THE EFFECT OF PLACE-BASED EDUCATION ON ACHIEVEMENT, ATTENDANCE, AND ENVIRONMENTAL ATTITUDES IN A HIGH SCHOOL ENVIRONMENTAL SCIENCE CLASSROOM

by

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DEDICATION

For Dr. Franklin “Herm” Fitz, who unveiled to me the many worlds of Earth.

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ABSTRACT

Placed-based education is the idea of using local contexts as a starting point for classroom learning. This study aims to evaluate a new program's effectiveness at increasing student attendance, attitudes towards the environment, and academic achievement through a place-based study of the environment. In an 11th grade environmental science class, ten students carried out year-long investigations at a 300-acre parcel of land set aside for conservation. The results indicated that the treatment improved student perception of school but did not increase actual attendance rates. Sixty percent of students in the treatment either met or exceeded the state standards as evaluated by the Oregon Assessment of Knowledge and Skills, and student views of the environment remained high throughout the treatment.

INTRODUCTION AND BACKGROUND

With no real cross-streets and only three small towns to speak of, residents of the McKenzie Valley rely on two simple prepositions when describing where they live: upriver or downriver. In my first year of teaching in the McKenzie School District four years ago, I mistakenly told a fellow teacher that I had to head upriver to get to "town" – another common colloquialism which refers to Eugene, Oregon, the second largest city in the state. Every local knows without a thought that Eugene is downriver, and to this day my now-retired former co-worker will laugh to tears at any mention of the direction the river flows.

This sense of place is imbued deeply in the people of the valley, and it is now being considered as one way to save our district, which is in a difficult financial spot. With a peak of around 500 students in the 1990s, our enrollment has dropped off to around 195 students in grades K-12 (Tompkins 2017). This is hardly a sustainable number, and our district in the last few years has resorted to cutting teaching positions. To raise enrollment and bring back some quality educational opportunities for our students, the administration proposed looking into the feasibility of transitioning to a charter school. During the 2015-2016 school year, a steering committee was formed of a group of administrators, teachers, and community members.

From these initial discussions came the idea of transitioning to a charter school with a "place-based" focus. As the sole district science teacher and a member of the steering committee and now charter board, I became intrigued by the power that approaching the curriculum with a place-based focus could have on student engagement

and achievement. With a locale as fascinating and unique as the McKenzie Valley, I began to think about how I could use local resources and interests to bring more value to my students' scientific education. From this came the idea for a place-based environmental science course which integrated fly fishing, a sport with lots of local significance, with field-based studies, which would help students develop their science process skills while also preparing them for careers in science.

The McKenzie River is the cord that binds our disparate district together, and with good reason. A biologist with the state called the McKenzie "the last stronghold for wild salmon" in the Willamette system, referring to the Spring Chinook which travel over 300 miles past our high school as juveniles, then again returning as adults to spawn in the headwaters (Whipple, 2007). Bull Trout reside in the main stem of the McKenzie and some of its many tributaries. The native strain of Rainbow Trout is locally known as a "Redside" due to its unusually bright and beautiful lateral stripe. This is a fish-filled river, of which conservationist and fly-fisher Roderick Haig-Brown once said, "Oregon's McKenzie is a perfect type of Pacific Northwest trout stream" (Wethern, 2001). It also serves as the sole drinking water source for the entire city of Eugene, population 157,000.

Fly fishing culture permeates the valley. The drift boat, now ubiquitous on all trout streams in the western United States, evolved on the McKenzie in the early 1900's and is still the chosen craft for fishing these waters (Fletcher, 2007). Every April, a wooden boat festival at a local lodge celebrates and showcases these boats from their earliest iterations to the more recent builds. Members of the McKenzie River Guides Association, founded in 1931, even claim that the idea of guided fishing trips began on

this river. Richard Brautigan, author of *Trout Fishing in America,* grew up fishing these waters, and Herbert Hoover repeatedly made trips down the river for its excellent fly fishing (Wethern, 2001).

The saying goes that the district is "forty miles long and a mile wide," though I think the width is inflated for poetry's sake, since most of the land behind the houses is either Bureau of Land Management or National Forest. There's no stoplight in our district, and really only one thoroughfare: Highway 126. Judging from just the multi-million-dollar homes that border the river, one would likely think our district is on solid financial ground, but the majority of our students are from impoverished households. We have a district-wide free-and-reduced lunch program which includes all students due to the district's high levels of need.

It hasn't always been this way, though, with wealthy retirees and a struggling working class. In the 1960s and 70s, while flood control dams were being built and timber production was at its height, our district enrollment peaked at around 500 students. Slowly, the dams were finished and the trees were felled, and the number of jobs dropped off (Tompkins 2017).

One major blow to the local economy was the enacting of the Northwest Forest Plan in 1994. During the late 1980's, a regional controversy surrounding the decline of spotted owl populations, followed by its listing as a threatened species under the Endangered Species Act in 1990, led to the Northwest Forest Plan, a 1994 federal policy that aimed to balance the protection of the spotted owl's critical habitat, old growth forest, with the economy and industry of the Pacific Northwest, which was heavily reliant

on timber sales. National forest timber sales hovered around 5 billion board feet during the 1980s, then plummeted down to under 1 billion board feet in 1994. The number has not risen above 1 billion since 1993, the last year before the Northwest Forest Plan. Figure 1 shows the amount of board feet cut and sold for these years.



Figure 1. Timber harvest and sales from National Forest land in Oregon (Charnley & Donoghue 2007).

The final factor that drove the working-class population towards town, according to lifetime resident and K-12 principal Lane Tompkins, came with the rising gas prices in the early 2000s. Many who were commuting into Eugene could not afford the added expense. Due to declining enrollment and budget shortfalls, five teaching positions were cut in the spring of 2016, leaving only one teacher to teach each subject grade 7-12, and two grade levels blended for each elementary teacher.

Currently, there is a shortage of employment opportunities in the valley. Thirty-three percent of the families in this area have no one earning. In the United States, this same value is 16%, while in Oregon it is 19%. Only 51% of the population over the age of 16 in the McKenzie valley participates in the workforce, compared to 42% in Oakridge (a similar small rural Oregon town), 62% in Oregon overall, and 64% in the United States (U.S. Census Bureau, 2017).

Compounding this issue in our area is a lack of affordable housing. According to the 2017 American Community Survey, the median home value for the McKenzie River Census County Division (CCD) is $332,000. The same value for the state of Oregon is $247,200. The median home value for the McKenzie valley is nearly double that of the value for the United States, which is $184,700. Another way to look at this is as home cost expressed as a percentage of median earnings. For the United States as a whole, the value of a house is 411% of the median income. Oregon sits higher, with the percentage at 557%, and the McKenzie River specifically has a value of 656%. Oakridge, another small rural Oregon town with similar median income and population size, has a value of only 234% (U.S. Census Bureau, 2017). This deficit of affordable housing limits tends to favor retirees and limits the number of working families moving into the district.

Related to both job scarcity and high cost of housing, many students in our district are considered homeless. For one sense of comparison, 3.90% of Oregon's total enrollment were classified as homeless in 2016-2017. McKenzie's percentage for the same year is 18.82%, which is the fifth highest in the state (Joy, 2018). Homelessness as defined under McKinney-Vento includes a number of transitional states of housing, like

living in a mobile home in the forest, staying with extended family members, living in cars, or living in substandard housing.

