings consist of 1.2% black, 5% East and Southeast Asian, 4.3% Latino, and the remaining portion of the population of other descent or mixed descent (Proximity, 2013). We are a wealthy community as a whole when compared to state averages for income, the median income in Hastings being \$119,029 in comparison to \$55,246 for New York State. Also, the poverty rate in our District in 2010 was only 3.6% of the population as compared with the state average of 20% (New America, 2013). The town was primarily blue collar two to three generations ago, but due to its proximity to New York City, and other appealing attributes, it has become increasingly gentrified. The population now consists of three basic categories of residents; upper class residents who have been able to purchase homes in Hastings at the current real estate values of \$648,927 median price for a single family house or condo in 2010, middle class residents who have inherited their homes from past generations, and lower class, or lower-middle class, residents who rent their living spaces (Hastings on Hudson, 2013). Our district spends approximately 20% more per student on education than the per capita state average (*New America*, 2013). The District's Special Education population in 2011 was 3.6% as compared to the state average of 6.6% (New America, 2013).

The class I conducted my research project with was a parallel science class with a 12:1:1, students to teacher to assistant teacher, mandated ratio. The program was

designed to support students who have moderate learning challenges, and other moderate disabilities that impact on their learning. The curriculum for the class is based upon the New York State Living Environment curriculum, and students can earn the mandatory graduation credit in life science, as well as satisfying the requirement of passing one Regents exam in science. I adapt the methods of presentation and, as much as possible, the curriculum, to the class' strengths and challenges each year. The students' learning styles tend to favor an experiential and multimodal approach. Students with similar profiles to those in my parallel class reported during informal interviews that they felt their strongest intelligences were visual-spatial, bodily-kinesthetic, interpersonal and naturalistic (Gardner, 1983). The Multiple-intelligence responses imply a predisposition among the students that would be stimulated through OE models of teaching and learning. The components of the outdoor model, Environment as Integrated Context (EIC), when fully implemented, would provide enhanced visual stimulation, greater opportunity for movement, increased social interaction and exposure to a naturalistic setting (Hoody & Liebermann, 2008).

The focus question and subquestions for my classroom research project emerged from these personal, social and educational factors.

- What impact did limited use of EIC methodology have on the content mastery of students with learning differences in a high school living environment class?
 - What impact did limited use of EIC methodology have on students' motivation and level of engagement?
 - How did EIC impact on students' content mastery?

- Did EIC's impact correlate with Learning Style strengths? Did it correlate with students' learning disabilities?

CONCEPTUAL FRAMEWORK

Outdoor Education (OE) is a phrase that covers many theories and practices in education and has a very long and deep historical background. As a generalization, it refers to an educational setting, the outdoors, but it also infers a pedagogical approach and a value system, as well. All forms of OE embody the core value that actual doing in a real-life setting is the most effective way to teach and learn. The environment, the task, the tools and the teacher-guide provide an experience through which the student, using their own senses, cognitive abilities and social-emotional skills, can explore, experiment and authentically learn. The student learns not just facts, concepts and skills related to a curriculum but also about themselves, their culture, their community and the natural order of things (Broda, 2007).

John Dewey is often credited as the philosopher and educator who laid the cornerstones of OE through his theory of experiential learning (Neill, 2010). Dewey (1916) espoused learning as a guided experience during which structure is used to channel the student's natural curiosity and desire to learn. This was a radical idea given the authoritarian nature of the American educational system of the early twentieth century. Dewey's educational philosophy recognized that each student brings with them a past that will impact their learning experience making it distinctly different for each individual. Given the complexity of this interaction, he proposed that instruction has the potential to either be educative or miseducative, and that an educational system that does

not allow for the proper balance of freedom and structure has the potential to be miseducative (Dewey, 1938). OE theories recognize the importance of Dewey's ideas and attempt to provide structured but flexible learning experiences that allow for students' individuality and lessen the likelihood of miseducative experiences (Neill, 2010).

Other theories related to OE are environmental education and conservation education whose movements began in the 1970's and 1980's, respectively. The movements made the focus of OE the instilment of an appreciation for nature, and the development of the students' desire to protect it (Broda, 2007; Walsh, 1976).

Environmental education is closely related to place-based education (PBE), which continued to broaden the goals of OE to include appreciation for local settings and enhanced community connectedness. PBE seeks to connect the community inside and outside of the school building, as well as past, present and future generations of the community. PBE uses a particular setting, often outdoors, as a focal point around which an educational experience is developed. This methodology incorporates all disciplines seamlessly while giving students the opportunity to have a positive impact on their community (Weldon, 2012).

Furthermore, the Environment as Integrating Concept (EIC) movement developed and took root in the 1990's. This educational philosophy integrated all of the theories of OE discussed thus far while also recognizing and incorporating expanding theories of intelligence and cognition (Hoody & Lieberman, 1998). Beginning in the early 1900's with the work of Binet and Montessori, the idea of what intelligence was and how it

could be measured developed. The possible application of defining and measuring intelligence in educational settings was a natural outgrowth of these ideas. These early investigations would develop in the mid-to late twentieth century into a rich and complicated exploration of how learners differ and learn best (Cassidy, 2004).

Developments at this time included the work of Howard Gardner and his expansion of intelligences beyond the verbal and spatial recognized previously to include seven areas, visual-spatial, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical, linguistic, and musical. Later, Gardner would expand these to include two more intelligences, naturalistic and existential (Gardner, 1995). Further explorations included the work of David Kolb, who developed a theory of learning referred to as the Experiential Learning Model. He described the learning process as involving four forms of processing and proposed that learners exhibited varying degrees of competence in the four areas of Concrete Experience/feeling, Reflection Observation/Watching, Abstract Conceptualization/Thinking and Active Experimentation/Doing (Kolb, 1984). Dunn, Dunn and Price (1984) developed the learning styles theory proposing “key factors” in the way learners construct new ideas. One set of factors being physical or perceptual and including the sensorial modes of intake, auditory, visual, tactile and kinesthetic. Currently, this concept is more specifically referred to as learning modalities (Cassidy, 2004). What developed from these theories was a learning styles movement in education that continues today.

The application of learning styles in education is controversial with proponents and opponents claiming that research supports each of their perspectives. For many

educators, the practical application of the theories amounts to recognizing the value of metacognition and a multimodal approach to teaching and learning. Fleming and Mills (1992) recognize four modalities, Visual, Auditory, Read/Write and Kinesthetic, and provide an inventory identified by the acronym VARK. The inventory can be used to aid teachers and learners in exploring their preferred modalities. Fleming refers to the modalities as forms of communication. He sees the modalities as means of communication in which both the teacher and learner exhibit relative strength or preference, relative weakness, or decided weakness or voids (Wright, 2011). The teacher or learner could also exhibit various balances between the forms of communication. He uses this scenario to explain a phenomenon that he observed in which relatively weak teachers had greater success with some students than their more competent colleagues.

In addition to incorporating learning styles theory, EIC programs utilize the local environment, employ student-centered, hands-on, problem solving strategies, and work across community, subject discipline and perspective boundaries to provide a rich instructional experience guided by educators and mentors (Hoody & Lieberman, 1998).

PBE and EIC are closely related pedagogical approaches that have been shown to have positive educational impacts on students and some evidence points to an even more profound impact on students with special needs. In a 2004 study of four PBE programs, two emergent findings were reported. First, PBE improved student motivation to learn and raised their engagement level. Second, special needs students responded very positively to community-based learning (Powers, 2004). In a 1998 study of 40 EIC programs nationwide, titled *Closing the Achievement Gap*, improved performance for all

student populations was documented through qualitative and quantitative data in all of the four core curricular subjects, as well as improvement in student motivation, engagement and behavior. In an attempt to explain these results Hoody and Lieberman (1998) wrote:

EIC educators emphasize project-and problem-based instructional approaches that appeal to a variety of sensory processes and learning styles. These approaches combine hands-on, minds-on methods to take advantage of students' cognitive, kinesthetic, affective, and sensory abilities. Such teaching more effectively engages students who have a broad range of learning modalities, than traditional pedagogies. (p. 23)

The accessing of students' potential to learn through a variety of cognitive processing centers or learning style strengths is one possible explanation for the success of EIC and related OE approaches. As national and state education trends increasingly emphasize verbal-linguistic and mathematical-logical intelligence to the neglect of other intelligences, students with strengths in the latter are increasingly marginalized at school. These students' abilities are so narrowly defined as to leave their potentials in other areas untapped and underdeveloped to their future detriment in a world that requires literacy in many of these areas. As well, these students are made to feel incompetent and a vital human need, the need to feel competent and to have an impact on one's community, is unmet for them (Wanlass, 2000).

Other explanations for the positive results of EIC programs include the impact that nature has on students' health and well-being. Robert Louv (2008) calls the increases in certain health problems within the population of the U.S., *Nature Deficit Disorder* (NDD). He theorizes people who are deprived of experiences of nature develop this condition. OE experiences counter the negative impacts of such deprivation. Symptoms of NDD in American society are argued to include increased diagnoses of Attention

Deficit/Hyperactivity Disorder, vitamin D deficiency, and increased rates of childhood obesity and myopia (Louv, 2009). Some of the manifestations of these conditions include lack of attention and focus, depression, malaise, behavioral problems and low self-esteem (DSM-5, 2013; Staff, 2014). All of these associated symptoms can have a significant, negative impact on student achievement.

The most recent theories related to EIC recognize the complexity and individuality of the learning process. They attempt to take into consideration the many variables that can influence that process, as well as trying to capitalize on the various intelligences of the learner. Dramaturgy is an all encompassing OE experience that leads a group of learners through a series of experiences that research has shown helps them make important discoveries about themselves. Student-participants are led through intensive, multiple-day outdoor experiences that challenge them physically, intellectually and emotionally. The participants are forced to access personal abilities they have never tapped into, as well as confront and explore counter-productive or destructive habits of mind. Martin (2001) discusses the importance of balancing various aspects of the participants' learning experience in the areas of physical, social, creative and emotional reflection. Although the outdoor experience of dramaturgy is very different from what can be delivered in a middle or high school class, aspects of the approach can inform instruction. The creation of a safe but challenging, learner-centered, multi-sensory experience that forces the student to more deeply explore themselves should be a goal of OE instruction. Schoolyard-enhanced learning is a more practical, short term approach to OE. It capitalizes on any easily accessible outdoor environment teachers can incorporate

into their lesson plans, but it also advocates the incorporation of many of the same elements of Martin's approach. Schoolyard-enhanced projects involve physically active games, interaction with peers and adult members of the community, visual arts expression, written expression and reflection exercises. It is an example of how even limited but well-developed OE teaching and learning experiences can be deeply engaging and life changing experiences for all involved (Broda, 2007).

METHODOLOGY

The methodology for this project was granted an exemption by the Institutional Review Board of Montana State University and all research was compliant with guidelines for working with human subjects. The participants in the study were four to six students in my parallel, living environment class. The make-up of the class changed during the course of the study and that is noted in the data analysis section. The class originally had six students but two dropped out of school, and although a fifth student joined the class, he was not present for all of the treatment and non-treatment units.

This class was part of a program originally designed to serve students with skill level delays and intellectual deficits. Due to the small size of our school and limited program offerings in special education, the program now serves any Individualized Education Plan student who was not successful in a less restrictive environment. The curriculum for the class was based on the New York State Regents Living Environment curriculum (NYSED: C&A, 2000). One of the program's main objectives was to prepare students to take the living environment Regents exam via a setting that provides a high level of support and alternative teaching methods. Class size in the program was 12 or

less, and additional support is provided by an Assistant Teacher. The cohort of students in the class present throughout the research project were diverse in their areas of deficit (Table 1).

The students that participated in the treatment and non-treatment units were all ninth graders age 14 to 15 years old. There was little gender diversity since only one of the four students was female. The students' primary disabilities, as determined by the Committee on Special Education, include Learning Disabled (LD) and Speech and Language Impaired (SLI). Definitions of special education terms used in this paper can be found in the glossary, Appendix G. In addition to these primary disabilities impacting on the students' learning, the students had additional deficits and disabilities. Their secondary and tertiary disabilities were behavioral problems, executive functioning deficits, memory deficits and low intelligence quotients. Some of the students also had social and familial issues that impacted on their learning. A learning styles inventory was used to identify their perceived areas of relative strength in order to determine if there was a correlation between OE and these areas of strength.

Table 1

Distribution of Participants in Grade Level, Age, Gender and Disabilities

Students	Age	Grade Level	Gender	Classification disability	Other deficits and disabilities	Learning styles inventory results
1	14	9	M	LD, language processing deficits	behavioral issues, executive functioning deficits	Not taken
2	14	9	M	LD, language processing deficits	SLI, receptive and expressive delays; LD, memory deficits	V-11 A-10 R-7 K-10
3	14	9	F	SLI, language processing deficits	LD, memory deficits	V-8 A-9 R-10 K-7
4	14	9	M	LD, executive functioning deficits	Behavioral issues	V-8 A-6 R-1 K-7
*5 JC	14	9	M	LD, memory and auditory processing	Low Intelligence Quotient, ADHD	V-6 A-8 R-6 K-10
*6 SD	18	11/12	M	SLI, language processing deficits	Low Intelligence Quotient, Substance Abuse	

Note. *Students not in the class during the entire project, ($N=4$).

Note. VARK is an acronym for Visual, Auditory, Reading/Writing and Kinesthetic.

