

Meaningful Watershed Educational Experiences:
An Examination of the Impact of Outdoor Education on Academic Achievement of Struggling
Middle School Science Students

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Abstract

The purpose of this study was to determine if participation in a Meaningful Watershed Educational Experience, or “MWEE”, would increase academic achievement for struggling middle school students in their science classes. This study utilized a quasi-experimental design, as twenty- eight eighth grade Baltimore County Public School students in a Title I school were analyzed for achievement in their science class after the treatment of participating in a MWEE and then compared against their seventh grade science grades. The study hypothesized that the treatment would not have an impact on academic achievement. After the MWEE participation treatment, the majority of students demonstrated increased overall grades in science classes from seventh grade to eighth grade. There were substantial threats to validity, however, which could make the argument for a more robust and longitudinal study during future research.

CHAPTER I

INTRODUCTION

Today's societal norms focus heavily on technological innovations. Between gaming systems, social media, television, and other electronic implications, the youth of today is inundated with artificial, indoor stimuli. This is becoming increasingly evident in the classroom as well. With each iteration of educational software applications, the modern classroom is more technology dependent than ever. While the argument can assuredly be made for the educational merits of technological advancements, this increasing reliance on technology opens itself to a conversation about where to draw the proverbial line. The middle school classroom is not only an environment for content instruction, but also an arena for the formative years in a person's life to develop emotionally, socially and cognitively. Providing middle school students, especially those in areas of high needs, with opportunities outside of the traditional classroom could possibly augment this development, but would most likely require extensive and repeated treatments.

Several studies have suggested that students experience several positive impacts from participating in some sort of outdoor educational program; with Meaningful Watershed Educational Experiences, or MWEEs regarded as maintaining the most fidelity. Over the course of several years of research, Beames (2017) noted repeated instances of increased psychomotor and cognitive abilities among MWEE participants. Further research suggests that participation in MWEEs may have positive influences on ADHD, childhood obesity, and trauma-induced stress recovery (Chawla, 2018).

This researcher has had several years of experience leading outdoor excursions with middle school students from a Title I school. Over the years, there has been evidence to potentially substantiate the notion that when students are actively engaged in a Meaningful Watershed Educational Experience, they are able to explore natural settings that they would normally not be exposed to. There is a reoccurring trend of increased interest in science classes after students participate in a MWEE. This interest in science content can in turn motivate a student who was previously struggling to apply more effort to their academic pursuits in the science classroom.

Statement of Problem

The purpose of this study is to determine if participation in a Meaningful Watershed Educational Experience will provide a student struggling with science content the ability to improve their academic achievement in science classes.

Hypothesis

Participation in a singular Meaningful Watershed Educational Experience will have no impact on academic achievement of struggling science students.

Operational Definitions

Meaningful Watershed Educational Experience (MWEE): A learner -centered experience based around hands-on activities which focus on local environmental issues.

Struggling Student: A student who earned either a “D” or “E” as a final grade in their course; based on a traditional “A-E” grading scale.

Environmental Literacy: An understanding of the impact of one's self and communities on local ecosystems.

Academic Achievement: The extent to which a student has completed intended educational outcomes.

CHAPTER II

REVIEW OF THE LITERATURE

Overview

When considering the broad scope of “education”, integration of natural surroundings has been primary since the dawn of mankind. The concept of incorporating outdoor education into formalized education took hold in the 18th century and was spearheaded by the likes of Jean-Jacques Rosseau and Johann Pestalozzi, who vocalized the experiential benefits that could be found in natural and agricultural settings (Coe, 2016). The concept of “kindergarten”, a term derived from the German language by Friedrich Froebel in the mid- 19th century, focused on coupling the inquisitive nature inherent during early childhood with natural phenomena and outdoor play to drive instruction. By the 1880’s, kindergartens were commonplace in the United States, as were supervised urban outdoor playgrounds with purposive, positive role models who incorporated character education into the recreational time (Frost & Sutterby, 2017).

It was around this time that famed progressivist John Dewey utilized and advocated for the use of “learning gardens” as a basis for experiential learning. This was shortly followed by the gradual incorporation of subjects such as botany into generalized studies and the emergence of open-air schoolhouses (Quay & Seaman, 2013).