In 2016-17, I had the opportunity to teach a middle school elective called "Outdoor Skills," during which I was able to borrow some fly rods from the Oregon Department of Fish and Wildlife (ODFW) and teach some casting basics and fly tying. The kids took to it like the proverbial fish to water, and I realized that by using fly fishing as a focus for my high school environmental science class, I might be able to incorporate ecological concepts into a hands-on, applicable skill set that would hopefully not only give them tangible reasons for caring for our watershed, but also introduce them to a lifelong pastime and local cultural thread.

Meanwhile, I happened to learn about a little middle school in the city of Salem, Oregon, whose eighth graders were performing original field research and turning out near-undergraduate quality research papers modeled after peer-reviewed journal publications. Mike Weddle, co-founder and director of Jane Goodall Environmental Middle School (JGEMS), a small charter school in Salem, Oregon, received a grant from the state to disseminate effective educational practices, and he introduced me to the project. Essentially, students form into groups focused on specific research questions, read the related literature, design a study to carry out, and go out multiple times throughout the year to collect data. They then individually write a paper and give a presentation to a board of experts in the field.

When I attended their presentations, I saw a group of 8th graders speaking comfortably and confidently about the effects of climate change and wildfires on pika

populations; another detailing a search for white-nose fungus in Ape Caves, near Mt. St. Helens; one sharing on the behaviors of captive elephants that indicate stress; and one that compared stream health of a restored creek and an unrestored creek.

First, students would share their research, then take questions from a panel of experts. When I attended, experts included a fisheries biologist from ODFW, a Salem School Board representative, the deputy conservation manager for the Oregon Zoo, and a representative from Portland State University. The questions came from mindsets of genuine interest and scientific rigor, and students generally were able to think on their feet and answer clearly and with ample scientific grounding.

In the spring of 2017, Mike Weddle convinced me to try a condensed version of this project with my Environmental Science class where students investigated invasive species. My students and I went through the entire process in one quarter, using materials from JGEMS and a plot of forest on our school property that was covered with invasive English Ivy. Students designed questions, collected data, wrote papers, and presented to a panel. Most student papers came out OK, with an average of about six pages, but one student really dove in and wrote a nearly professional scientific paper with a length of 20 pages.

In March of 2016, A local land trust group, the McKenzie River Trust (MRT), purchased 278 acres of riverside land just a half mile down the road from our school known as the Finn Rock Reach (FRR), which used to belong to a logging company. The property is an important conservation plot in our region. It encompasses important spawning grounds for upper Willamette spring Chinook salmon, which were listed as a

threatened evolutionarily significant unit under the Endangered Species Act in 1999. The section of river surrounded by the property is foraging ground for Willamette Bull Trout, which were listed as threatened in 1998. Three of the five populations of Willamette Bull Trout have gone extinct, and the strongest current population, limited as it is, lives in the McKenzie (Oregon Department of Fish and Wildlife, 2005). The property is also habitat to other species of importance to the ecosystem and of conservation concern, including the western pond turtle and the yellow-breasted chat. Through talks with MRT in spring of 2017, I was given permission to use the land as a "living laboratory" and as a place to carry out field research with my students.

Environmental science is an elective science course, and as such has unofficially been relegated in our district to students who choose not to take physics or chemistry, a choice usually due to the classes' rigor. With the administrative push towards Place-Based Education (PBE), a prime location to do ecological research, and a synchronicity of professional support opportunities, I began to redesign my Environmental Science class to be focused around three threads: the skills of fly fishing, the basic concepts of ecology, and the field research paper.

I began to wonder, if students were given a unifying skill set that would benefit them regardless of their interest in science, would it increase their motivation to learn the science concepts alongside the fly fishing concepts? Could an intentional local angle even increase student attendance? All of this led to my focus question: What effect does place-based education have on the achievement, attendance, and environmental attitudes of environmental science students?

CONCEPTUAL FRAMEWORK

In order to properly design and assess the implementation of place-based unit, it is important to have a clear understanding of what makes a particular unit of study place-based. The historical context that gave rise to PBE also illuminates some of the reasoning behind this particular school of thought's emergence and can shed light on why it makes sense to use as a pedagogical lens in my current teaching assignment. A review of the current literature regarding PBE does generally show a positive impact on the areas of focus of this study (namely attendance, achievement, and motivation), and a summary of these findings is included below.

Defining Place-Based Education

For the purposes of this study, I will be using the definition of PBE provided in David Sobel's 2013 book "Place-Based Education: Connecting classrooms and communities:"

> Place-based education is the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science and other subjects across the curriculum. Emphasizing hands-on, real-world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens (p. 11).

Place-based education is focused on local investigations which are perceived as relevant and important to students within the context of their daily lives. Curriculum design is structured intentionally around student-led inquiry projects. The focus is on how students connect to their local environment instead of being centered on what students do and do not know of an external canon (Demarest, 2015). For example, instead of

checking what erosional principles students should know, a place-based unit might take students into the field to a farm where erosional processes have a real impact on the land and the people. Through observation and guided inquiry, students would develop investigations to learn more about these processes in a contextualized situation. The subtitle of Demarest's book summarizes the intent of place-based education well: "exceeding standards through local investigations."

A major emphasis in PBE is student autonomy and genuine inquiry. This idea pairs well with the principles for science education which underlie the 2012 *Framework for K-12 Science Education*. The first is that "Children are born investigators," which emphasizes that inquiry is a natural and unavoidable state of experiencing the world. This document also outlines the importance of treating science as both a body of knowledge and a series of practices, which are necessarily based on inquiry. Place-based education emphasizes the importance of inquiry by foregrounding it as a central tenet of curriculum design. Units are centered around local investigations, not necessarily content strands (Demarest, 2015).

A list of 18 qualities and characteristics of place-based education was developed to determine exactly how place-based a particular school's practices were listed in Johnson, Duffin, and Murphy's 2012 paper on place-based learning and environmental quality. This list, included here as figure 1 as a part of the definition of modern place-based education, is also included later in this paper in student survey form as a measurement to evaluate how place-based the treatment unit was.

Table 1
Characteristics of Place-Based Education (Johnson, Duffin, &Murphy, 2012)

Program was personally relevant to learners	Tailored to individual learning styles
Program was experiential or hands-on	Promoted attachment to local place and/or community
Promoted understanding on larger scale	Included a service learning component
Used the local environment as context for learning	Included structured reflection by students
Students worked individually and in groups	Utilized existing or created new local partnerships
Program was project-based	Fostered collaboration with local community
Supported by school/organization leadership	Program was driven by students
Contributed to authentic community needs	Supported by local community
Content was interdisciplinary	Program was initiated by students

History of Place-Based Education

Modern place-based education started with the work of John Dewey. In a series of lectures, published as *The School and Society*, he makes the assertion that education should be "made a genuine form of active community life, instead of a place set apart in which to learn lessons." He highlights the trend of incorporating manual labor skills into schooling but notes that it is taught without a social context and is not genuine application. Instead of training students to be sewing automatons, he suggests that students should go to farms, shear sheep, card the wool, make the yarn, and make a product. Through this, he suggests that students can be led to learn about plants, animals, means of production, economy, math, problem-solving, and a host of other ideas. (Dewey, 1899).