During the treatment period from December 2014 through April of 2015, the students were exposed to an intervention based on Environment as Integrating Concept (EIC) methodology. On a monthly or bimonthly basis instruction took place outside. The

outdoor learning experiences were connected to local environmental issues that impact the students' community and local ecosystems. These issues included deer overpopulation and an immunocontraception program being implemented in their town. Students participated directly in the project by monitoring a deer exclosure experiment, monitoring deer feed spreader sites, and by going door to door to elicit homeowner participation in the program. In addition, students conducted water quality tests of the local pond and river. They participated in monthly walks in the local forest and made seasonal observations of the area. They also observed and collected data about the local, native flora and fauna and non-native, invasive species. These treatment experiences included a trip to a local preserve where students were required to conduct a field study to determine why a tree species was being devastated. All of these experiences were part of both the longitudinal treatment and the discrete treatment unit on ecology and the scientific process.

A second unit was conducted during which two related topics were taught, one being related to the students' outdoor education (OE) experiences and the other unrelated. This unit on mitosis and meiosis was taught during the class' involvement in the deer immunocontraception project. Connections were made between the OE experiences and meiosis, but not mitosis, for the purpose of seeing if even this limited exposure would improve content mastery. A third unit was used as a control or non-treatment unit on transport which was taught entirely without OE exposure. Additional OE experiences preceded the treatment units and results on exams prior to treatment will be looked at for

longitudinal significance. These OE experiences were part of my curriculum from prior years before the proposal of the research project.

A baseline was established through the Melillo Baseline Exam (Appendix A), a teacher-developed unit test given at the beginning of the school year before the students were exposed to any form of OE for this class. Unit tests were tracked longitudinally including post-treatment units and post-non-treatment unit data. All teacher-made tests were constructed from archived living environment Regents questions. Unit tests consisted of 25 to 30 multiple choice questions and 5 to 10 constructed response questions. The midterm exam was 65 questions in length, 45 multiple choice and 20 constructed response. For the purpose of the study, all scores were calculated as a direct ratio of number of correct items to total number of items. Teacher-made unit tests were given after the treatment and non-treatment units. The treatment unit topics were ecological studies and the scientific process, and meiosis, and the non-treatment unit topics were transport and mitosis. The units were presented over two to three weeks. The results of the treatment and non-treatment units were compared to determine the impact of the treatment. Box and whisker plots illustrated the class means of treatment and non-treatment results on teacher-made unit tests and labs. A line graph correlated time and the class mean on unit test scores. Scatterplots of treatment and non-treatment results illustrated correlations between the units and students' disabilities and learning style strengths, and their individual performance on treatment and non-treatment labs.

School district cultural baselines regarding the use of OE in the district were established by the Melillo Student Pre-treatment Interview (Appendix B) and the Melillo

Teacher OE Survey (Appendix C). The student interview instrument was a semi-structured interview with seven scripted questions and an open-ended request for relevant thoughts or predictions about my research plan. The interview questions sought to uncover the frequency and quality of students' past outdoor experiences, as well as their memories of and residual feelings about those experiences. The interview was also designed to provide pre-treatment information that could help to better design the treatment to have a positive impact on the participants, such as students' tolerance for weather variables. Four students taking part in the study were interviewed by the teacher-researcher. The interviews took place in class and during the after school tutorial period.

The Melillo Teacher Outdoor Education Survey was designed to provide data about teacher practices and attitudes toward OE. It consisted of eleven Likert-scale questions with requested or invited explanations of responses, and one free response question. Teachers of all disciplines, grades five through twelve of the Farragut Middle School and Hastings High School, were asked to take the survey. Survey responses were solicited via email, hard copies put in mailrooms and a personal request was made at a high school faculty meeting during which copies were made available. The results of the survey were analyzed for the summative trend of the scores from +2/definitely agree to -2/definitely disagree. Positive integer scores correlate with a teacher's expression of use of OE and/or positive attitude toward its use and negative scores indicated the opposite. Responses were also analyzed as qualitative data for positive and negative teacher attitudes toward OE. The responses were aggregated by grade level and discipline taught and illustrated in a histogram.

The Melillo Student Post-treatment Outdoor Education Survey measured students' feelings toward OE after treatment (Appendix D). The survey consisted of ten Likert-scale questions and two adjective checklist questions. The results of the survey were analyzed for the summative trend of the scores from +2/definitely agree to -2/definitely disagree. Positive integer scores correlate with a student's expression of positive attitude toward OE and negative scores indicated the opposite. A histogram illustrated the class mean for all questions. Adjective checklist questions were scored between +4 to -4. Each positive adjective was valued as +1, and each negative adjective was valued as -1.

Another quantitative instrument used was the Melillo Outdoor Education Engagement Level Chart (Appendix E). Behavior was charted by the Assistant Teacher in the class which allowed me to remain engaged with the students. Data was collected during 23 class sessions between December and April of the project. The chart calls for a plus sign or minus sign to be entered for each student in the class at ten minute intervals. The Assistant Teacher was simply looking to see if students were engaged in the lesson activity according to expectations established by teachers' directions or class precedent. One of four activity descriptions were recorded; outside student-centered (OSC), inside-student centered (ISC), outside-teacher centered (OTC) or indoor teacher-centered (ITC). The chart also calls for clarification of other activity characteristics; hands-on, minds-on, community-based, and whether students were working individually, in pairs or in groups of more than two. The intent of the chart was to determine if the students were better engaged during OE activities, or if other variables were playing equally significant or

more significant roles in their level of engagement. The choice to make the data collection time interval based was to randomize the sampling, and to gather data about the impact of the length of our class periods on students' engagement levels. Our school runs 80 minute block periods which can be problematic for students with attentional issues.

Qualitative data collection instruments for this study, other than the student interview discussed earlier, included student and teacher journals and pictures taken of the students during outdoor activities. Student green journals were used in a number of different ways as part of the treatment (Broda, 2007). Students were asked to make entries in the journals that helped them develop their observational and inference-making skills. They were asked to use the journals to record field notes during pond water testing, participation in the deer immunocontraception program, and on field trips and forest walks. Journal prompts also focused students on noting seasonal changes and reflecting on how being outside in nature made them feel. The journals were also used to generate information about the project's subquestion as to how EIC brought about change in students' attitudes toward OE and science class.

Pictures taken of the students during OE experiences illustrated the engagement and motivation levels of the students. Use of the cameras during outdoor experiences was also a motivational tool for some students and offered them a different participation modality. Sharing pictures taken of students, and pictures taken by the students, also generated excitement and interest among the students.

Teacher journals were used to collect anecdotal information related to the research questions. Journal entries were made by both myself and the Assistant Teacher without structured prompts. Science classes were held three times a week and we wrote in our journals on average once a week in response to those classes. They also provided qualitative data that I may not have structured the study to collect without this open-ended approach.

In order to answer the capstone project focus question regarding the correlation between Learning Styles and EIC methodology, students were given the VARK Inventory (Appendix F) to determine their self-reported areas of relative strength (Fleming, 1992) (Table 1). The students in my parallel science class have generally been placed in the program because they were unsuccessful in mainstream classes. I often observed that they experienced greater success during lessons and activities that allow them to use alternative modalities. The purpose of this data instrument was to look for correlations between strengths outside of those more traditionally emphasized in the classroom. All data collection instruments were triangulated with other instruments to determine their validity (Table 2).

Table 2
Data Triangulation Matrix

Research Questions	Data Source		
	Quantitative	Qualitative-Students	Qualitative-Teacher(s)
1. What impact did limited use of EIC methodology have on the content mastery of students with learning differences in a	Regents style, teacher-made unit exams, and midterm exam	Students' Green Journals	Teachers' journals
	Lab grades	The Melillo Student Pre-Treatment Outdoor Education Interview	

high school living environment class?	The Melillo Student Post-Treatment Student Survey The Melillo Outdoor Education Teacher Survey		
2. What impact did limited use of EIC methodology have on student motivation and level of engagement?	Melillo Student Engagement Level Behavior Chart	Students' Green Journals Photographs of students during outdoor experiences	Teachers' journals Photographs of students during outdoor experiences
3. How did EIC impact on students' content mastery?	The Melillo Student Pre-Treatment Outdoor Education Interview The Melillo Student Treatment Student Survey The Melillo Outdoor Education Teacher Survey	Students' Green Journals Melillo Post-treatment Student Interview	Teachers' journals
4. Did EIC's impact correlate with Learning Style strengths? Did it correlate with students' learning disabilities?	VARK Learning Styles Inventory Students' learning disabilities according to Individualized Education Plan classification and Committee on Special Education meeting information	Melillo Post-treatment Student Interview Students' Green Journals	Teachers' journals

DATA ANALYSIS

The data from the Melillo Baseline Exam produced a class mean of 54.0% and a standard deviation of 13.9% ($N=4$). The data from the post-treatment test showed an

increase in the mean for the sample to 57.3% and a standard deviation of 14.8%. The combination of these two descriptive statistics is inconclusive when considered together (Table 3)(Figure 1).

Table 3.

Student Pre and Post-treatment Exam Scores in Percent, Note. (N=4).

	Pre-treatment Scores in %	Post-treatment Scores in %
Student 1	65	38
Student 2	65	60
Student 3	36	57
Student 4	50	74
Mean	54	57.3
Standard Deviation	13.9	14.8

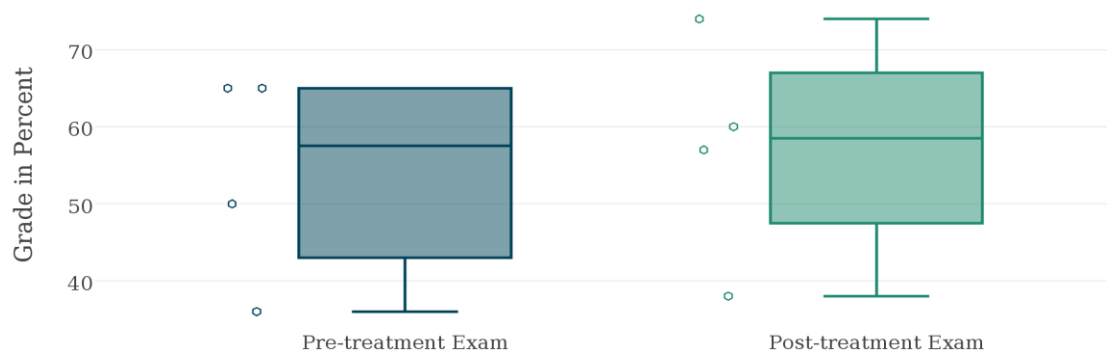


Figure 1. Pre and Post-treatment class exam results, (N=4).

The increase in the mean between the pre and post-treatment tests was 3.3%, and there was an increase in the median between the two tests of 1.0% points. The first quartile pre to post-test increase was 4.5%, and the third quartile rose 2.0%. The minimum score for the pre-test was 36% and for the post-test it was 38%; the maximum scores were 65% and 74%, respectively (Figure 1). Longitudinally, student test scores fluctuated between

October and April of the school year. The class mean shows no overall trend during the school year. There was no correlation between greater frequency of EIC and OE events and exam results. The greatest frequency of OE exposure occurred between February 13th and the administration of the March 12th exam, which produced a 52.4% class mean. The April 30th exam followed the field trip to study the impact of invasive species at a nature preserve and produced a 57.3% class mean (Figure 2).

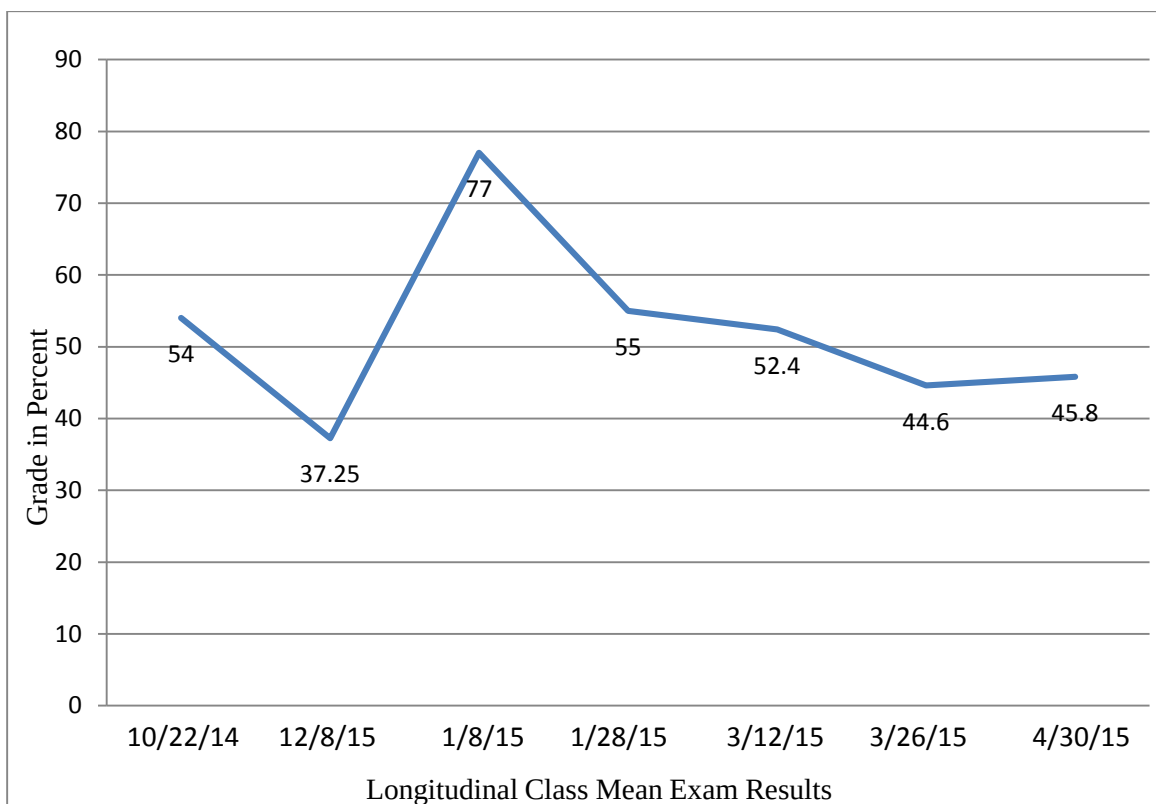


Figure 2. Longitudinal class mean exam results, (N=4). The topics of the exams in chronological order were ecology, biochemistry, life activities and organelles, cumulative midterm, meiosis and mitosis, transport, and ecology and the scientific process.