Societal norms began to shift as technology and urbanization advanced and outdoor education became less of a priority. In 2005, Richard Louv penned *Last Child in the Woods*, introducing the notion that children were suffering from “nature-deficit disorder” as they became increasingly more and more detached from the natural surroundings (Coe, 2016). Himschoot (2017) makes mention in her article of a 2010 study conducted by the Kaiser Health Foundation

which found that children average over fifty hours a week on digital media. The article also notes a United Nations report from 2014 that found 54% of the world population resides in urban settings. This growing trend has even led to proposals for legislation to mandates additional outdoor education.

This literature review will first explore examples of case studies which exemplify what outdoor education entails. It will then detail the various benefits of outdoor education on the mental and physical states of students, as well as social benefits. Lastly, the review will demonstrate the impact that outdoor educational experiences has on academic implications, namely student interest and academic achievement.

Examples of Outdoor Education

Outdoor education covers a broad spectrum of activities, is appropriate for all age groups, can be incorporated through multiple contents, and is not isolated to off-campus experiences. Several authors (Himschoot, 2017; Griset, 2010; Allison, Tunks, & Hardman, 2017) described their experiences; all of which were unique from one another. The common theme was alignment of curriculum and standards with experiential, project-based learning that took place both in and out of the classroom.

Himschoot (2017) explained how biodiversity was taught by deviation from teaching about the tropical rainforests in favor of developing a daylong investigation into the biodiversity of the local ecosystems just outside the school grounds in an Alaskan town. Fourth-grade students worked in tandem with volunteers from local agencies such as the U.S. Forest Service and Department of Fish and Game to identify various native organisms and discuss their role in the ecosystem. When the students came back to the school campus, they were later able to identify

significantly more examples of plants and animals than when they simply studied them through traditional methods.

Allison, Tunks, & Hardman (2017) demonstrated that outdoor education does not require constructing a garden or any other labor-intensive activities. The authors note that using readily available resources is more than sufficient provided students can explore and be engaged, all while adhering to state and national standards. During this particular outdoor education experience, teachers and other community stakeholders accompanied second graders as they explored the nature center in Mobile Bay, Alabama. They were afforded both structured and unstructured exploration time, all while participating in cross-curricular extension activities. When the students returned to school the following day, they completed a summative assessment in the form of a presentation focused on a local marine organism that they interacted with of their choice.

Outdoor education also provides the opportunity for much more rigorous and longitudinal research, as stated by Griset (2010). Students from a high school in Maine participated in Project Learning Tree and Project Wet where they worked side by side with the local timber company to assess the ecological impact of the timber industry on the local ecosystem. Students were able to develop an intensive service learning project out of the year-long project as they took on several roles, from evaluating long term research and environmental policies to physical working alongside the employees of the timber company. Students kept a field journal throughout the process and ultimately presented their findings to their community about the impact on the local ecology by the timber company.

Benefits of Outdoor Education

Mental and Physical Health

There is substantial literature focused on the impact of outdoor education on the physical and mental well being of children. Prolific outdoor education advocate Richard Louv established what he refers to as the New Nature Movement which asserts that taking children into the woods for experiential learning and play is an integral tool for countering the growing trend of childhood obesity associated with a sedentary lifestyle that a technology-rich environment develops. (Coe, 2016). Beames (2017) also notes that outdoor education requires children to engage their surroundings with psychomotor, cognitive, and sociological fidelity that may otherwise go untapped. Chawla (2018) makes references to several cases around the globe where incorporating outdoor education, regardless of the extent, has demonstrated improvement in such as areas attention deficit hyperactivity disorder, impulse control, chronic absenteeism, reduced blood pressure, and stress recovery when compared with comparable groups without an outdoor education component. Chawla infers that place-based education permits a lower -stress environment for cognitive processing and even goes so far as to suggest that outdoor air quality is a factor as well.