In the 1970s, Eliot Wigginton echoed Dewey and enlisted his struggling high school English students to go out into their community, interview locals, and compile their interviews into an ethnography documenting local Appalachian folklore, skills, and

customs. This work was published in 1972 as the popular *Foxfire,* the first of a fourteen-book series. In the introduction, he explains his journey of throwing aside the textbooks to start a magazine based on local folklore on a whim. His students went from disengaged, even antagonistic, to enthusiastic co-creators of an authentic project based on the people they were surrounded by. Through conducting, writing, editing, and publishing interviews with local people, students were engaged in work which was both valuable for the community and a real way that they could improve their English skills. (Wigginton, 1972). The efforts to teach using local culture as a cornerstone did not stop with Wigginton but continued on to some extent as a pedagogical strategy through the "Foxfire Approach to Teaching and Learning," whose eleven principles stem out of John Dewey's work and presage PBE (Starnes, 1999).

PBE's Effect on Achievement

Place-based education efforts have documented success in improving both academic and behavioral goals. A collaboration of education groups from twelve states called the State Education and Environment Roundtable (SEER) looked at schools practicing PBE (referred to in the study as "Environment as an Integrating Context," or EIC). Fourteen of the schools, which represent different states, gathered information on their standardized tests. In these fourteen schools, 39 standardized tests were administered, and on 92% of those tests, students involved with PBE scored better than their non-treatment cohort. Teachers in the study reported that students' gains were not only on content, but also on applying scientific concepts to new processes (Liberman & Hoody, 1998).

The school which most heavily influenced the design of my treatment unit, Jane Goodall Environmental Middle School (JGEMS) in Salem, Oregon, released data from their students' Oregon Assessment of Knowledge and Skills (OAKS) tests. This is the state test of science in Oregon, and is administered in the 5th grade, 8th grade, and 11th grade years. They released information for their cohorts as compared to students who applied to the charter but were not selected. The two groups are similar in the fifth grade year, which is before the students have attended JGEMS, but scores in the JGEMS group are higher on average than the control in eighth grade, after attending JGEMS for three years. Figure 2 shows the groups' scores both before and after their involvement with JGEMS. This data also suggested improvements in reading and math test scores ("Retired teacher shares why JGEMS students outperform," 2014).

A 2012 study by Brian T. Gatreau and Ian C. Binns studied the effect of place-based inquiry by looking at three paired Biology I classes during an ecology unit. Two of the classes emphasized place-based inquiry projects, while one was taught in a traditional manner that showed no special focus on place. The intent of the study was to determine whether PBE had an impact on state test scores. They were not able to demonstrate a significant different between the two groups' test scores. While this does not show an advantage to PBE, it does suggest that PBE can be as effective as a traditional approach in content acquisition.

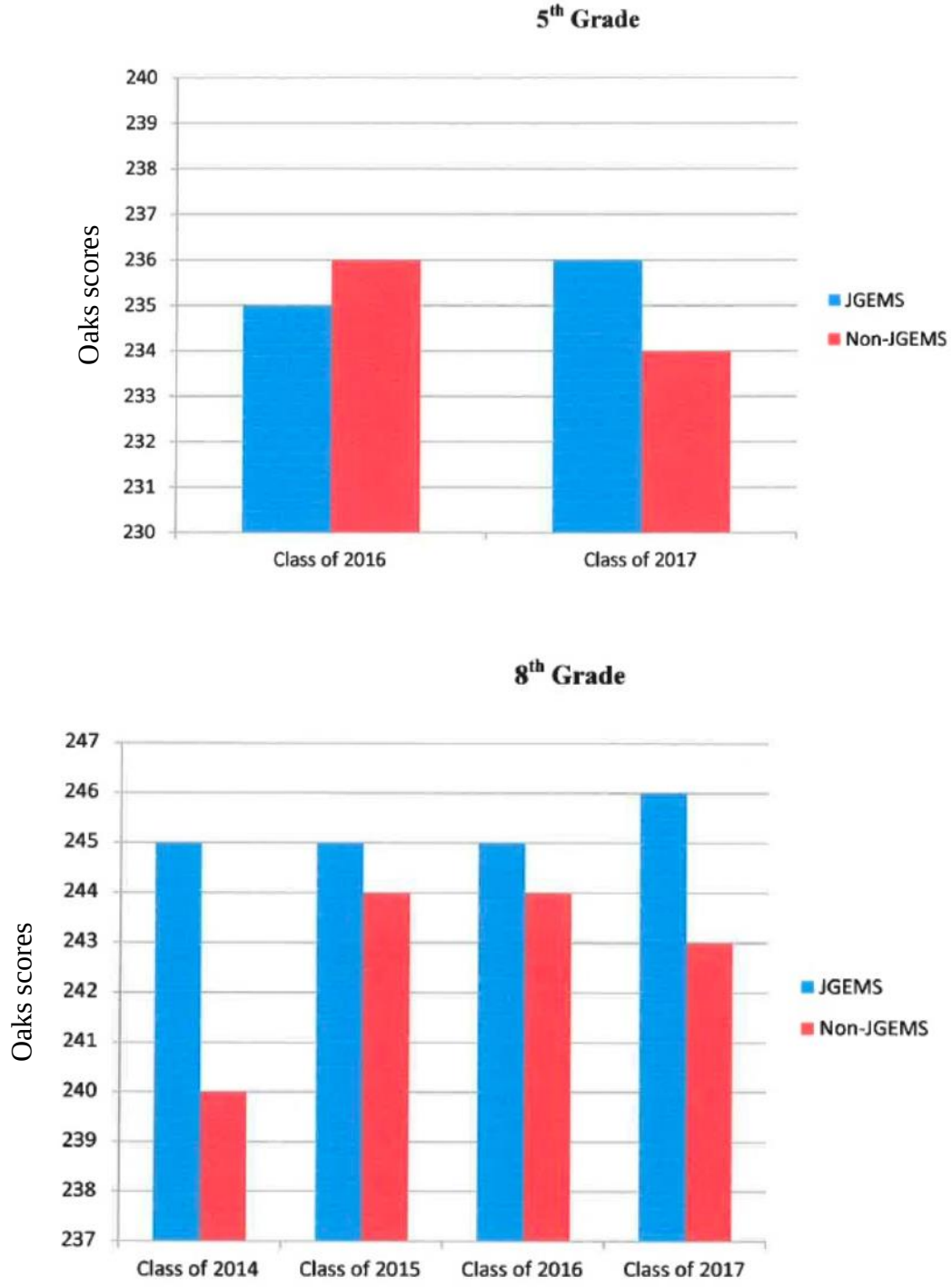

Figure 2. JGEMS science OAKS results (sample size (*N*) was not reported).

PBE's Effect on Attendance

Attendance is a crucial factor in student success and has been linked to student achievement. A 2007 study by the Consortium on Chicago School Research at the University of Chicago found that course attendance was a reliable indicator of course success, and that "attendance is the strongest predictor of overall grades" (Allensworth & Easton, 2007, p. 18). This report does not make an attempt to determine whether this is a causal relationship or not; both the possibility that low attendance affects GPA and that poor performance encourages absenteeism are considered. This same report investigated factors influencing student attendance. The most important two factors uncovered by a survey of students and teachers were students' view of high school's relevance to their futures and student-teacher relationships (Allensworth & Easton, 2007).