The data from the treatment and non-treatment units for the research sample produced mean results of 52.4% on the combined treatment unit, 44.6% on the non-treatment unit and 57.3% on the treatment unit with a standard deviation between the

three means of 6.4% ($N=5$). The data from the treatment and non-treatment exams showed a difference of 12.7% between the means for the two exams. This difference is 1.98 times the standard deviation of the data set. The difference between the treatment and combined treatment exam means was 4.9%, less than the standard deviation. The difference between the non-treatment and combined treatment exam means was 7.8%, 1.22 times the standard deviation.

Table 4. *Combined, Non-treatment and Treatment Students' Exam Results, Note. ($N=5$).*

Student #	Combined Score	Non-treatment Score	Treatment Score
1	58	46	38
2	38	34	60
3	43	51	57
4	65	29	74
5	58	63	Absent /Calculated as 0
Class Average	52.4	44.6	57.3

The median scores for the three exams were a combined 58.0%, non-treatment 46.0% and treatment 57.0%. The difference between the combined and non-treatment exam medians was 12.0% and the difference between the treatment and non-treatment exam medians was 11.0% ($N=5$). Each demonstrated an increase in scores on the unit exams that involved degrees of exposure to OE. First quartile differences between exams

were 9.0% between combined and non-treatment, and - 4.3% between treatment and non-treatment. Third quartile differences were 5.8% between combined and non-treatment, and 9.5% between treatment and non-treatment. First quartile differences did not show a consistent increase in scores relative to units involving OE, but third quartile differences did show consistent increase (Figure 3).



Figure 3. Treatment and non-treatment class mean exam results, ($N=5$).

For the treatment unit, Student # 5 was absent from class when the exam was taken. He subsequently did not make up the exam within the week. If the statistics are generated without this student's exam calculated in as zero, all differences between treatment and non-treatment quartiles are increased and positively skewed toward the treatment unit scores. The treatment and non-treatment differences for first quartile were 6.0%, for the median they were 12.5% and for the third quartile they were 13.0%. The minimum score for the non-treatment exam was 29% and for the treatment exam it was 38%; the maximum scores were 63% and 74%, respectively (Table 4) (Figure 4).

The data from student exams are not conclusive. There was some evidence of improvement when comparing the discrete treatment and non-treatment units but this was not supported by the longitudinal exam scores. In order to corroborate improvement due to EIC and OE there should have been improvement on the exams following our work on the immunocontraception project and the field trip. However, the exam questions were less directly related to the work we were doing than were the labs and field study work that we did. Results on these assessments showed greater increases in student grades.

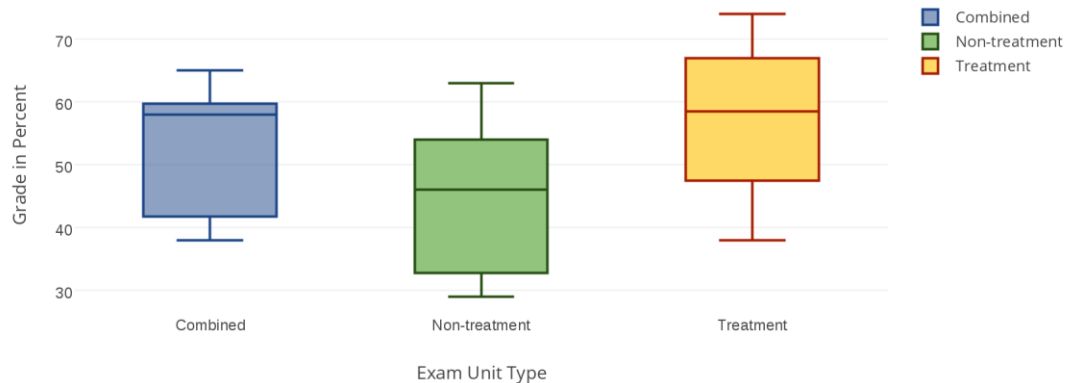


Figure 4. Treatment and Non-treatment class mean exam results without zero score, ($N=5$).

Data from individual students' lab grades showed a correlation between treatment exposure and increased lab scores for four out of five students. The combined lab grade mean when calculated without the zero score for Student #5 was 77.8%, the non-treatment mean was 70.6% and the treatment lab was 83.0%. The difference between the means of the combined lab and the non-treatment lab was 7.2%, and the difference

between the treatment and non-treatment lab was 13.6% (Figure 5). The statistical significance of the correlation needs to be considered in light of variables uncontrolled for between labs. Lab variables included varying degrees of abstraction and difficulty of the concepts, and the degree and type of hands-on tasks required. For example, the NYS required curriculum includes four labs that must be taught and completed by all students and the content of these labs are included on the Regents exam. One of these labs was part of the non-treatment unit on transport. Although I use a consistent lab format for my teacher-developed labs, the State lab differed from that format which might lower student scores. However, this State lab is very interactive and may have been more engaging for the students thereby, theoretically, raising student scores.

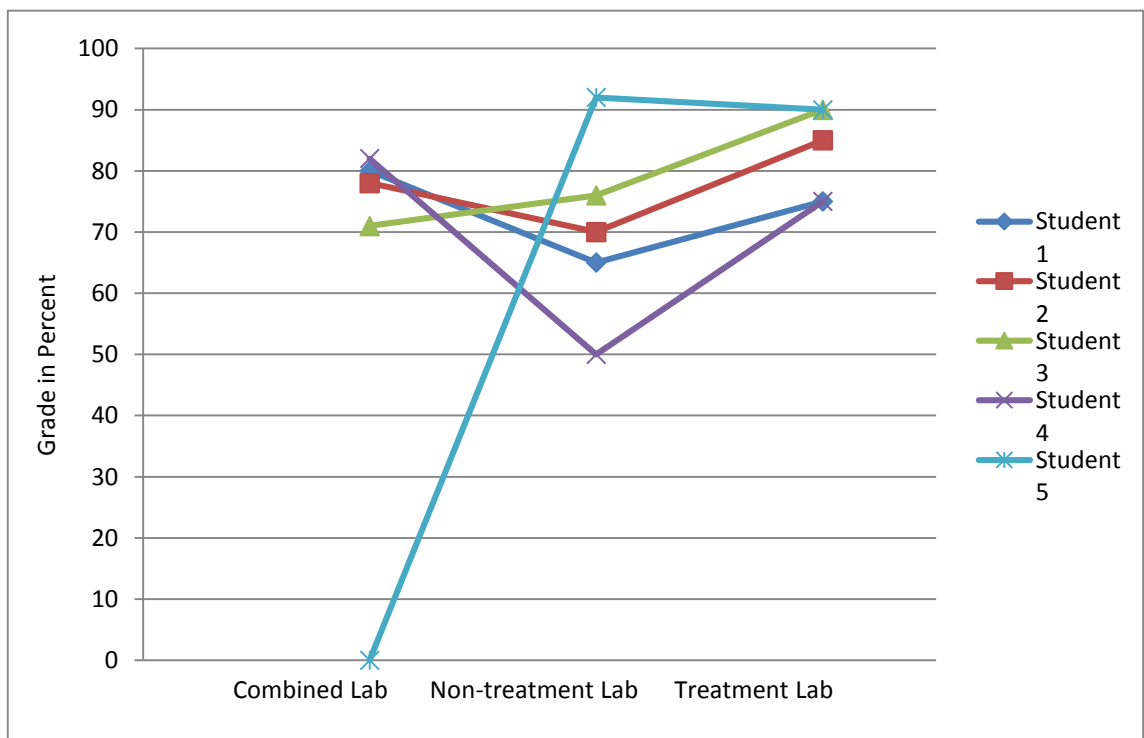


Figure 5. Treatment and Non-treatment student lab grades, ($N=5$).

The exam results were correlated with learning style strengths and the students' primary and secondary learning disabilities. Students with executive functioning among their primary or secondary learning disabilities showed lesser gains between non-treatment and treatment units than students who did not have an executive functioning disability (Figure 6). The differences between non-treatment and treatment exam scores for students without executive functioning disabilities were 6% and 26%. The differences between exams for students with executive functioning disabilities were -8%, -29% and 9%. The mean change for students without this disability was 16% and for students with the disability the mean difference was -9.3%.

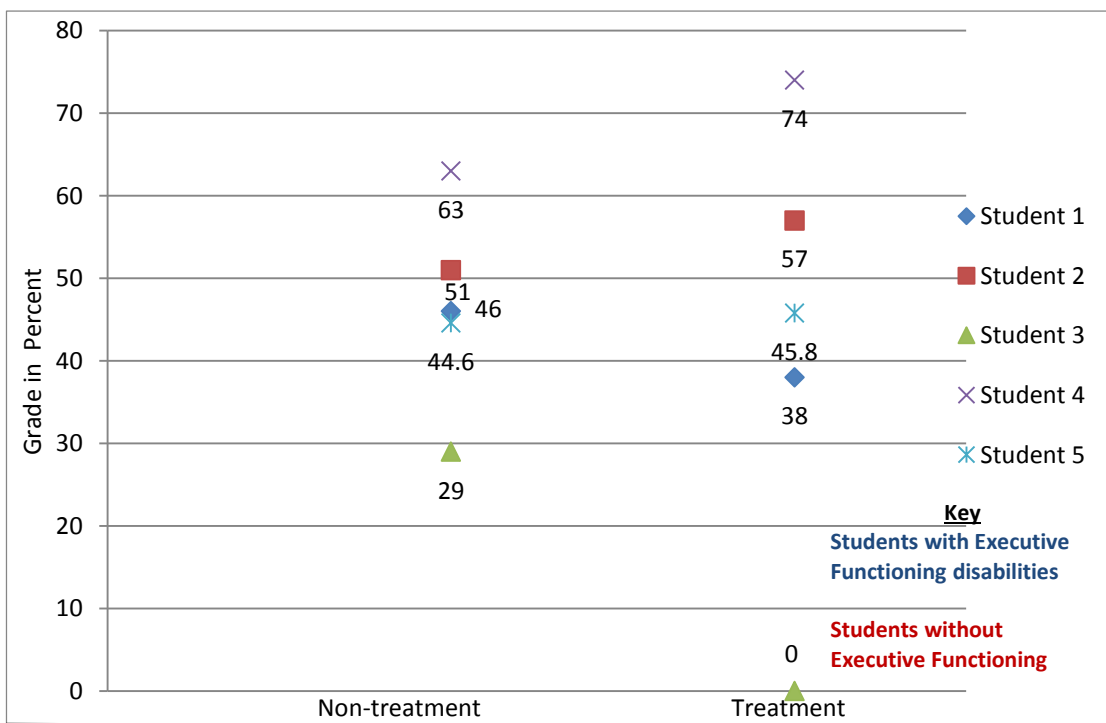


Figure 6. Treatment and non-treatment exam scores according to disability, (N=5).

The exam results showed no correlation with the students' self-identified primary learning style strengths (Figure 7).

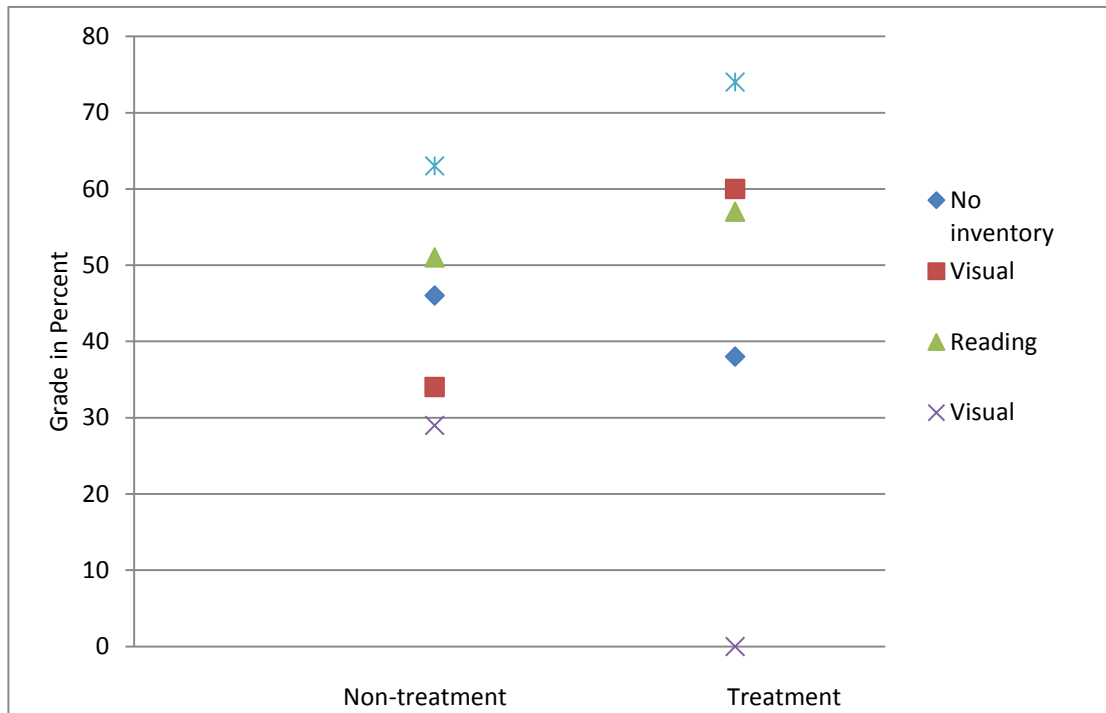


Figure 7. Treatment and non-treatment exam scores according to learning style strength, (N=5).