Social Benefits

Coe (2016) states that the very nature of outdoor education lends itself to activities that require collaboration and relationship building among students, as well as teachers, with the environment. Longitudinal observations of students interacting with one another in a natural setting point toward experiences which are more open-ended and incorporate small, heterogeneous grouping when compared to typical classroom settings (Chawla, 2018). This in turn allows for

opportunities for growth in social interactions, and cooperation. Several authors (Quay, 2015; Griset, 2010; Himschoot, 2017) note the benefit of taking children out of their typical environment and presenting them with problem-based learning opportunities. The authors also go on to note the increase in environmental stewardship and respective pride within the communities. Griset (2010) speaks of how her students took pride in advocating for planting more trees on the school grounds after working alongside the local timber company in Maine. Himschoot (2017) references an increased interest in science careers among her students and how volunteers from the various wildlife agencies that assisted with her BioBlitz in Alaska became local celebrities. While this is clearly beneficial for the students on a personal level, this potentially has significant implications on a global scale as our planet is faced with myriad environmental concerns.

In 2014, the Inter-governmental Panel on Climate Change reported, beyond any scientific doubt, that sea levels were rising, Earth's waters and atmosphere are warming, sea ice is diminishing, and weather patterns are altering drastically. The report goes on to claim that without human mitigation, we are at risk of severe impact to the quality of human life, especially in areas already at risk (Chawla, 2017). This is not to suggest that all hope is lost, however, as many governing bodies are stepping up to implement change. It stands to reason that outdoor education can and will play a substantial role in altering how humans treat their local and global environments.

Academic Implications

Impact on student interest

It has been a long-held belief by many influential members of the education community that outdoor education allows for a more comprehensive educational process. John Dewey regularly advocated for outdoor education, citing that experiential learning coupled with meaningful reflection will counter “educational confusion” and lead to actual synthesis and application of new information (Quay & Seaman, 2013). These researchers also discuss how Dewey felt that, when compared against outdoor education, traditional modalities of education failed to accurately mirror how we learn and evolve organically as individuals. Several authors (Allison, et al., 2017; Griset, 2010) echoed Dewey’s sentiment and found that when their students participated in outdoor education experiences, they demonstrated a pronounced increase in ability to articulate their findings. Furthermore, research suggests that behavioral issues amongst the participants decreased, enrollment in science electives increased, and more students participated in science-based extracurricular activities.

Research suggests that this increased interest applies to the STEM careers as well. While STEM education is grounded in project-based learning, a study conducted in 2010 found that there was a negligible increase in interest in STEM careers from students who had completed week-long STEM camps. In contrast, similar studies have found that STEM interest increases after students participated in service learning opportunities centered around environmental after students participated in experiences that focused on environmental issues (Son, Mackenzie, Eitel, & Luvaas, 2017). A focus group was conducted with 22 students who

spent a week participating in several STEM challenges, some of which were based in outdoor education. When asked about when the students felt the most engaged, autonomous, and competent was during the outdoor challenges (Son, et al., 2017).

Students are not the only ones who benefit from the outdoor education experiences. Beames (2017) made note of how the planning, preparation, and execution of outdoor activities pushes educators to develop professionally, build leadership capacity, and stronger bonds with their students. Himschoot (2017) goes into great detail about the challenges that teachers addressed and overcame together to successfully execute their Alaskan Bioblitz; building collegiality and competency among the staff.

Impact on academic achievement

There is researched-based evidence to suggest that outdoor education has positive impacts on student academic achievement, not only in science classes, but across the content. A primary rationale for this correlation is how outdoor education lends itself to cross-curricular activities. While Allison's Mobile Bay discovery day specifically set out to fulfill the Next Generation Science Standard 2-LS4- 1 Biological Evolution: Unity and Diversity, the activities therein worked on building vocabulary, mathematical computation, and developing higher level questioning and critical thinking skills (Allison et al., 2017). Students who participated in the Maine timber company experience were able to take their new knowledge and skills back to school and apply them in their Health, Art, Foreign Language, and Industrial Technology courses (Griset, 2010).