In the report "Closing the Achievement Gap," which investigated the impact of PBE (which they called "Environment as an Integrating Context" programs), the State Education and Environment Roundtable reported attendance and behavior data for four cohorts, each of which showed an increase in attendance rates when compared to students in traditional programs. Little Falls High, one of the focus schools, reported a 2.4% higher rate of attendance for students in their 9th grade "Environment as an Integrating Context" program. The 9th graders at Tahoma High showed a 1.5% higher rate. The 10th graders at this school showed a 1% increase. These first three cohorts were only tracked for one year, but the final reporting school, Valley High, looked at student attendance for two years and showed an 11% increase (Liberman & Hoody, 1998).

PBE's Effect on Interest

Student interest in a subject is important for student achievement. If a student is interested in a topic, that student will be more likely to work hard and spend more time engaged in a specific task. A 2009 review of literature related to interest and achievement states that knowledge, positive emotion, and personal value are three key components of developing interest (Harackiewicz & Hulleman, 2010).

The importance of interest is also emphasized in The *Framework for K-12 Science Education,* which states as an underlying principle the need to connect with students' "interests and experiences." They assert that increasing students' engagement with science could be tied to impact not only on students' high school achievement, but also on career choice or paths of study after high school. The aim of place-based curriculum design is to center the unit specifically around questions which are developed by the student and are inherently interesting to them. Student questions and background knowledge are not seen as a body of prior knowledge to be corrected or built upon, but as a "foundation of learning" (Demarest, 2015).

METHODOLOGY

Treatment

The main research question of this study was "What effect does place-based education (PBE) have on the interest and achievement of Environmental Science students?" This broad question led to several sub questions, which are as follows:

- Does a place-based approach to Environmental Science improve students' attendance?

- Do students perform better on state tests after implementing an intensive research project?
- Does PBE increase student ownership of their environment and interest in environmental issues?

Environmental science is only offered one period per day. To enable field-based experiences, the administrators allowed a cap of 14 students for this course. The course began with 14 students, but due to one student moving from the district, one student transferring into a math course he required for graduation, one student's acceptance into an accelerated nursing program at another high school, and one student beginning homeschooling, the course enrollment at the end of the study was only ten.

The course was designed to be focused on a central place-based project in which students developed their own research questions and designed data collection procedures to answer their own questions. Because of this, the methods of data collection are more descriptive than comparative; the intent of this study is not to claim whether or not place-based education is more effective at its goals than other methods, but simply to evaluate a program's success. Since increasing classes with a place-based approach is encouraged by the administration at McKenzie, this study mostly sought to find out whether or not place-based methods could foster positive academic achievement, attendance, and student interest. As detailed in the following section, attempts were made to compare data to a non-place-based class and to other students in the school who were not participating in the class, but not much emphasis is placed on these comparisons due to small sample size.

Instead of organizing the course with a rigid, content-based progression as I tend to do for my other non-PBE courses (for instance, biology), the entire design of this course was centered around student-led research projects. For the first quarter, we focused on the basic principles of ecology, then transitioned directly to project work. In early September, students read textbook sections introducing ecological concepts, then made visits to the Finn Rock Reach property to observe and experience them first-hand. In October and November, we finished up our initial content-driven studies and transitioned to a focus on the group projects.

Students selected others that they would like to work with and divided themselves up into three groups. The first step in their investigations was to compile a list of interesting factors about the FRR and generate researchable questions. After considering many possible angles through repeated field visits, a workshopping session led by Mike Weddle of JGEMS, and some basic preliminary research, the three groups defined their focuses.

One group, inspired by a study they discovered that connected Coho salmon mortality to heavy metal pollution from roadway runoff (Le, 2014), decided to investigate the levels of metals found in roadside sediment at a stretch of road next to a stop sign compared to a stretch of road along a straightaway to see if the application of brakes led to an increase in the concentration of metals.

Another group became interested in biodiversity and mosses as a micro-habitat and decided to investigate if there was a measurable difference in the biodiversity of organisms living in mosses when comparing samples taken at the FRR from a young

replanted forest, some house sites that were razed and not replanted in the 1980s, and an old-growth forest stand.

The final group became interested in soil health and how it might differ between the young forest, house sites, and old forest.

Once students generated an initial question of interest, they began to delve more deeply into researching both the general ecological principles that related to their topics and the specific studies which were similar to theirs. Many class periods at this point were structured open inquiry sessions, in which students had defined their interests and were searching for information to help them better understand the issues at hand. During this time, students wrote the first draft of their introductions, which would serve as the main context for their research papers. The months of November and December 2017 were focused on background research.

In January and February, students developed their methodologies. We also completed an abridged field study as a class to introduce students to data collection methods.

In March through April, we focused almost exclusively on data collection. May and June were focused on data analysis, writing the paper, and preparing for the final presentations.

Presentations occurred on June 4, from 5:30 to 7:00pm and served as the course final. Student presentations were slated to be 15-20 minutes long, followed up by 10-15 minutes of questioning by the panelists. This year, four local organizations agreed to serve as panelists. The panelists this year included Mark Shultze, the executive director

of the H.J. Andrews Experimental Forest; Joe Moll, the executive director of the McKenzie River Trust; Mike Weddle, a member of the board of directors at Jane Goodall Environmental Middle School; and Justin Demeter, the education coordinator for the McKenzie Watershed Council. In addition to this panel, the presentations were open to the public and school staff, students, and the general public were encouraged to attend.

Data Collection

Most of the data used for this study was collected between October and April of 2017. Some of the data collected was from years past, specifically historical attendance data and previous years' 11th grade OAKS standardized science test. In all of the assessment methods I strove to find a balance between quantitative and qualitative data, but the balance absolutely swung towards qualitative data. I emphasized student and teacher voice as primary form of feedback and used the numerical data as a second angle to understand the students' perceptions.

Attendance

Three instruments were used to measure the treatment's effect on student attendance. I gathered raw attendance data for this cohort for the first three quarters of the year for both 2016-2017 and 2017-2018. These data were compiled and presented as a stacked column chart to see if there was any improvement in students' attendance in the current year as compared to the year previous.

A survey with Likert response items, included below as Appendix B, was used to gauge students' own perception of their school attendance and their reasons for attending

school. This survey was first administered on October 30, 2017 before the treatment had started. It was again administered during the week of April 23, 2018, before the students completed the treatment unit and as the most high-stress section of student research was under way. The means were compared to see how much student thought changed over the course of the treatment. The first section of the survey focuses on getting students' own perceptions of their attendance trends and their reasons for attending (or not attending) school. With a response of 1 being strongly disagree and a response of 5 being strongly agree, a response of 3 would indicate neither positive nor negative. The second section of the survey focuses on specific courses' impact on their willingness to attend school.

Finally, an interview was conducted with each student during the treatment unit. Every student who was present for the entire treatment unit was included in the interview sessions. The interview was designed to collect information on each sub question, but the questions pertaining specifically to gather information about student self-perception of attendance were, "How has your attendance been so far this year? How would you compare it to last year?" and the follow-up, "If different than last year, what might be some reasons?" This interview is included as Appendix C. The interview was transcribed using the online service Temi, which automatically transcribes audio recordings, then was corrected and proofread manually.

Academic Achievement

Three separate measures were also used to evaluate the impact of the treatment on student's academic performance. Firstly, student scores on Oregon's state science test, the Oregon Assessment of Knowledge and Skills (OAKS), were compared to last year's

scores. All students took the test, which is only administered in the students' 11th grade year. The data was recorded as a raw score and categorized as either "Does not meet," "Meets," or "Exceeds" as classified by the Oregon Department of Education. This information is reported in Appendix D as a set of detailed scores for individual students, along with a document showing class averages for the last five years. These data were analyzed two separate ways. First, the percentage of students who met the state standards was considered all by itself, because an important factor is whether or not this approach (along with their previous science classes) enables students to meet the state standards. Secondly, this year's average, along with the averages of the last few years, was plotted on a graph to show the class's performance as a whole in context of our district's recent history.