During the Melillo Pre-treatment Student Outdoor Education Interview, when asked if they preferred learning outdoors or indoors, all of the students answered that they preferred the outdoors (N=4). All four students responded that they remembered outdoor learning experiences from their past in a positive light. When asked why they preferred learning outdoors the students reported in all cases that it was more fun. Student #4 said that when he was learning outdoors and having fun, equating the two things, he was better able to listen and learn. During the interview of Student #2, he repeatedly used the word *trapped* in reference to learning indoors and explaining why he preferred to learn outdoors. Student #6 reported that he had grown up on a farm before he immigrated to this country. He said that since he had come to this country all of the learning had been from textbooks and worksheets. When describing his experiences on the farm and why he

thought learning outside is better he said, learning outside is “not as boring, it’s more fun and interesting and you get to use your hands, when you’re using your hands, looking, hearing it is easy to learn because you actually did it.” Student #1 described why learning outside is more effective by saying, “you have more examples” of what you are learning. Similarly, Student #2 said, “like if a kid wants to be a fireman and you take him to the fire station he’s going to learn more about being a fireman than if you say took him to the police station. You’re in the environment.” It is important to note however that the students interviewed were only able to recall general topics studied during outdoor experiences and did not have detailed recall of the related content. Student #2 was able to recall in relationship to a hot air balloon experiment conducted outside in sixth grade that “heat rises and currents can pick up a lot of stuff. “ In general, the students were unable to recall specific facts or concepts when recalling their experiences. Most experiences were being remembered from two or more years in the past.

Students’ responses to the Melillo Post-treatment Student Outdoor Education Survey indicated a strongly positive attitude toward OE (Figure 8). The highest possible positive score on the ten Likert-style questions was +20 points. All of the students’ responses fell in the +6 to +15 range. On the adjective identification style questions students identified almost exclusively positive adjectives in reference to OE and almost exclusively negative adjectives in reference to indoor education. Adjectives identified by respondents as associated with OE included comfortable, excited, capable and interested.

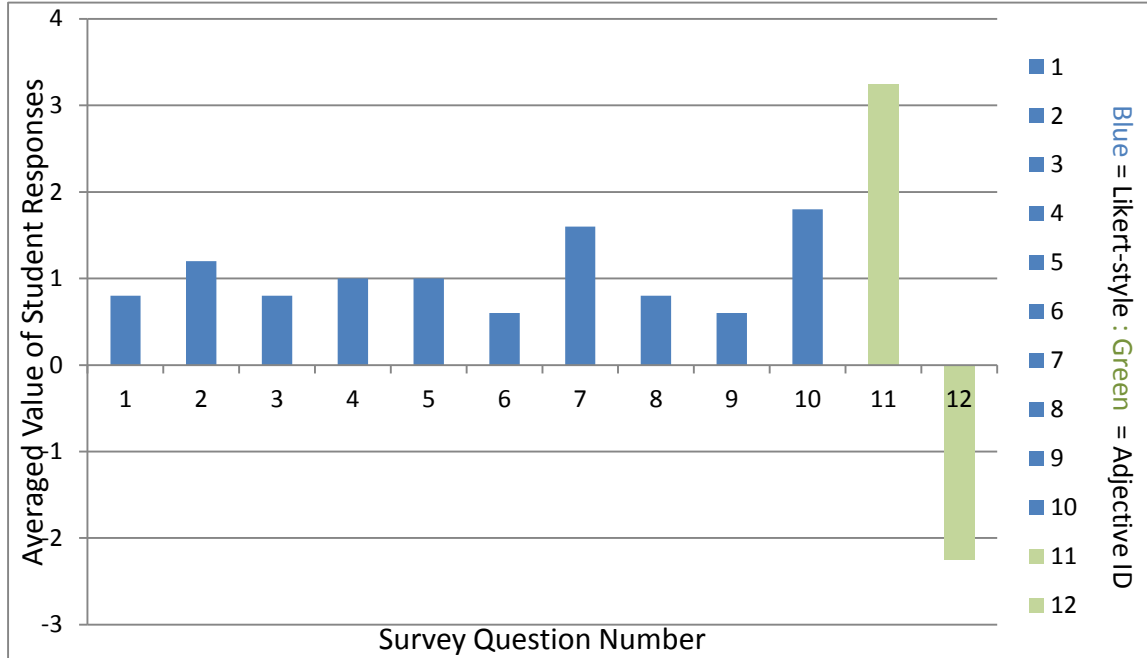


Figure 8. Melillo Post-treatment Student OE Survey mean of responses, (N=5).

Note. The y-axis values represent the range of possible student responses for the survey questions.

Responses to the Melillo Teacher Outdoor Education Survey determined that teachers were taking students outside three or less times a year ($N=23$). Although the Likert Scale scores determined an overall positive trend in teachers' attitudes toward outdoor education, teachers reported very limited use of outdoor experiences (Figure 9). Nine teachers reported taking their classes out zero times during the school year, and nine teachers reported taking classes out one to three times.

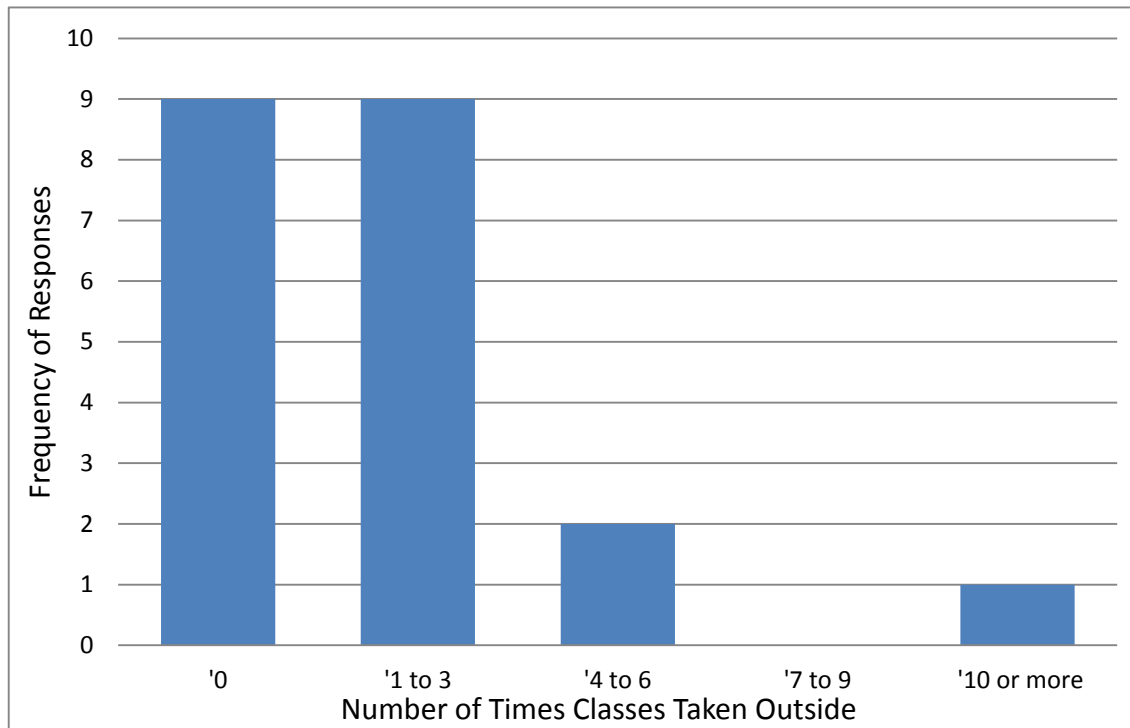


Figure 9. Melillo Teacher OE Survey frequency of outdoor experiences, ($N=22$).

Teachers also reported uncertainty about the educational outcomes of educating in an outdoor setting. When asked if their students understood content material better when learned outside, Question #6, sixteen responded that they were not sure. Similarly, when asked if the students remember content better, Question #7, eighteen responded that they were not sure, and if students were more engaged, Question #8, thirteen responded, not sure.

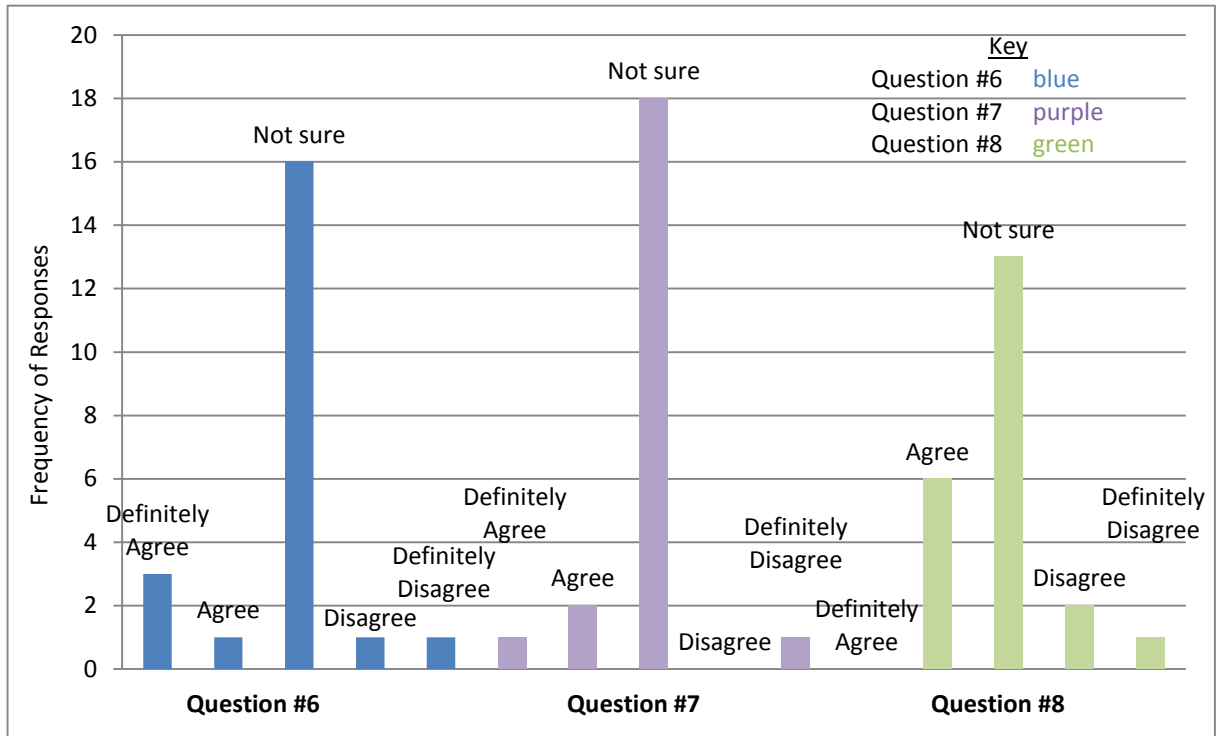


Figure 10. Melillo Teacher OE Survey frequency of responses to questions 6, 7 and 8, (N=22).

Teachers responded in an overall positive manner toward outdoor education even if they did not see it as integral to their content area. Correlations between content areas taught and positivity or negativity toward OE included a negative trend among special education teachers and a positive trend among science teachers (Figure 11). The quantitative and qualitative responses of teachers in these two disciplines are particularly relevant to the research questions. The Likert Scale totals for Special Educators were -5, -3 and +5, and they expressed concern about behavioral problems and safety when teaching outdoors. One Special Educator wrote, “There’s always a risk when taking (students with) behavioral problems outside of the structural environment of school. I just

don't seem to have the energy to take that risk on." They also expressed doubt as to the outcome of the research project in determining a significant impact of OE on the learning of students' with disabilities. The survey responses of science teachers all fell in the +1 to +2 range. One science teacher expressed concerns about time constraints and feeling overwhelmed with designing outdoor activities that support the curriculum. A second science teacher wrote that "the structure and procedures of schools (are not) very conducive to OE." This teacher anticipated an outcome to my research that supported the use of OE. The respondent reported having had extensive OE during his/her high school education and regretted that we did not provide the same to our students. Respondents from other curricula expressed regret over the lack of OE in our school and in other public schools writing, "OE is lacking in public schools Students need to be outside more and moving much more." This teacher predicted my research would show higher levels of engagement and motivation in the students. Another response read, "I feel we are so actively moving towards the use of technology – but outdoor education (which I value highly in my own life and my own children's' lives) has never even been addressed." The only Physical Education response that I received highly valued OE and cited "funding and time constraints" as impediments to doing more OE with students. Negative survey responses toward OE fell into two general categories, insufficient time to both cover curriculum and incorporate OE, as well as the distraction to students of being outdoors. One respondent wrote, "There are so many distractions when we're outside – even just the novelty of being outside in and of itself – that it's hard for my students to maintain their focus."