"Nature-based learning" is a term that is synonymous with outdoor education. Chawla (2018) conducted research pursuant to a 2015 grant awarded by the National Science Foundation to investigate the impact of Nature-based learning on student well-being, academic achievement,

and ecological citizenship. Among the findings of the research conducted the world over, it was widely claimed that students with exposure to natural settings and outdoor educational experiences celebrated smaller achievement gaps, higher rates of proficiency on standardized tests, and higher graduation rates when compared with comparable schools that lacked the outdoor education experiences. One of the research studies featured in the review evaluated forty schools across the United States that had recently implemented outdoor education programs. When teachers and administrators were interviewed, 98% noted higher levels of student engagement and decreased disruptions in the classroom setting (Chawla, 2018).

Summary

Outdoor education has been incorporated into formal education to varying degrees since its inception. In recent years, international interest has been on the rise to incorporate outdoor education in a more consistent manner with a brighter spotlight. Research is frequently conducted regarding the impact of outdoor education on student well-being, academic achievement, and stewardship within the environment and their communities. There is substantial evidence to suggest that outdoor education consistently has a positive impact on all of these.

CHAPTER III

METHODS

The purpose of this study was to determine if participation in a Meaningful Water Educational Experience (MWEE) has an impact on academic achievement in a science course for struggling middle school students.

Design

This study used a quasi- experimental design as all members of the group were subjected to the same treatment and were not selected at random. Data was collected during a pre-intervention/post-intervention timeframe and the students served as their own control. The study examined the effects of participation in a Meaningful Watershed Educational Experience (MWEE) on academic achievement in science classes. The independent variable was the MWEE participation. The dependent variable was the impact on academic achievement in science classes.

Participants

Participants in this study included twenty-eight 8th grade students who currently attend a public school in the South East region of Baltimore County, Maryland. The school has approximately 700 enrollees. There is a relatively even distribution of gender, as well as of African American, Caucasian, and Hispanic students. The school is in the bottom 15% of Maryland schools in terms of overall academic achievement. The school also serves as the regional ESOL center, with approximately one third of the student population comprised of students with English as their second language.

The twenty-eight 8th grade students selected for this study were purposively selected based on their academic achievement in science class during 7th grade. Selected students were identified as struggling with science, having earned an overall grade of “D” or “E” during their 7th grade year. Of the selected students, thirteen had IEPs, seven had 504s, and fifteen students were enrolled in the ESOL program. Of the selected students, seven of them were in multiple categories. Sixteen of the students were female and twelve were male and all students attended the same school for both seventh and eighth grade.

Instrument

The data collection instrumentation used in this study served to analyze the overall grade earned by the twenty-eight subjects for their 7th grade science class. Their science GPA was used as the baseline data for the study. Their post-intervention science GPAs were then monitored for the first two quarters of their 8th grade year and compared against their 7th grade science achievement.

Procedure

The students selected for this study were chosen based on data collected regarding their enrollment in the same school the year prior and having earned an overall science grade of a “D” or “E” for their 7th grade science grade. These students then attended a two-day, off campus field trip to Day’s Cove in White Marsh, Maryland. During the experience the students engaged in activities such as orienteering, seine netting in marsh lands, using microscopes to analyze microorganisms, and field cataloging. Throughout this process, they were prompted to make observations and hypotheses about their findings, all while making correlations to key concepts from the NGSS 7th grade science curriculum, such as methods of conservation of energy and

matter. Upon completion of the two-day event, the 8th grade students returned to campus and collaboratively generated multimedia presentations that were submitted to their 7th grade science teachers with the intention of serving as instructional aids for their previous teachers to use with their current 7th grade classes.

After the intervention, student achievement in science classes was monitored quarterly and compared against their overall academic achievement in 7th grade science.

CHAPTER IV

RESULTS

The purpose of this study was to determine if participation in a Meaningful Water Educational Experience has an impact on academic achievement in a science course for struggling middle school students. Of the twenty-eight students in the study, thirteen students had an IEP, six students had a 504, and fifteen students were in the ESOL program. Seven of the students fit into two or more of the aforementioned categories. All of the students selected had earned a final grade of “D” or “E” in 7th grade science and participated in a Meaningful Watershed Educational Experience (MWEE) in the first two months of their 8th grade science class. After evaluating their academic progress in the first two quarters of eighth grade science, it was determined that sixteen of the twenty-eight students demonstrated an increase in science academic achievement, ten demonstrated no change, and two students showed a decrease in science academic achievement after completion of the MWEE.