In conjunction with the state test, students wrote reflection pieces that asked them to consider what influenced their performance on the test. They wrote these after school as an optional assignment. While the numbers provided by the state test gave an indication of objective student performance, by themselves they could not tell the full story. The reflective feedback that students generated provides some of the interior thought processes associated with the scores, which was helpful in interpreting the things that influenced their performance on the test.

The students' transcripts were also collected. These were used to look at students' historic science performance as semester grade letters and to see how their grades in this years' class corresponds to their science grades from the last three years.

Environmental Interest

In order to measure the treatment's effect on student interest about and care for the environment, three data sets were collected. An abridged version of "The Environmental Attitudes Inventory" developed by Milfont and Duckitt (2010) as a "valid and reliable" way to measure different aspects of people's deeply-held environmental views was administered once before the treatment had begun, and once toward the end of the treatment unit. These values were then compared visually to establish the difference between students' environmental attitudes before and after the treatment.

The aforementioned student interviews, which were conducted throughout the course and included as Appendix C, contained several specific questions designed to elicit students' out-of-class attitudes towards the environment. Those questions specifically were:

- "Have you found yourself thinking about the environment outside of class hours? If so, please share a specific instance. Follow-ups: is this usual for you?"
- "Think about the readings we've done so far this year. Which was your favorite and why?"
- "Describe your relationship with fly fishing."

Student responses were transcribed and categorized into three categories: "Negative," "neutral," and "positive." These responses will be used to shed further light on the student attitudes gathered in the Environmental Attitudes Inventory.

The final measure of student environmental interest was a running audio journal in which I, as the teacher and researcher, recorded thoughts and observations during the car ride to or from school. This effort was an attempt to capture subjective thoughts and

views of how the course was going, and what moods and responses I encountered from these students that wouldn't be captured in other more structured data sources. These were not scheduled recordings, but recordings that I deemed important — usually recorded once a week on a specific day of significance, whether positive or negative. These recordings were transcribed and again categorized into three categories: "Negative," "neutral," and "positive." Arbitrary observations were not categorized.

Table 2
Summary of Data Collection Techniques

Data source	Questions		
	Does a place-based approach to environmental science improve students' attendance?	Do students perform better after implementing an intensive research project?	Does PBE increase student ownership of their environment and interest in environmental issues?
Attendance survey	X		
Attitude survey			X
Student interview	X	X	X
Teacher journal		X	X
OAKS scores		X	
Attendance data	X		
Focused reflection	X	X	X

DATA AND ANALYSIS

The first data to consider are the students' evaluations of the course based on the characteristics of place-based education found in Johnson, Duffin, and Murphy's 2012 paper. The specific survey, designed as a Likert scale evaluation, is included as Appendix C, and the data are summarized below in Figure 3. This survey was administered on April 26, and only eight of the ten remaining students participated. One hundred percent of

students either agreed or strongly agreed that the course was centered around a project, focused on both group and individual work, included structured reflection, and was locally-based. Eighty-eight percent of students also affirmed that the course promoted their understanding of concepts on a larger scale. Two areas which stand out as the lowest affirmed were administration support and personal relevance, with only 50% and 37.5% respectively either agreeing or strongly agreeing.

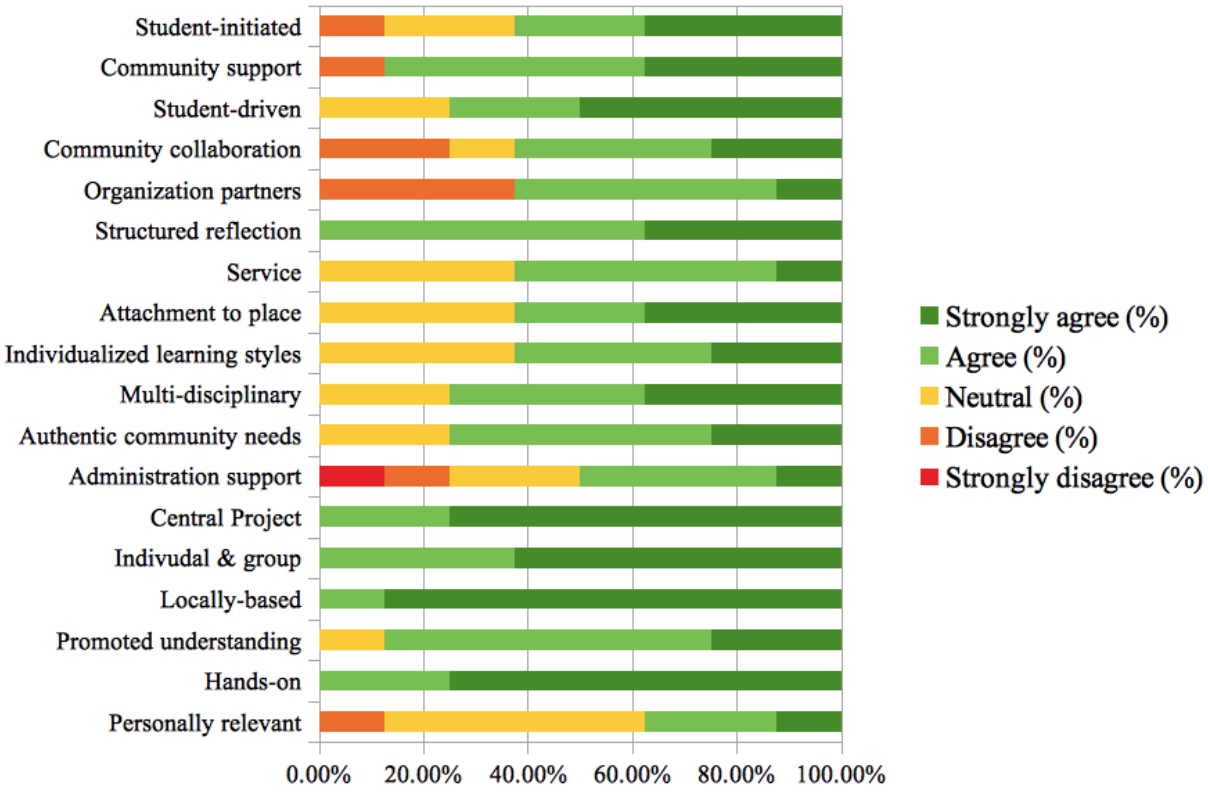

Figure 3. Student perception of course's place-based characteristics after six months of working on their projects, (*N*=8).

Students were very positive about the non-traditional aspects of class. When asked simply to describe their experience in environmental science class, 91% of students responded with strongly positive impressions. One student described the projects without

using any evaluative language, which would be considered a neutral response. To isolate out the impact of this treatment specifically, I also asked them to compare their experience in environmental science to their experience in 2016-2017 in biology, which I also taught, which has similar content, and which had more or less the same students. Ninety-one percent of students identified environmental science as being a more valuable class, while one student gave a non-evaluative response that highlighted the use of entry tasks in environmental science. Of the students responding positively, 70% specifically mentioned appreciation of the hands-on, application, or real-world angles. Eighty percent of the students reported "learning more."