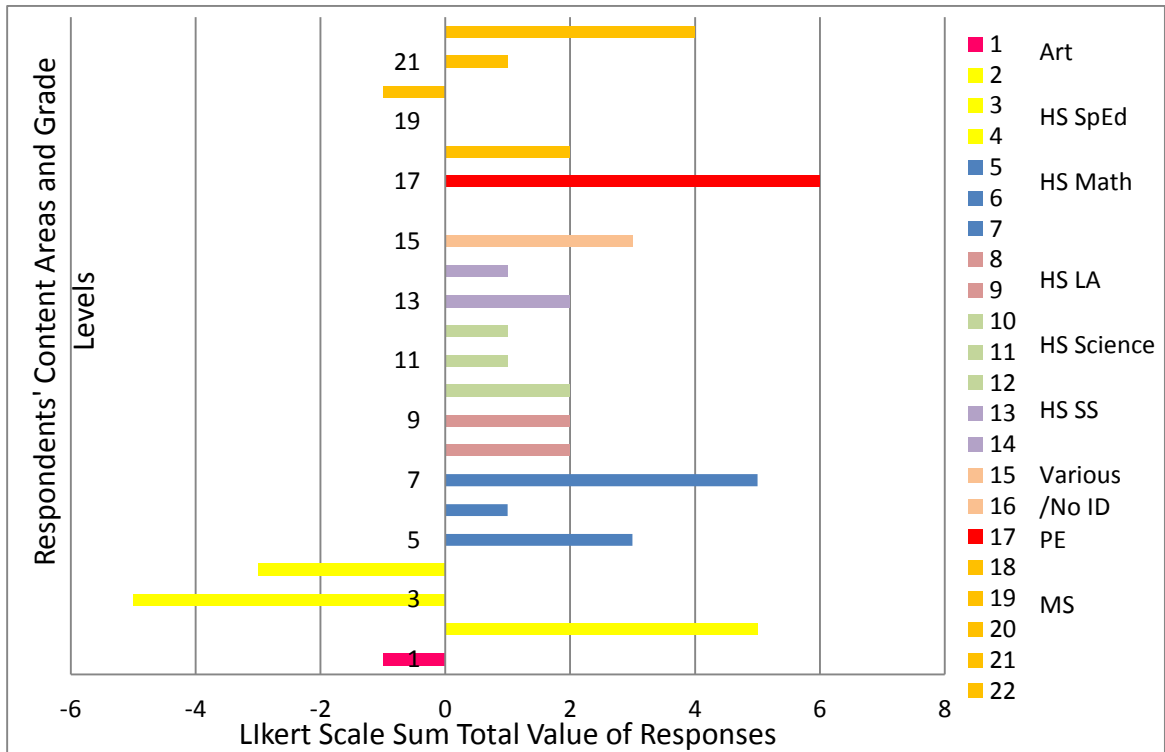


Figure 11. Melillo Teacher OE Survey Likert Scale teacher scores according to content area and grade level, (N=22).

The baseline set by the students' interviews and the teachers' surveys show limited exposure of students to OE in our district both historically and currently. The students remember OE experiences positively and many teachers perceive OE as a positive teaching tool but little work is being done outside. The teachers' concerns about time, distraction and safety were clearly reported impediments, but the teachers' lack of certainty about the actual educational impact of OE was an implied impediment to its use. Given their uncertainty and some of the informal, free responses of teachers, it is also implied that they have had little training in OE as teachers. I can self-report that outside

of the MSSE program I had no training or professional development in OE, PBE or EIC in all of my 28 years of teaching.

The Melillo Student Engagement Level Behavior Chart was used during 23 class sessions and OE experiences. The aggregated data for indoor teacher-centered (ITC) learning showed the class mean time on-task to be 58.4%, and for indoor student-centered (ISC) learning the mean time on-task was 70.4%. For the treatment sessions of outdoor student-centered (OSC) learning the class mean time on-task was 91.1% and the outdoor teacher-centered (OTC) was 40%. Data for the latter was not collected on enough occasions to see this statistic as significant. The difference between the ITC mean time on-task and the OSC mean was 32.7%. The difference between the ISC mean time on-task and the OSC mean was 20.7%. Although not directly related to the research questions, the difference between the ITC and ISC mean time on-task was 12.0% (Figure 12). The number of students present during behavior charting fluctuated between four and six.

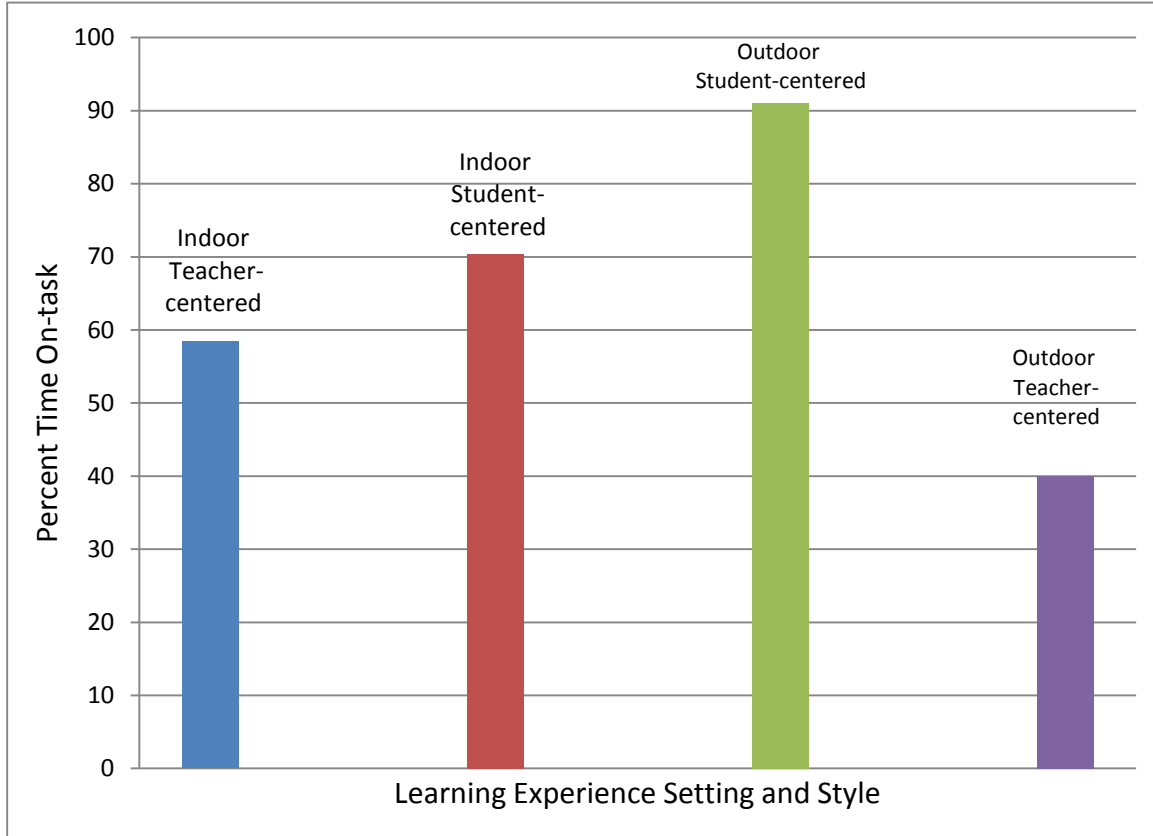


Figure 12. Melillo Engagement Level Behavior Chart class mean results, (N=5).

The data for time on-task during the learning experiences in different settings and given different styles of presentation showed a correlation for all students between the outdoor setting and increased time on-task. The difference between time on-task percent for ISC and OSC was 24.0% higher for Student #1, 16.9% for Student #2, 21.1% for Student #3, 38.2% for Student #4 and 29.7% for Student #5. There was also a positive correlation between style of presentation that showed an increase in time on-task for student-centered learning. The difference between time on-task percent for ISC and ITC was 14.9% higher for Student #1, 8.6% for Student #2, 14.6% for Student #3, 17.6% for Student #4 and 22.0% for Student #5 (Figure 13).

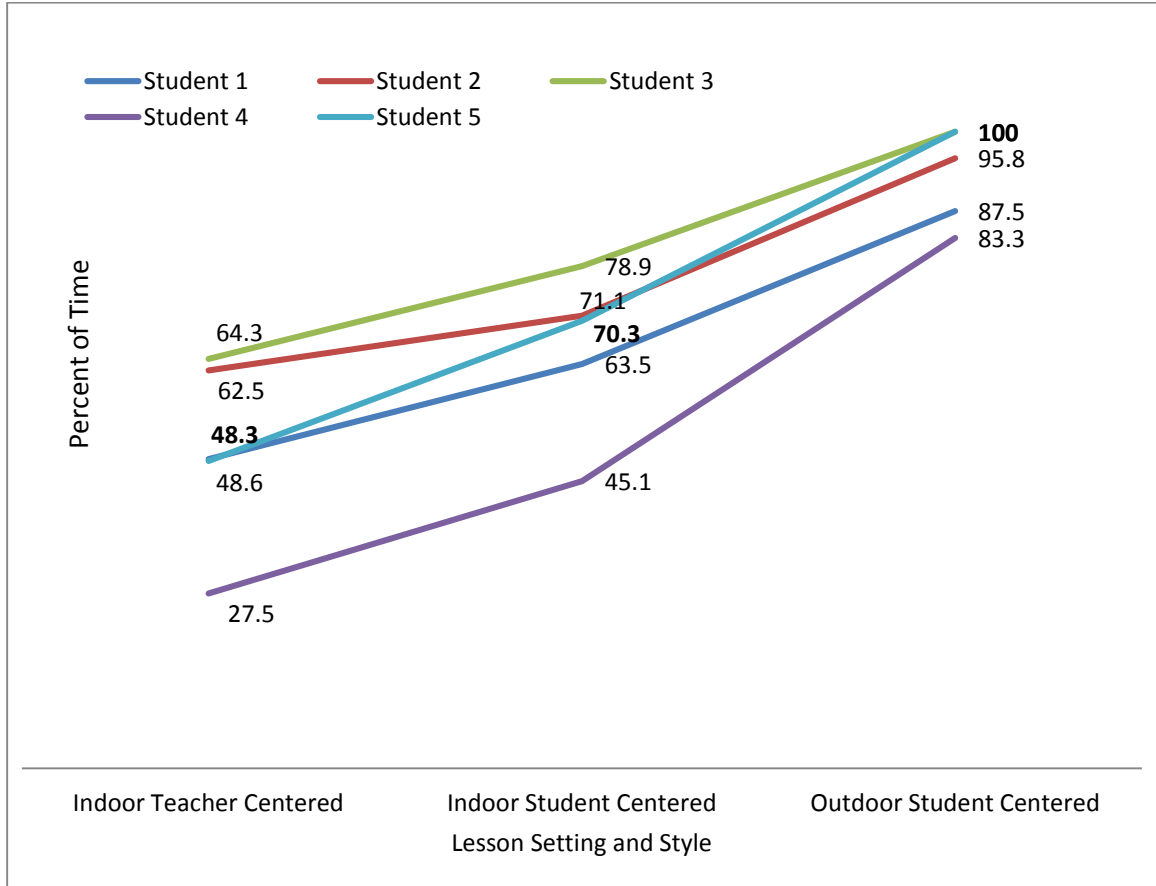


Figure 13. Melillo Engagement Level Behavior Chart student mean results, (N=5).

Student green journal entries provided one source of qualitative data used to answer the research questions. Given the students' learning disabilities that impact on literacy skill development, the journals did not provide as much evidence as anticipated. In answering the research question about OE and content mastery, student journal entries illustrated improvement in some students' ability to make more accurate and precise observations. Accurate observation is used here to mean sense or measurement-based, or a factual statement about natural surroundings. For clarification, statements of intrapersonal observation or inferences, for example, were not counted as accurate observations. Student #3 recorded no accurate observations of nature on a walk in early

November, but in mid-April she was able to record six accurate observations. For example, she wrote in December, “I smell McDonalds” and in April she wrote, “I see a damaged tree with holes in it and a healthy tree with nothing on it.” Also, whereas the student was unable to connect observations to a logical inference based on those observations in November, in April she was able to write, “I hear the stream flowing” and connect this to the inference “The water used to be frozen but now it’s not.” Student two recorded the observation, “water is cold lots of leaves and kinda choppe from wind cinda bumpy,” in November but in April he independently thought to use his cell phone to look up weather statistics and recorded eight separate pieces of information including their units of measurement. Students #1 and #4 were distracted and did not record in writing any accurate observations during the November or April outdoor experiences. Student green journal constructed responses to questions relating meiosis and the deer overpopulation project in Hastings showed limited understanding. Out of the possible nine total points awarded on three separate questions, students’ scores ranged from three to four and a half.

Student green journal entries provided varied evidence about student engagement and motivation. In some cases students recorded engaged comments such as, “I saw some beautiful trees that were amazing.” when asked to reflect in their journals, while other students were disengaged from the assigned activity and were engaging in inappropriate behavior instead. As an example of heightened engagement and motivation, Student #2 who has dysgraphia, went home and voluntarily rewrote a journal entry on the computer

so that he could better express his thoughts. He then came in the next day and stapled it into his green journal without prompting from the teachers.

Qualitative evidence from the teacher-researcher and Assistant Teacher's journals provided student specific and class data about engagement and motivation. Journal entries that evidenced the impact of OE on students occurred at a ratio of greater than two to one, positive to negative, in both teachers' journals. The Assistant teacher in the class made observations contrasting students' level of engagement when indoors versus when learning outdoors. She wrote, "during the pre-walk discussion, five out of six students were staring off or had heads down...Once we went out for our group walk, five out of six students were on task." On the same occasion I wrote, "The students were very excited to get outside and only one of the six, Student #6, was concerned about the cold." Both teachers noted in their journal entries that students were less engaged in conflict during this walk. Students' motivation levels were noted in various ways, including their comments during a post-walk discussion when they made very practical and logical suggestions about how to improve our productivity in eliciting homeowners' permission to dart deer on their property. Another telling incident that evidenced student motivation was when Student #2 came to school only for science class the day after his dog died because we were going on a walk and he did not want to miss it (Figure 14).