A number of statistical analyses were run on the data. Those analyses were designed to answer the following questions:

1. What was the overall pattern of grades and grade change from grade 7 to grade 8?
2. Were there statistical findings regarding the grade change?
3. Was there any impact on the various special needs’ students discovered in the data?

It must be recognized that the data were ordinal in terms of grade data for grade 7 and 8. The data is considered ordinal as the metrics used to measure academic achievement are presented as letter grades of “B”, “C”, “D”, or “E”, as opposed to demonstrating grade values in terms of

percentage points. Additionally, the status of IEPs, 504 plans, and ESOL services is nominal data, as the grouping carries no quantifiable inequities or numerical delineations from one another.

For each of the three questions, the analyses are presented below with comments:

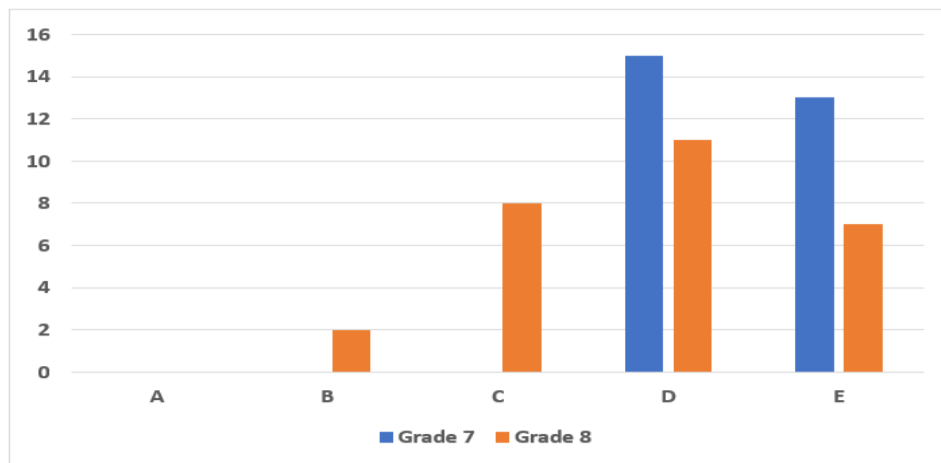
1. **Question 1:** What was the overall pattern of grades and grade change from grade 7 to grade 8?

Table 1
Distribution of Grades

	A	B	C	D	E
Grade 7	0	0	0	15	13
Grade 8	0	2	8	11	7

Chart 1

Bar Chart of the Grade Distribution



The pattern in Table 1 and Chart 1 indicate that change occurred from Grade 7 to Grade 8 in terms of the distribution of grades improving. There are fewer lower grades and more higher grades.

Question 2: Were there statistical findings regarding the grade change?

First, a chi square analysis of independence of the grade 7 data from the grade 8 data was performed and that analysis indicated that the data were independent. That is, the grade 8 data did not depend on the grade 7 data. This confirms the Table 1 and Chart 1 non-statistical analysis.

Question 3: Was there any impact on the various special needs' students discovered in the data?

Again, chi square analysis of independence of the grade 7 and grade 8 data by special needs was conducted and again the data showed that the data were independent and thus the intervention had an impact on the students. Since student scores improved the intervention was helping.

Data analysis indicated rejection of the null hypothesis.

CHAPTER V

DISCUSSION

The purpose of this study was to determine if participation in a Meaningful Water Educational Experience had an impact on academic achievement in a science course for struggling middle school students. Data analyses presented in Chapter IV indicated that the null hypothesis was rejected.