Student attendance was compared for the first three quarters of the years 2016-2017 and 2017-2018. Since there were only two students in the junior class who were not a part of the treatment group, the change in attendance data for the treatment group was compared to the entire high school population as a whole. The students in the treatment group for whom complete data was available (N=10) was compared to all of the non-treatment students in the school for whom data was available, grades 10-12 (N=27). Both groups reported a 1% increase in absences from 2016-2017 to 2017-2018, which suggests no significant impact, either positive or negative, of the treatment on attendance rates.

The students' perceptions of their attendance did seem to suggest that the treatment had an effect on their willingness to attend school, even if it did not actually statistically translate into more seat time as compared to the non-treatment cohort. In the student interviews conducted throughout the treatment, five out of 11 students responded that environmental science class specifically either had an impact on their decisions to

attend school or make them more willing to. Two students, whose attendance was worse in 2017-2018 than in 2016-2017, and who reported perceiving it as such, reported struggling with personal problems or illness that were unrelated to school and mentioned a desire to attend more. One student during the course of the interviews voiced the impact she saw in her willingness to attend school as, “If I slept in, I like, made sure that I got here for, like, environmental science because I like really enjoy it. And so, it's like, it's a class that more people are like, yeah, like I said, they do complain but it's a class that they want to show up to. It's like, okay, well we're going to get to go outside or we're gonna do some sort of like fly fishing type thing.”

The initial survey results for student views of their own attendance also showed a positive outlook. Students ranked each option in regards to how it influenced their desires to attend school with a value of 5 being “Strongly positive,” 3 as “neutral,” and 1 as “Strongly negative,” Non-treatment classes, namely English, math, and social studies, showed means of 3.0, 1.9, and 4.0 respectively. Environmental science showed a mean of 4.5, indicating that it had more positive responses. Place-specific activities showed higher means. Visiting the Finn Rock Reach had a mean of 4.9, while planning and carrying out field research had a mean of 4.0. Fly casting practice had a mean of 4.9 and tying flies had a mean of 3.7. One question in the survey tried to isolate out specifically the impact of a place-based approach by asking about how reading about ecology in Oregon would influence their motivation to attend and how reading about ecology in Connecticut would influence their desire to attend. Oregon readings received a mean of 3.5, while Connecticut received a mean of 2.45. The higher values for treatment items in the survey

suggest that when compared to other classes, a place-based environmental science course more positively influences students' desires to attend, and a place-based activity as compared to a non-local activity holds the upper hand in student motivation. Students took the same survey on April 30, and all means decreased except for three: English class, textbook reading, and tying flies, suggesting attitudes remained fairly constant throughout the year. No mean changed by more than .6.

Student attitudes towards the class and towards the environment tended to be positive. The survey based on Milfont and Duckitt's Environmental Attitudes Survey showed some marginal growth in several topics but did not indicate a large shift in student attitudes towards the environment. The percentage of students who indicated a positive or strongly positive view of the environment in each category increased in each category except for "Enjoyment of Nature" and "Ecocentric concern." The largest positive shift in attitude was in a shift towards support for encouragement of population growth policies, followed by support for interventionist policy, then by anthropocentric conservation values. The change from pre- to post-survey responses are shown below in

Figure 4.

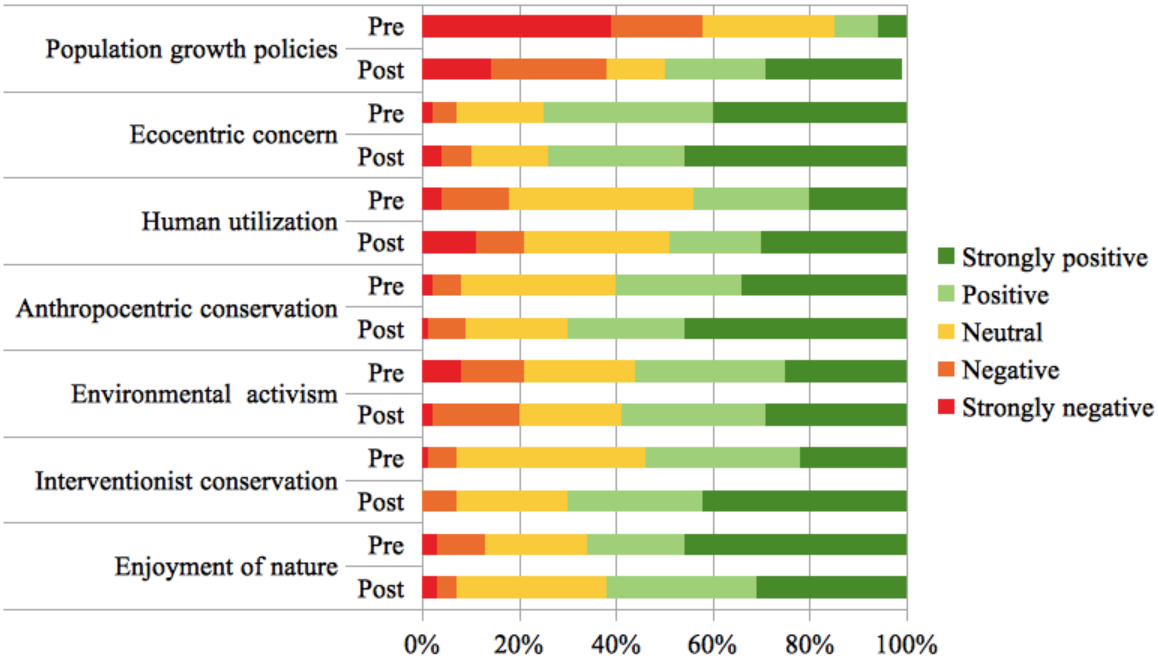

Figure 4. Pre- and post-test values for environmental attitude survey (*N*=12 for pre and *N*=10 for post)

Another measure of student attitude toward their particular environment was a transcription and categorization of student interviews. Of all 11 interviews, which included one student who transferred schools during the course of the treatment, 82% indicated that they thought about the environment outside of class. Two students gave specific examples of considering environmental relationships in their daily lives, while the remaining seven mentioned a generic consideration for the environment, which was most commonly picking up litter, recycling more, or using less water.

The last measure of student attitude towards the environment and environmental studies was the teacher journal. Of six capstone journal recordings, all included both positive and negative views of student attitudes. Of these, three were recorded on days

which the net student attitude seemed negative, and three were recorded on days when student attitudes seemed positive.

Student achievement was measured by three metrics: performance on the state science test (OAKS), GPA, and the teacher journal. The first two measures captured academic performance while the third focused more on science process skills.

Of the ten students who participated in the treatment unit throughout the year, 60% met or exceeded the state standards on the Oregon Assessment of Knowledge and Skills (OAKS). Thirty percent of the students in the treatment group are on IEPs. Fifty percent of the students who did not participate in the class but took the test this year met or exceeded standards (*N*=4). Figure 5 compares these data to the years from 2011 to 2018.