Figure 14. Student #2 demonstrates deer feeder to other students

Entries that evidenced the positive impact of OE on student understanding of content occurred in a one to one ratio. The Assistant Teacher wrote about Student #3, “although the objective of the trip was clearly presented...the student was not clear on the goal of the trip.” However, it was also noted about the same student, “(she) is able to recall details from tasks in which she was involved more easily than details from language-based lessons.” Similarly, I wrote about the class in general that, “Recall of ecology topics was low even though we had discussed some of the topics on previous

walks...” But in a latter journal entry I noted that “(the students) remained engaged in the field study activities and completed the two main objectives of the trip accurately and independently.” (Figure 15)



Figure 15. Students #2 and #3 cooperatively engaged during field trip

Finally, the journal entries noted that students were far more engaged in the practical activities and hands-on, minds-on tasks conducted outdoors. This was noted most often and most clearly in reference to Students #2 and #3 (Figure 16). The Assistant Teacher wrote after a service learning walk connected to the deer project that “she (Student #3) seemed to benefit from processing information in vivo as opposed to second-hand delivery and is able to more readily grasp the big picture and make

reasonable connections.” In reference to the same project learning event I wrote, “The students are engaged by tasks that are grounded in an immediately purposeful activity in a way they never are by the abstract pursuit of knowledge.”



Figure 16. Students #2 and #3 labeling water and soil samples

The combined evidence of the engagement charting, students’ and teachers’ journaling and pictures taken during OE experiences strongly indicates an increase in student engagement and motivation related to EIC and OE. Although there is some counter evidence suggesting that students with executive functioning issues find it difficult to attend when outside, the behavior charting shows their level of distraction to be even higher when learning inside whether the lessons are ITC or ISC.

INTERPRETATION AND CONCLUSION

In answering the research questions for this project the clearest answer was to the question, “What impact did limited use of EIC methodology have on student motivation and level of engagement?” The answer to this question was that there was a clearly positive impact. Data from the engagement chart showed a dramatic difference in the level of engagement between Indoor Teacher Centered and Indoor Student Centered as compared to Outdoor Student Centered, and this data was corroborated by the students’ survey responses and interviews. Furthermore, the students’ raised level of engagement was clearly illustrated by the pictures taken of them while learning outside. I was not comfortable taking indoor pictures of the students during lessons for confidentiality reasons or for the purpose of documenting their disengagement in that way. However, the contrast is obvious when you have spent time in the classroom with my students. As an illustration, Student #3, the only girl in my class, often drifts off into complete disengagement during lecture formatted lessons or when the boys in the class are getting into disciplinary problems. In contrast, our teachers’ journal entries describe her excitement and joy during outdoor experiences.

The feeling of having this class outdoors is something that the data cannot communicate. The relief, increased sense of community and happiness that being outside in nature brought to our class is argument enough for OE. Louv’s theory of Nature Deficit Disorder certainly gained weight with me through the results and experiences of this classroom research project (Louv, 2008). Students craved the time outside and were disappointed and listless when I could not make time in our class schedule to take them

out. Added to this is the increased level of self-confidence that the students exhibited when accomplishing concrete tasks related to their community and the curriculum. The students were proud of the work that they were doing for the deer overpopulation project and I felt proud of them, too. This was in contrast to the frustration that we all felt when working in the classroom to learn some of the abstractions of the state required curriculum. These outcomes are in line with research that identified the need for students with varied strengths to be given opportunities to exhibit their competence (Wanlass, 2000).

Less clear was the answer to the question, “What impact did limited use of EIC methodology have on the content mastery of students with learning differences in a high school living environment class?” Obviously, one serious issue with my research is the size of the sample group. It is not valid to come to any conclusions based upon the performance of only four to five students over the course of less than one school year. It is also difficult or impossible to control for many variables when conducting research in an educational setting in order to determine clear causation. Variables that could not be controlled for during this project were the emotional and social dynamics of the student grouping. Individual students’ emotional well-being on any given day was widely variable and their behavior in reaction was consistently disruptive of the educational setting. It was also difficult to make the levels of abstraction and difficulty of unit topics comparable, and even if I perceived them as comparable, the students’ individuality as learners could make that perception invalid. A further variable was the quality of the OE experiences and my training as an outdoor educator. I was in the midst of a learning

process myself during the research project and that had an impact on the results. Also, it is difficult to rule out simple factors such as the impact that any novelty in presentation could have on engagement. Broda (2007) makes a case for any form of outdoor education based upon its potential to provide novelty, if nothing else. Taking these flaws in the research into account, the data collected for the treatment and non-treatment exam grades and lab grades showed some improvement in the understanding and remembrance of content material taught with even limited outdoor exposure. More research would be needed to determine if the overall impact on student performance would be positive, and if that positive impact would include results on the living environment Regents exam. (Those results were available in late June. Two students passed the exam with scores 65 or higher, two students scored between 55 and 64, and the fifth student received a 28. Given the students' challenges these scores support the continued use of OE.) The greatest concern that came from my research is time. The OE experiences require a great deal of time and it is already difficult to present all of the required curriculum to students who have learning delays requiring extra processing time. In order to accomplish all objectives, EIC experiences would need to be exceedingly well-crafted which is going to take greater professional development on my part.

If given that OE improves student engagement and motivation level, and content understanding and remembrance, then the answer to the research question, "How did OE impact on students' content mastery?" would be that engaged students learn more than disengaged students. Furthermore, the answer to the question, "Did EIC's impact correlate with Learning Style strengths and weaknesses? Did it correlate with students'

learning disabilities?” is interesting and perplexing. My anticipated outcome to this aspect of the research was that students with a kinesthetic learning strength and executive functioning issues would show the greatest positive impact. In contrast, the only correlation that seemed apparent was that the students who did not present with executive functioning issues benefitted more from OE. The students with executive functioning issues seemed to struggle with attention, focus and following procedures in an outdoor setting only somewhat less than they did inside. In fact, the concerns expressed by teachers about safety and distraction when outdoors were valid concerns. The validity of the concerns does not make the effective use of OE impossible, but it does highlight the need for outdoor lessons to be well-structured and well-managed by the teacher.

VALUE

The value of this study for me and for other educators is at least four fold. First, it taught me the true value of collecting and interpreting data in order to inform my teaching. I was especially taken by the illustration of the differences in students’ engagement levels through the charting and graphing of the data. It will be a future goal for me to collect data when I perceive a need for change in my teaching or in an educational setting, as it should be for all educators. I would like to repeat this research project with a larger class or classes. I would plan the project to run from September through June, and that would allow me to ascertain the impact on students’ Regents exam scores. Without evidence that OE can have a positive impact on test scores, or at least not have a negative impact, it would be difficult to defend the practice to other teachers.

Secondly, given the engagement data, I will reduce the amount of time that I spend presenting information in a teacher-centered manner. I would like the opportunity to share this particular data with my colleagues since it gives clear evidence of the students' need for hands-on and minds-on learning in order to remain engaged. This creates a great deal of tension for teachers given the state requirements and the amount of contact time that we have with students, but the data makes the emphasis on student-centered learning an imperative.

Thirdly, I have learned that in order to conduct strong research and run effective OE I need to further develop my curriculum and lesson plans. A goal in this area is to work with the lessons I have and apply the 5E structure in order to develop well-crafted units that engage students, utilize student-centered strategies and incorporate OE. The 5E structure is a technique I would also like to share with colleagues because it is versatile and practical and has great potential to increase student engagement.

Lastly, I am thoroughly convinced of the power of EIC methodology and determined to develop my skills as a teacher in this area. I have no doubt that well-crafted learning experiences in science that get students outside and working on community-based, tangible goals via practical applications, works. There is no doubt these are the experiences my students will remember when they move on in life. An illustration of this was when two former students came after school to study with me and brought up a hiking trip we had taken last year. The students talked about having kept the rock samples and walking sticks they collected on the trip. We laughed and exchanged stories about that day. That's the impact that I want to have as a teacher. I want to be the teacher whose

outdoor lessons led a student to become a hiker, or an environmentalist or to pursue a career in the sciences, or simply to better understand who they are as learners and people and feel more competent and confident in themselves. I believe that I accomplished some of these goals with at least two of my five students this year. During our field study trip Student #2 said, “Isn’t nature great. I really like being out here. I mean it, I’m not being sarcastic.”

REFERENCES CITED

- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth ed. 2013, Arlington, VA: American Psychiatric Association, 2013.
- Broda, H. (2007). *Schoolyard-enhanced learning: Using the outdoors as an instructional tool*, K-8. Portland, Maine: Stenhouse Publishers.
- Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York City: Columbia University.
- Dewey, J. (1938). *Experience and Education*. New York City: Columbia University.
- Fleming, N.D. (1995), I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom, in Zelmer, A., (Ed.) *Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA)*, HERDSA, 18, 308-313.
- Fleming, N.D. & Mills, C. (1992). Not Another Inventory, Rather a Catalyst for Reflection. *To Improve the Academy*, 11, 137-155.
- Gardner, H. (1995). "Multiple Intelligences" as a Catalyst. *The English Journal*, 84 (8), 16-18.
- Gardner, Howard (1983): *Frames of mind: The theory of multiple intelligences*. New York: Basic Books
- Hoody, L & Lieberman, G. (1998). Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning. Results of a Nationwide Study. *State Education and Environmental Roundtable*, San Diego, CA.
- Louv, R. (2009). Do Our Kids Have Nature-Deficit Disorder? *Educational Leadership*, 67(4), 24-30.
- Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill: Algonquin Books.
- Martin, A. (2001). 'Dramaturgy': *An Holistic Approach To Outdoor Education*. *Australian Journal of Outdoor Education* , 5 (2), p. 34.
- Neill, J. *Outdoor Theories: A Review and Synthesis*. 2010. Outdoor Recreation Industry Council Annual Conference. Slideshare. Web. 12 Feb 2014
- New York State Education Department: Curriculum and Assessment, Living

- Environment Core Curriculum. (2014). Retrieved from <http://www.p12.nysed.gov/ciai/mst/pub/livingen.pdf>
- New York State Education Department, General Education & Diploma Requirements. (2014). Retrieved from <http://www2.ed.gov/policy/elsec/leg/blueprint/faq/complete-education.pdf>
- New York State Education Department: Office of State Assessment, Regents High School Examination in Living Environment. (2013). Retrieved from <http://www.nysedregents.org/LivingEnvironment/613/lenv62013-examw.pdf>
- New York State Education Department: Office of State Assessment, Grade Eight Intermediate Level Science Test. (2014). Retrieved from <http://www.nysedregents.org/Grade8/Science/614/ils62014-exam.pdf>
- Powers, A. (2004) An Evaluation of Four Place-Based Education Programs, *The Journal of Environmental Education*, 35:4, 17-32, DOI: 10.3200/JOEE.35.4.1/-32
- Rudolf, D. (2012). *Effect of Outdoor Education Methods and Strategies on Student Engagement in Science: A Descriptive Study*. (Unpublished professional paper). Montana State University, Bozeman, Montana.
- Staff, Mayo Clinic (n.d.). Vitamin D. - *Drugs and Supplements*. Retrieved April 27, 2014, from <http://www.mayoclinic.org/diseases-conditions/childhood-obesity/basics/complications/con-20027428>
- Staff, Mayo Clinic (n.d.). Childhood Obesity. - *Complications from childhood obesity*. Retrieved April 27, 2014, from <http://www.mayoclinic.org/diseases-conditions/childhood-obesity/basics/complications/con-20027428>
- U.S. Department of Education, A Blueprint for Reform: The Reauthorization of the Elementary and Secondary Education Act, (2010). Retrieved from www2.ed.gov/policy/elsec/leg/blueprint.
- U.S. Department of Education, College and Career Ready Standards and Assessments. (2010). Retrieved from <http://www2.ed.gov/policy/elsec/leg/blueprint/faq/college-career.pdf>
- U.S. Department of Education, No Child Left Behind Act of 2001. (2001). Retrieved from <http://www2.ed.gov/policy/elsec/leg/esea02/index.html>
- Walsh, V. (1976-01-01). null. The Exploration of the Outward Bound Process.

- Wanlass, Y. (2000) Broadening the Concept of Learning and School Competence. *The Elementary School Journal*, 100 (5), 513-527.
- Weldon, L. (2012) Increasing Student Success and Participation in Science Using Place-based Education (Unpublished professional paper). Montana State University, Bozeman, Montana.
- Wright, A. (Interviewer) & Fleming, N. (Interviewee). (2011). What is the Link Between VARK and Communication? [Interview video]. Retrieved from <http://vark-learn.com/introduction-to-vark/>

APPENDICES

APPENDIX A
MELILLO BASELINE EXAM

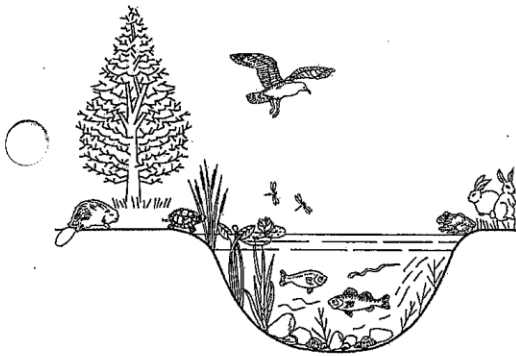
1. A fundamental concept of ecology is that living organisms

- A) are independent and do not interact with each other or with the physical environment.
- B) do not interact with other living organisms, but do interact with the physical environment
- C) interact with each other, but do not interact with the physical environment
- D) interact with other living organisms and interact with the physical environment

2. The organisms in a pond and the physical factors influencing them best describe

- A) a population
- B) an ecosystem
- C) a biosphere
- D) a food chain

3. The diagram below represents many species of plants and animals and their surroundings.



What does the diagram best represent?

- A) a population
- B) a community
- C) an ecosystem
- D) the biosphere

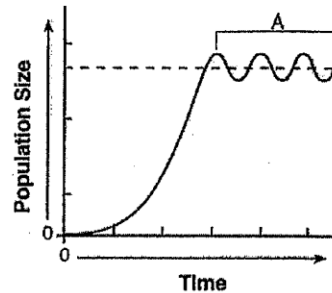
4. Which statement best describes an ecosystem maintaining a state of approximate equilibrium?