Implications of the Results

After further consideration, there were several implications of this study. Perhaps the most influential is the difference in overall academic achievement between the participants from 7th to 8th grade. Typically speaking, 8th grade students are more academically focused as impending high school placement becomes relevant. There are potential maturation implications to consider as well. In addition to the lapse of time in between control and treatment, the school underwent a dramatic change in administration. The administration for the participants during their 8th grade term was very transparent in their intention to retain students who did not demonstrate sufficient academic achievement. During the participant's 7th grade year, this message was noticeably absent. Finally, the research time frame is arguably incomplete. The grades achieved during the 7th grade year were the average of four quarters of grade recording. The data collected during the 8th grade year was the average of only two quarters of grade reporting, as this was the only data available at the time of the study. It is plausible that after four quarters of grade reporting, the data could skew in either a favorable or unfavorable direction.

Threats to Validity

All research studies suffer from threats to validity. In educational research, the validity threats are divided into threats to External Validity and Threats to Internal Validity. In this study external validity threats specifically involved the sample. Perhaps the most glaring threat is the selection bias of the students sampled. Participation in the Meaningful Watershed Educational Experience required a signed permission slip to attend. This implies that all student participants were voluntary and had a previous inclination toward attending the event, so the sampling was not totally random or indicative of the general population. Additionally, all the students involved were of the same grade level and started with similar baseline data in regard to academic achievement. Again, this threatens the ability to make generalized claims about the validity of the study.

Threats to internal validity involve those threats originating in the design of the study. In particular, the design of this study did not account for threats such as maturation or instrumentation. The participants in the study were evaluated on their academic achievement pre- and post-treatment. The lapse in time between the two assessments comprised the better part of a year, which can have especially dramatic impacts when the participants are adolescents. It is conceivable that increased academic achievement could be attributed to study participants merely maturing as students and taking their academic pursuits more seriously.

The instrumentation used in this study presents potential threats to the validity of the study. Students were measured on academic achievement from 7th grade to 8th grade. This implies that their academic achievement was measured by different evaluators and different content from one grade to the next. The argument could be made that an increased letter grade could be attributed to the participant's 8th grade teacher potentially implementing a more lenient grading policy or subject matter which is easier to master.

Connections to the Literature

The data suggests that participation in a Meaningful Watershed Educational Experience does positively impact student achievement in science classes. This is consistent with the findings in Chapter II. The literature suggests that a hands-on, off-campus outdoor educational experience will typically encourage student involvement in content-related endeavors. This is evident in Griset's article (2010) where students from a Maine high school were able to participate in longitudinal studies about the ecological impact of the timber industry on their ecosystem. Griset goes on to state a noticeable increase in academic effort among her students.

While the purpose of this research was focused solely on science classes, the literature reviewed for this study repeatedly suggested that an increase in academic achievement was evident across all content areas. During an interdisciplinary Meaningful Watershed Educational Experience in Mobile, Alabama, Allison et al., (2017) reported that their second grade students generated very comprehensive presentations about their local ecosystem. The authors made mention of how the students utilize skills they obtained through Language Arts and Social Studies in order to successfully generate their presentations.

Implications for Future Research

In the future, this study should cover a longer data collection window and more treatment opportunities. For example, merely following the students from 7th to 8th grade after only one Meaningful Watershed Educational Experience (MWEE) allows for too many threats to validity. Increasing the duration of study over the course of several years and after conducting several MWEEs should reduce the threats to validity. Additionally, focusing solely on achievement in science classes may be too narrow. If the focus were on academic progress in all classes, this could

provide greater insight into the overall impact of participation in a MWEE on a student's academic achievement. Additionally, participation in MWEEs has further implications beyond academic achievement; namely environmental stewardship and community involvement. The impact of participation in MWEEs on these factors could provide for worthwhile research.

Summary

The results of the research suggest that participation in asingular Meaningful Watershed Educational Experience will have a positive impact on academic achievement. Sixteen of the twenty-eight participants in the study demonstrated an increase in academic achievement in their science classes from 7th grade to 8th grade. Therefore, the null hypothesis was rejected. There are considerable implications and threats to validity in this study, however. The study does not account for a change of instructors and school administration. Additionally, the data recording windows for the pre-treatment and post-treatment time frames are not the same and the study does not account for the physical and mental maturation of the participants that occurred over the course of the study. That is not to say the study is without merit, but in an effort to decrease further implications and threats, future research would benefit from a more longitudinal nature with a longer testing window and multiple treatments.

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