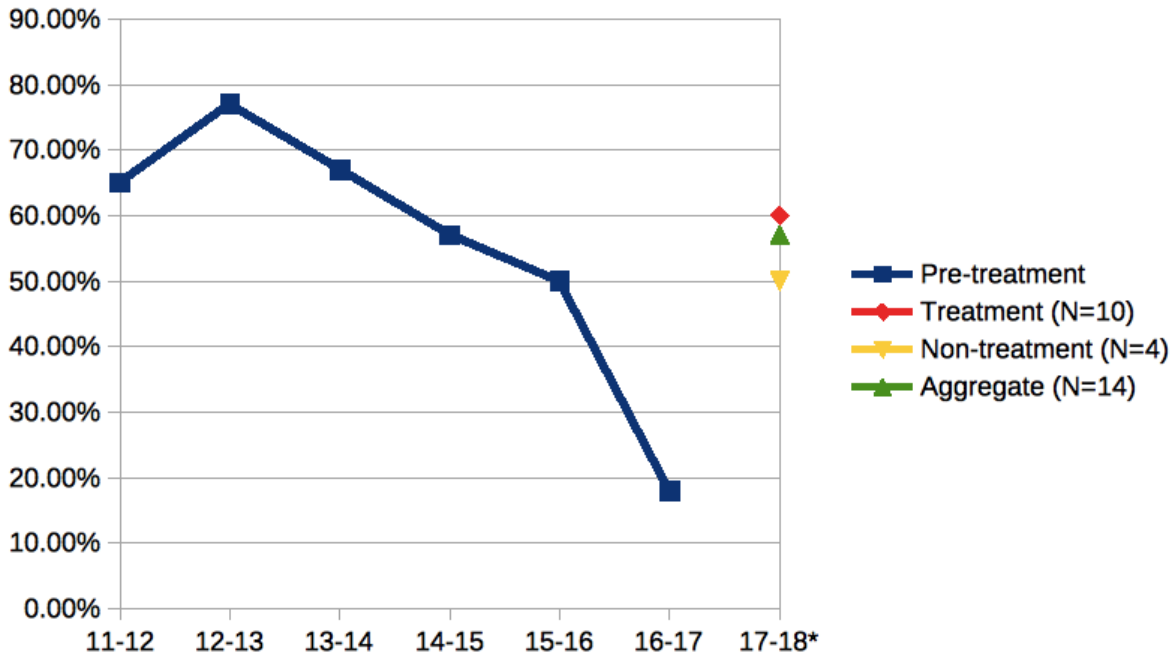

Figure 5. Percentage of students who met or exceeded on the standardized OAKS 11th grade science test across years from 2011 to 2018.

INTERPRETATION AND CONCLUSION

Discussion

In summary, this study seemed to suggest that students who participated in a year-long place-based study showed increased desire to attend school, acceptable academic performance, and a strong interest in the environment.

The original intent of this study was to determine what effect place-based education has on student attendance, motivation, and achievement. Through analysis of various quantitative and qualitative measures, it seems that some tentative conclusions can be reached about PBE's successes and shortcomings in this particular context. While the attendance numbers did not show a quantitative improvement in student attendance, interview and survey data suggested that students willingness to attend school, a potential underlying factor influencing attendance, was increased. Student attitudes towards the environment grew marginally. Student achievement seemed to improve when compared to historic values.

From the attendance survey, it became clear that students were initially excited and very positive about the potential to have a course which included both outdoor-based field projects and fly-fishing techniques and skills. Over the course of the year, this enthusiasm decreased no more than other courses, and remained as a high motivator for attending school. During the first year, this did not translate into much changed student behavior, although there was one instance of a student coming in on a day she had considered skipping. Interest could help students attend more if skipping is the problem,

but in the survey, most students claimed that missing school is not a choice that they willingly make.

Environmental attitudes began fairly strong: students in this rural district seem to have a high appreciation for nature from the beginning. One major positive shift in class perception was on population growth policies. At the beginning, students were strongly opposed to statements such as “We should strive for the goal of ‘zero population growth.’” Through designing investigations centered around a local restoration area, students directly investigated human impact on the land and water. From this starting point, we were able to have discussions about human impacts on the environment and to look at what effects population growth can have on the environment. One interesting thing to note is that all categories showed an increase in positive perception except for “Enjoyment of Nature” and “Ecocentric concern.” Enjoyment of nature may have decreased because the reality of meticulously collecting data might have changed the way students view our class trips.

Textbook reading showed a slight positive increase in perception, and while it could have been arbitrary it is interesting to note that the view of textbooks increased while most other academic courses decreased. This might have something to do with the way textbooks were used in the class. Instead of jumping from topic to topic, we only used textbook readings to get basic information about a topic that came up during our studies. For example, the soil group decided that they were interested in studying soil health, but when they started to define exactly what they were interested, they realized that they couldn’t get much further until they had a basic understanding of soil. We then

took a look at the soil chapter from an environmental science textbook to get some background data. Because the textbook was approached as needed, when I asked students to compare the way they approached a textbook in this class to the way they have in the past, one student reported, that they had “a way to apply that to what we're doing outside, which is like, usually you're just reading the book to read the book because of the teacher tells you to you. This is applying directly to what we're doing.” Another student’s group had a large section which pertained to their studies, and they chose to approach it differently: “There was a lot to read so we just split it all up and which I think was really beneficial. And then also I was like, okay, like I have to do this section of this reading and I need to do it for my group. So, I kind of like was more motivated because I had, like, a purpose to be doing it.”

Throughout the year, students also read technical science writing. The group which was studying macro invertebrates living in mosses found a very jargon-heavy, detailed writing for specialists on bryophyte ecology. I read through the source, and because of the level of vocabulary, I had to read it with my phone at the ready to look up words. Some of the words were so domain-specific that when googled, the only result that came up was the article we were reading. Two students identified this as their favorite reading; it wasn’t assigned or required, and certainly wasn’t easy, but it gave kids a chance to wrestle with authentically important texts and gave them motivation to persevere. One student reported, “I just like reading about moss. It was, it was very interesting and weird.” When asked about the difficulty of the reading, and whether or not that played any role in the reading, this student reported having dyslexia and that it

was even more difficult to read for that reason. I asked how long the student spent reading it, and the student replied, “Probably more than five hours. Because I was reading it at home, in my spare time. Because I was bored.” When asked why the student chose to read about invertebrate moss habitat instead of any of the other entertainment options at home, this student said “Because it was interesting to me. That's probably why. And I like kind of learning new things sometimes.”

The effect on academic achievement was difficult to measure. While the overall percentages of students passing their OAKS test was not where I would ideally like to see it, this year’s scores indicated a strong rebound from last year’s precipitous dip. This may be related to the aforementioned fact that last year students had no idea that they were taking the test until the day it was administered. The percentage is roughly on-par with what it had been the few years previously. It was also encouraging to see that students in the treatment group fared well, especially since thirty percent of the students are on IEPs.

Limitations of the study

This study was faced with a number of limitations that should be taken into account. First, the number of students who participated in the treatment was only 10. This is not a large enough sample to make significant claims, but it was the entire junior class except for three students who, in reality, attended a community college for their coursework while enrolled at McKenzie. Some of the data is compared against previous classes, and with such small student cohorts, there is variation from year to year.

With a small class and an all-encompassing treatment, it was difficult to find control groups that authentically would demonstrate the effect of the treatment on the

students, so some of that information is dubious. For example, when comparing environmental science to another course, students are considering different subjects, different teaching styles, and different teacher personalities.

Some measures were influenced by students' former science experiences, namely the OAKS science test. Students in this year's treatment have had three different science teachers during their first year of teaching, which included six unique preps. Also, last year, students were not told about the test until the morning they took it, which is more than likely a large part of why their test scores were so low.