- A) Nutrients from decayed organisms are recycled in a forest ecosystem.
- B) All the frog species in a South American rain forest become extinct.
- C) A mutation spreads through a species of bacterium, making them unable to decompose wastes.
- D) Mice are released into a field ecosystem as food for a declining predator population

5. Which process will result in a gain of energy in an ecosystem?

- A) photosynthesis in algae cells
- B) digestion in hummingbirds
- C) ATP synthesis in fungi
- D) respiration in maple tree cells

6. Base your answer to the following question on The graph below indicates the size of a fish population over a period of time.



What does the section of the graph labeled A represent?

- A) biodiversity within the species
- B) nutritional relationships of the species
- C) a population becoming extinct
- D) a population at equilibrium

7. Sugar maples and white pines are two different tree species that often grow side by side in the Adirondack Mountains. Which statement concerning these trees is correct?

- A) Since they are both trees, they can interbreed.
- B) Since they are not closely related, they do not compete with one another.
- C) Even though they are both trees, each plays a different role in the ecosystem.
- D) They utilize totally different abiotic resources.

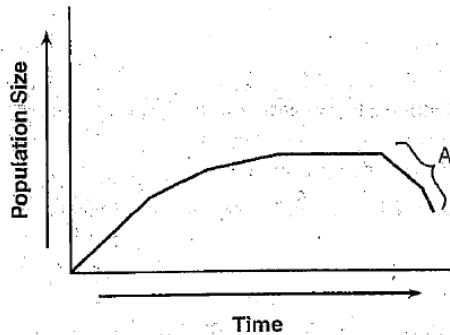
8. Which two processes are responsible for keeping the percentage of atmospheric oxygen at relatively constant levels?

- A) circulation and coordination
- B) respiration and coordination
- C) respiration and photosynthesis
- D) photosynthesis and circulation

9. Base your answer to the following question on Which statement describes the ecosystem represented in the diagram below?



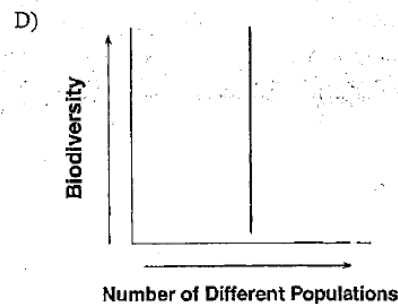
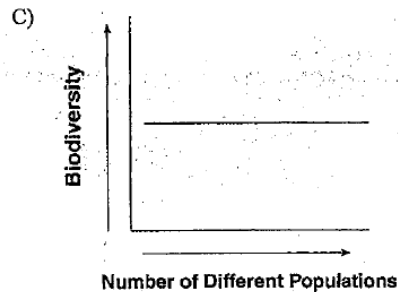
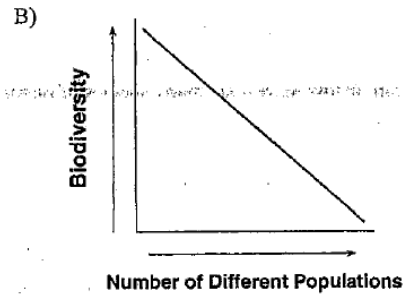
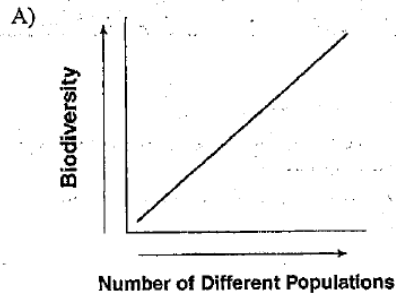
- A) This ecosystem would be the first stage in ecological succession.
 B) This ecosystem would most likely lack decomposers
 C) All of the organisms in this ecosystem are producers.
 D) All of the organisms in this ecosystem depend on the activities of biological catalysts.
10. The graph below shows the changes in the size of a population over a period of time.



Which environmental condition could have caused the change in the population size at A?

- A) an increase in competition
 B) a constant availability of shelter
 C) a decrease in the size of its predators
 D) an unlimited supply of its food
11. In lakes that are exposed to acid rain, fish populations are declining. This is primarily due to changes in which lake condition?
- A) size B) temperature
 C) pH D) location

12. Which graph best shows the relationship between the amount of biodiversity and the number of different populations in an ecosystem?



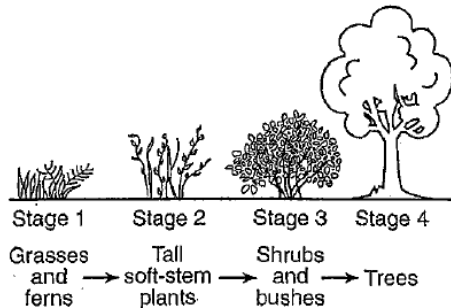
13. Which activity would reduce biodiversity in a forest ecosystem?

- A) adding plants that are naturally resistant to insects
- B) protecting wildflowers from logging activities
- C) replacing harvested trees with young trees that are naturally found in the forest
- D) clearing a large area and planting one species of hardwood tree that can be used for lumber

14. Shawangunk Grasslands National Wildlife Refuge has been developed from an abandoned airport to restore habitat for six species of birds that require an area rich in tall grasses. Workers must continually remove trees that are beginning to invade the area as a result of

- A) direct harvesting
- B) genetic engineering
- C) evolutionary change
- D) ecological succession

15. Changes in an ecosystem over a long period of time are shown in the diagram below.



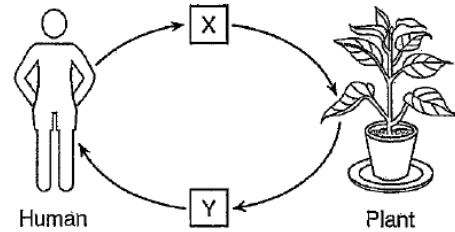
These changes will most likely lead to a

- A) stable ecosystem that can last for many years
- B) loss of heterotrophs that cannot be recovered
- C) long-term rise in environmental temperatures
- D) forest consisting of only producers and decomposers

16. Which organisms directly help to reduce overpopulation in a deer herd?

- A) parasites and predators
- B) parasites and scavengers
- C) decomposers and predators
- D) decomposers and consumers

17. The diagram below represents a cycling of materials.



Which row in the chart below shows the substances represented by X and Y?

Row	X	Y
(1)	oxygen	carbon dioxide
(2)	glucose	oxygen
(3)	carbon dioxide	oxygen
(4)	amino acids	carbon dioxide

- A) 1 B) 2 C) 3 D) 4

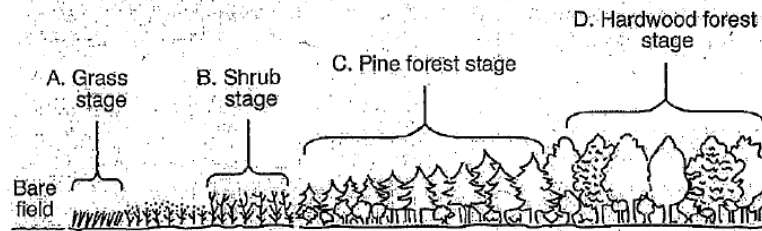
18. Many families now use compost to make the soil in their gardens more fertile. They collect vegetable scraps and yard trimmings, place them in a compost pile or special container, and let them decompose. The organisms primarily responsible for decomposing the vegetable scraps and yard trimmings are

- A) plant parasites
- B) autotrophs
- C) bacteria and fungi
- D) scavengers and viruses

19. Which statement describes an activity of a decomposer?

- A) A mushroom digests and absorbs nutrients from organic matter.
- B) A sunflower uses nutrients from the soil to make proteins.
- C) A snail scrapes algae off rocks in an aquarium.
- D) A hawk eats and digests a mouse.

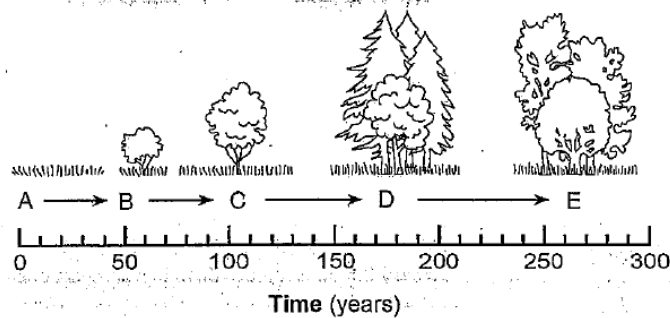
20. The diagram below represents the various stages of ecological succession in New York State.



If the ecosystem is not altered, which stage would be the most stable?

- A) grass B) shrub C) pine forest D) hardwood forest

21. An ecological process is represented below.



Which statement describes an event in this process?

- A) Community B modifies the environment, making it suitable for community C.
 B) Community D modifies the environment, making it suitable for community C.
 C) Community E will develop into community A, if the environment remains stable.
 D) Community A organisms will develop directly into community D organisms.

22. Deer ticks are responsible for spreading Lyme disease. This organism, which feeds on the blood of warm-blooded organisms like mice, deer, and humans, is best described as a

- A) predator B) scavenger
 C) parasite D) host

23. A change in the acidity of mountain lakes would most likely be a result of

- A) ecological succession of the area at the top of the mountain
 B) the introduction of new species into the lakes
 C) air pollution from smoke stacks miles away
 D) planting grasses and shrubs around the lakes

24. State *one* possible *negative* impact of importing a natural predator to control a pest.

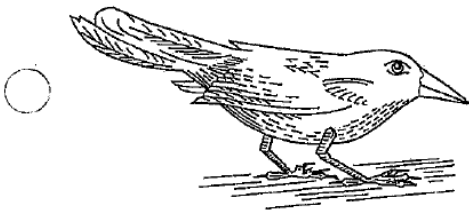
25. Damage to the ozone shield over the United States is likely to cause

- A) increased warming of local ecosystems
- B) increased exposure to ultraviolet light
- C) reduction in the pH of acid precipitation
- D) reduction in the frequency of floods and droughts

26. Many species of plants interact with harmless underground fungi. The fungi enable the plants to absorb certain essential minerals and the plants provide the fungi with carbohydrates and other nutrients. This describes an interaction between a

- A) parasite and its host
- B) predator and its prey
- C) scavenger and a decomposer
- D) producer and a consumer

27. The diagram below represents a woodpecker finch.



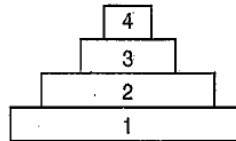
This bird may best be described as

- A) a decomposer that most likely feeds on nectar (a sugary liquid) from flowers
- B) a heterotroph that may eat insects and is more closely related to a robin than to an earthworm
- C) a scavenger that feeds on animals and reproduces asexually
- D) an autotroph that probes tree bark for insects and is pathogenic

28. A human activity that could significantly *decrease* the amount of carbon dioxide in the air is

- A) increasing the use of fossil fuel
- B) controlling insect pests that eat stored grain
- C) burning garbage and trash to generate electricity
- D) preserving and expanding forest habitats that shelter wildlife

29. Four levels of an energy pyramid are represented below.



Which statement about this energy pyramid is correct?

- A) Organisms in level 4 receive their energy directly from the Sun.
- B) Organisms in level 2 are carnivores.
- C) Organisms in level 2 receive their energy from level 3.
- D) Organisms in level 1 are autotrophic

30. What is the primary source of energy for all the organisms in the ecosystem represented below?



- A) photosynthesis in the producers
- B) respiration in the heterotrophs
- C) light energy from the Sun
- D) minerals from the rocks

31. People living in and around the Amazon rain forest have used parts of the gaviola tree to prepare medicines. Research is being conducted to determine if this tree can provide cures for many types of cancer. Continued destruction of rain forests might

- A) reduce biodiversity and remove organisms with the potential to help humans
- B) increase biodiversity and remove damaged and diseased trees
- C) reduce biodiversity and increase the reproductive rates of all organisms
- D) increase biodiversity and ecosystem stability where humans plant crops

Part II

Answer the following questions on the topic of “Population Sizes” according to the instructions given for each question, and based upon the information in the paragraph below. All answers should be given in full sentences. You may use the information on p. 69 of your study packet in order to answer the questions, BUT DO NOT PLAGIARIZE meaning DO NOT directly copy whole phrases, sentences or paragraphs.

The ecosystem of Sugar Pond is located within the Temperate Forest biome. Before human beings moved into this area in great numbers and developed the land, the pond and surrounding forest was a fully self-sustaining, balanced system. Many species of organisms inhabited the ecosystem and their populations were controlled by “limiting factors”. Today, certain populations of animals and plants have greatly increased or decreased in number. The deer population is very large while the coyote population has just about disappeared. A non-native species of vine is growing out of control and killing off native species, such as the Sugar Maple.

Question #1: Fill-in the blank boxes of the “Factor and Example Chart” below as it applies to the Sugar Pond ecosystem. Two examples of how to do this are given to you on the chart. If you answer using the species mentioned in the paragraph above it will make it easier for you to answer question 2 of this section.

<u>Factors that Limit Populations</u>	<u>An Animal or Plant Example Related to Sugar Pond</u>
1. amount of food and water	Deer that live at SP have plenty of plants to eat and fresh water to drink.
2. competition for food, water, shelter and light.	
3. light	
4. number of predators of the animal, or herbivores that eat the plant	
5. disease	A disease called “Blighted Elm Disease” is killing trees in other parts of the temperate forest biome. SP isn’t affected by the disease. The Elm population is strong.
6. shelter available	

Question #2: On the lines below, explain in detail how the disturbance of **at least 3** of the “**limiting factors**” found on the chart has **resulted**, or could have resulted, in a population mentioned in the paragraph becoming **either too large or too small**. You must use **at least 3 vocabulary words** from the box below in your answer.

predator	carnivore	biotic	niche
prey	omnivore	abiotic	biodiversity
herbivore	food web	habitat	consumer
producer	self-sustaining	community	ecosystem

[illegible]

APPENDIX B

MELILLO PRE-TREATMENT STUDENT INTERVIEW

Date: _____

Age: _____

Grade: _____

Gender: _____

IEP Classification and Other Disabilities: _____

Remember to state that participation in this interview is not mandatory and that non-participation will not impact on the student's grade in the class.

What school experiences have you had with learning outdoors, such as field trips to outdoor settings or experiments conducted outdoors or just going outside for class time? (During pre-treatment interview say, "Don't include your experiences in this class.") Try to remember as many examples as you can, and as many details as you can from each example.

Can you remember what you were learning about on these occasions?

Do you think that you remember more of what you learned during these experiences than during indoor school experiences?

If yes/no, why do you think that is?

Do you remember anything about how you felt during these experiences? Were you more or less interested in what you were learning?

Do you remember these experiences in a positive or negative way?

Overall, given the experiences you've had, do you prefer to learn outdoors or indoors?

The question I'm trying to answer through my research is "will OE improve the learning of various kinds of students in science class."

Do you have any thoughts about that question, or a prediction as to what I'll learn through my research?

Is there anything else you'd like to tell me about your OE experiences, or any educational experiences that you think apply to my research?

APPENDIX C

MELILLO TEACHER OUTDOOR EDUCATION SURVEY

Subject Area(s) of Specialization: _____

Date: _____

Your responses on this survey will be used only for the purposes of my research. The participant responses will remain anonymous when incorporated in my research report.

Directions: Answer the questions below by circling the response that best describes your teaching and approach to teaching. There is space for brief written explanations in cases when your responses may require clarification. By “outdoors” I am referring to a non-enclosed space. If you are not sure if a learning experience qualifies, please use the written response space to clarify.

<u>Statement</u>	<u>Response-1</u>	<u>Response-2</u>	<u>Response-3</u>	<u>Response-4</u>	<u>Response-5</u>
1. I have been teaching for ...	0-5 years	6-10 years	11-15 years	16-20 years	More than 20 years
2. I teach grades...	5 th -6 th	7 th -8 th	9 th -10 th	11 th -12 th	Mixed grades
Please specify if you answered “Mixed grades.”					
3. I take my classes outdoors for lessons...	0 times during a school year	1-3 times during a school year	4-6 times during a school year	7-9 times during a school year	10 or more times during a school year
Please specify if you teach four or five assignments, and if the outdoor experiences are across your assignments or specific to certain classes.					

4. OE is a valuable pedagogical tool.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
5. Access to the outdoors is highly relevant to my discipline.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
6. My students understand content better when they learn outside.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
7. My students remember content better when they learn outside.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree

8. My students are more engaged in lessons when they learn outside.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
9. Learning outside better suits the learning styles of all of my students.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
10. Learning outside better suits the learning styles of some of my students.					

(EIC is a methodology that uses the outdoors, and community-based issues related to the outdoors, as the learning context for students.)

Do you have any thoughts about this research question, or a prediction as to what I'll learn through my research?

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Thank you for helping me with this project. I appreciate you taking the time to participate.

APPENDIX D
MELILLO POST-TREATMENT STUDENT OUTDOOR EDUCATION
SURVEY

Name: _____

Date: _____

Participation in this survey is voluntary and not participating will not impact on your class grade.

Directions: Answer the questions below by circling the word that best describes your feelings about the statement.

<u>Statement</u>	<u>Response-1</u>	<u>Response-2</u>	<u>Response-3</u>	<u>Response-4</u>	<u>Response-5</u>
1. I understand what I learn better when I learn outside .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
2. I remember what I learn better when I learn outside .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
3. I understand what I learn better when it relates to where I live .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
4. I remember what I learn better when it relates to where I live .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
5. I am better able to pay attention to what I learn when I'm outside .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
6. I get excited about going outside for science class.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
7. I am more interested in what I learn in science when class is outside .	Definitely agree	Agree	Not sure	Disagree	Definitely disagree

8. Learning science outside better suits my learning styles.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
9. Learning outside makes me feel like a more successful student.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree
10. I would rather go outside for science class than learn inside.	Definitely agree	Agree	Not sure	Disagree	Definitely disagree

Directions: Circle all of the adjectives that complete the statement in a way that describes your feelings. If you would like to explain your responses in writing use the lines below each statement.

11. When I am **outside** learning I feel...

comfortable	uncomfortable	bored	excited	capable	incapable	disinterested	Interested
-------------	---------------	-------	---------	---------	-----------	---------------	------------

Explain:

12. When I am **inside** learning I feel...

comfortable	uncomfortable	bored	excited	capable	incapable	disinterested	interested
-------------	---------------	-------	---------	---------	-----------	---------------	------------

Explain:

Please use the back of the survey to tell me anything else about learning outside versus inside that you think would be helpful or important.

APPENDIX E

MELILLO OUTDOOR EDUCATION ENGAGEMENT LEVEL CHART

Melillo OE Engagement Level Chart

Date: _____

<u>Time Interval</u> Every 10 mins. of 80 min. block	<u>Student AB</u>	<u>Student SD</u>	<u>Student TG</u>	<u>Student EJ</u>	<u>Student MS</u>	<u>Student TV</u>	<u>Activity Description</u> Outdoor student-centered – OSC Outdoor teacher-centered – OTC Indoor student-centered - ISC Indoor teacher-centered – ITC hands-on - ho, minds-on - mo, community-based - cb individual – ind, or pairs or group (Lesson description on back.)
12:05							
12:15							
12:25							
12:35							
12:45							
12:55							
1:05							
1:15							

APPENDIX F
VARK INVENTORY



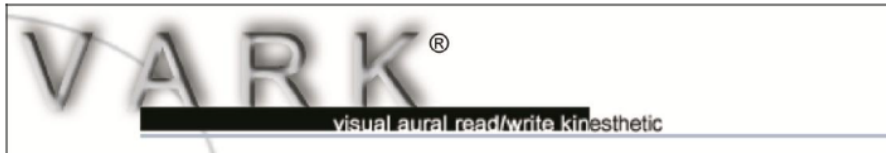
The VARK Questionnaire – The Younger Version

How Do I Learn Best?

Choose the answer which best explains your preference and circle the letter(s) next to it.
Please circle more than one if a single answer does not match your perception.
 Leave blank any question that does not apply.

1. I like websites that have:
 - a. things I can click on and do.
 - b. audio channels for music, chat and discussion.
 - c. interesting information and articles in print.
 - d. interesting design and visual effects.
2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:
 - a. see the words in my mind and choose by how they look.
 - b. hear them in my mind or out loud.
 - c. find them in the dictionary.
 - d. write both words on paper and choose one.
3. You want to plan a surprise party for a friend. I would:
 - a. invite friends and just let it happen.
 - b. imagine the party happening.
 - c. make lists of what to do and what to buy for the party.
 - d. talk about it on the phone or text others.
4. You are going to make something special for your family. I would:
 - a. make something I have made before.
 - b. talk it over with my friends.
 - c. look for ideas and plans in books and magazines.
 - d. find written instructions to make it.
5. You have been selected as a tutor or a leader for a holiday program. This is interesting for your friends. I would:
 - a. describe the activities I will be doing in the program.
 - b. show them the map of where it will be held and photos about it.
 - c. start practising the activities I will be doing in the program.
 - d. show them the list of activities in the program.
6. You are about to buy a new digital camera or mobile phone. Other than price, what would most influence your decision?
 - a. trying it.
 - b. reading the details about its features.
 - c. it is the latest design and looks good.
 - d. the salesperson telling me about it.
7. Remember when you learned how to play a new computer or board game. I learned best by:
 - a. watching others do it first.
 - b. listening to somebody explaining it and asking questions.
 - c. clues from the diagrams in the instructions.
 - d. reading the instructions.

8. After reading a play you need to do a project. Would you prefer to:?
- a. write about the play.
 - b. act out a scene from the play.
 - c. draw or sketch something that happened in the play.
 - d. read a speech from the play.
9. You are about to hook up your parent's new computer. I would:
- a. read the instructions that came with it.
 - b. phone, text or email a friend and ask how to do it.
 - c. unpack the box and start putting the pieces together.
 - d. follow the diagrams that show how it is done.
10. You need to give directions to go to a house nearby. I would:
- a. walk with them.
 - b. draw a map on a piece of paper or get a map online.
 - c. write down the directions as a list.
 - d. tell them the directions.
11. You have a problem with your knee. Would you prefer that the doctor:
- a. showed you a diagram of what was wrong.
 - b. gave you an article or brochure that explained knee injuries.
 - c. described to you what was wrong.
 - d. demonstrated what was wrong using a model of a knee.
12. A new movie has arrived in town. What would most influence your decision to go (or not go)?
- a. you hear friends talking about it.
 - b. you read what others say about it online or in a magazine.
 - c. you see a preview of it.
 - d. it is similar to others you have liked.
13. Do you prefer a teacher who likes to use:
- a. demonstrations, models or practical sessions.
 - b. class discussions, online discussion, online chat and guest speakers.
 - c. a textbook and plenty of handouts.
 - d. an overview diagram, charts, labelled diagrams and maps.
14. You are learning to take photos with your new digital camera or mobile phone. I would like to have:
- a. examples of good and poor photos and how to improve them.
 - b. clear written instructions with lists and bullet points.
 - c. a chance to ask questions and talk about the camera's features.
 - d. diagrams showing the camera and how to use it.
15. You want some feedback about an event, competition or test. I would like to have feedback:
- a. that used examples of what I have done.
 - b. from somebody who discussed it with me.
 - c. that used a written description or table of my results.
 - d. that used graphs showing what I achieved.
16. You have to present your ideas to your class. I would:
- a. make diagrams or get graphs to help explain my ideas.
 - b. write a few key words and practice what to say again and again.
 - c. write out my speech and learn it by reading it again and again.
 - d. gather examples and stories to make it real and practical.



The VARK Questionnaire Scoring Chart

Use the following scoring chart to find the VARK category that each of your answers corresponds to. Circle the letters that correspond to your answers

e.g. If you answered b and c for question 3, circle V and R in the question 3 row.

Question	a category	b category	c category	d category
3	K	V	R	A

Scoring Chart

Question	a category	b category	c category	d category
1	K	A	R	V
2	V	A	R	K
3	K	V	R	A
4	K	A	V	R
5	A	V	K	R
6	K	R	V	A
7	K	A	V	R
8	R	K	V	A
9	R	A	K	V
10	K	V	R	A
11	V	R	A	K
12	A	R	V	K
13	K	A	R	V
14	K	R	A	V
15	K	A	R	V
16	V	A	R	K

Calculating your scores

Count the number of each of the VARK letters you have circled to get your score for each VARK category.

Total number of V s circled =	
Total number of A s circled =	
Total number of R s circled =	
Total number of K s circled =	

APPENDIX G

GLOSSARY OF SPECIAL EDUCATION TERMS

Glossary of Special Education Terms (as used in this research paper)

AD/HD – Attention Deficit/Hyperactive Disorder – currently used terminology describing a condition that makes it difficult for students to attend, and in HD cases remain still for periods of time. ADD is no longer used to describe this condition. Functional MRI tests have indicated that this condition is in part due to low average levels of activity in the pre-frontal cortex of diagnosed individuals. It is considered a health condition that makes a student eligible for special education services in New York State.

Auditory Processing Deficit – cognitive delay or impairment in comprehending and responding to information communicated through the sense of hearing, although hearing is not impaired.

Behavioral Issues - conditions through which the student's in school misbehavior and inability to abide by standard classroom practices and school rules impacts on their ability to learn and participate in the mainstream setting.

Classified – a student who has been identified by the CSE as in need of special education services and has an IEP specifying his/her educational needs for academic success.

Classification Disability - the condition, disorder or area of impairment that was identified by the Committee on Special Education as the primary reason the student needs Special Education services.

Committee on Special Education – an assemblage of educators, related service providers, the student's parents, and the student, charged with determining the student's need or continued need for special education services. The make-up of the committee is determined by Federal and state law,

Executive Functioning Deficit – a term that refers to difficulty in integrating sensory input and information in order to plan out and perform functional activities. Students with executive functioning deficits demonstrate difficulty managing their time and materials, constructing and producing long term projects and essays and/or anticipating the outcomes and causation of their behaviors.

Language Delays and Expressive and Receptive Language Processing Deficit – see Speech and Language Impairment

Learning Disability - disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations. Specific learning disabilities include conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia and

developmental aphasia. The term does not include learning problems that are primarily the result of visual, hearing or motor disabilities, of mental retardation, of emotional disturbance or of environmental, cultural or economic disadvantage.

Source: Massachusetts Department of Elementary & Secondary Education
<http://www.doe.mass.edu/sped/links/learndisability.html>

Low Intelligence Quotient – intelligence quotient or IQ scores below 85 are considered below average. Students with low IQ's have cognitive disabilities which are different from learning disabilities.

Memory Deficits – a cognitive disorder interfering with one or more of the functions of memory, short term memory, long term memory or working memory. The condition is diagnosed through low scores on specific IQ subtests involving memory function.

Multiple Disabilities - simultaneous impairments (such as intellectual disability-blindness, intellectual disability-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in a special education program solely for one of the impairments. The term does not include deaf-blindness.

Speech and Language Impairment - a communication disorder such as stuttering, impaired articulation, a language impairment or a voice impairment that adversely affects a child's educational performance. This category would also include cognitively based conditions that cause delays and deficits in a student's ability to express themselves through spoken or written communication or understand spoken or written language in order to learn or function in daily life.

Information in the glossary definitions was taken from or confirmed by the websites below if not otherwise cited.

<http://www.specialeducationguide.com/about-us/>

<http://www.aacap.org/>

<http://www.webmd.com/>