The data instruments, with the exception of the OAKS science test and the Environmental Attitudes Survey, were developed solely for the purpose of this study and have not been evaluated as reliable measures beyond a few readers.

VALUE

The study had quite an impact on me as a teacher and has some findings which may interest other teachers interested in implementing similar studies in a similar setting. As a teacher, I learned many things about how students react to and engage with some non-traditional methods and found some confirmation of my initial interest in using place-based education as a gateway to deep learning. However, I also was reminded that educational methods in themselves will not inherently lead to gains without trial, careful planning, and a solid conceptual framework. Other teachers who are interested in PBE might be able to take away the apparent gains in student engagement and interest but use the lack of gains in other areas as potential cautions and important keystones to target as they develop a new unit.

The subjective experience in my environmental science class as compared to biology class is one of the largest take-aways for me. As the data suggests, both the kids and I were extremely excited to be working together doing real science. In biology class, for contrast, we don't yet have a strong underlying foundation of experiential science. Lab are peppered in as after-thought, case-by-case experiences mostly to quell rebellion. This strategy is not due to intent but mostly due to the necessity of a teacher surviving six different classes to a wide age range. Having a unifying, student-driven project as a central thread of environmental science allowed the students and me to work through some incredibly complicated, real-world problems of carrying out a study. The difficult days were complicated, unclear, and messy, but they still helped students learn perseverance, teamwork, and rigorous scientific methods.

The good days, on the other hand, were extreme highs. Students confronted problems with experimental design and came up with new independent angles to fix gaps they hadn't foreseen. We spent hours in the woods, reeling out measuring tapes, throwing quadrats, digging holes and collecting useful, real data. When we worked in the lab on days after data collection, students willingly came in during their lunches after working through a full period to run tests. They asked to pull out their phones to snap shots of the tardigrades, springtails, mites, and rotifers they saw swimming around in their samples, or to filter their samples once more before sending it out to the lab for analysis.

While data on this was not collected specifically, I am fairly confident through a year of working with these students that they have a critical, analytical skill set that they might hang on to, and that might serve them well in the future. The authentic trials of

working as diverse groups with self-direction and an attention to solving relevant problems might, if we're lucky enough, carry on to their careers in whatever field they study.

Nothing that I measured suggested that these students had a better leg-up in science. They seemed more interested, and their words suggested that they generally gained an appreciation for the scientific processes that inform research. I can say that this model of teaching set me as an inquiry guide; a facilitator who helped students isolate and determine a course of study. If an administrator were to walk in to a class period during the final half of the year, they would learn more about the day's objectives and the "lesson plan" by talking to the students than they would from talking to me. The benefits of PBE as I see them allow students to participate in research as real agents of learning.

Unfortunately, this paper was submitted before the students in the focus course, environmental science, actually gave their public presentations. However, I teach another extremely place-based course, which I believe can be helpful in understanding the value of this study although I did not collect any data from these students. In the freshman year earth science course, students spend the second semester digging into primary sources about the geology of a local landform, write a paper, and present to a panel of experts. The freshmen went through a nearly parallel process leading up to the presentations, but this project was based solely on book research, not field research. Their presentations were on June 1, 2018.

Exactly like the environmental science course, these presentations were held at a fire station conference room between our school and town. It was open to the public and

presided over by a panel of experts. Students came professionally dressed and every single student stood at the front of an audience of staff, families, fellow students, and professionals and shared clearly and correctly the story of their landform and how it tied into the geologic story of the region. They answered the presenters' questions with confidence and did a great job of weaving together pieces of the broader story with their own research to make reasonable conjectures about things they had not studied.

There is no measure of how successful this night was, but I absolutely swelled with pride watching my students, many of whom previously struggled with science, speak confidently as experts and being taken seriously by those who had many years of experience. The students knew that their hard work had paid off, and after their presentations they were beaming at each other and congratulating each other on a job well done. One student, who would only whisper when asked to read aloud in class last year, presented at a comfortable volume despite severe stage fright and a self-reported lack of self-confidence. When the presentations were all over, kids were congratulating each other, and one student gave the generally quiet, hesitant student a running-jump hug to congratulate her on her performance. In this instance, the presentation was really a large core of the place-based experience, and I regret that I am not able to include information about the environmental science presentations in this report.

Based on this year of implementing place-based education, I cannot yet give a resounding account of the success of the method, but I can say that it really shifts the balance towards inquiry and student-driven learning. I intend to change a lot of the course for next year, but the backbone of PBE will remain. I need to do a better job of teaching

the fundamental concepts of ecology and more explicitly teaching sampling and research methods. People don't learn against their will, but once intrigued and engaged, will generally work hard towards even difficult goals. The intrigue and engagement is really enhanced with a student-centered, place-based approach. Now, I need to strengthen the foundation.

This is some of the first intentionally place-based education at McKenzie High School, and I will be sharing what I learned with other teachers and the administration, since this is the direction the school is headed in. The biggest lesson for myself, the teachers, and the administration is that PBE is not an easy-to-implement panacea for all of our school's ills. Some of the administration and the community sometimes have an overly-rosy and simple view of PBE which can set up interested teachers for failure. One of the biggest perceptions is that PBE in itself will inherently increase student achievement and solve all of our school's problems. This very clearly isn't the case.

While students did show initial interest and I was motivated to teach science in a more authentic and interesting way, the amount of work I had to put into the course was far higher than anything have faced before, and it did not clearly enhance students' understanding of environmental science. It is a valuable framework but requires extremely careful planning and a more intentional dedication to not only the process of science and specific, localized problems, but on what is traditionally considered environmental science content.

Other teachers interested in implementing place-based education should be aware of the amount of time and energy that is needed to begin PBE. Rarely are there ideal

textbooks that focus on local ideas at the proper level. In this process, it is more likely that a teacher will find readings in newspapers, magazines, on the radio and on local television. From what I have found, it feels more authentic and valuable to myself and the students but is not an easy path. Without support from several local schools, including a tested framework I could build my own content upon, I don't think we would have succeeded to the level we did. I also had a distinct advantage in that I was a representative on the McKenzie Watershed Council (MWC), a local coalition of many groups. Over the past four years, I've gotten to know a variety of people involved with the care of our environment. In fact, three out of the four panelists who served on the environmental science panelists board I met through the MWC. The fourth was an ecology professor at the University of Oregon whom I knew personally.

After the presentations, each of these groups reached out and proposed having a deeper involvement in the process. It looks like next year each student group will be paired with an expert in either the academic or professional realm related to a specific topic. One panelist who represented the Eugene Water and Electric Board offered to mentor a group in algae bloom monitoring at our local reservoir, an especially timely topic as a reservoir the next watershed over had unsafe levels of cyanotoxins, which caused temporary restrictions on drinking tap water in Salem, our state capital. The University of Oregon professor offered to teach kids how to carry out climate change studies similar to what she does in her lab. The executive director of the H.J. Andrews Experimental Forest will be helping a group collect and analyze seasonal phenology data. Our McKenzie Watershed Council partner will be leading a team in water quality

analysis throughout the watershed. The Jane Goodall Environmental Middle School put me in touch with a group that surveys American Pika as an indicator of climate change.

While it isn't easy to forge connections with a network of real-world professionals, and there is no simple, straightforward way to work towards using your local environment as a cornerstone of learning, it seems to be worth the challenge. Even from a completely subjective viewpoint, I as a teacher approach the school days with a bit more joy and confidence that the hour I get to spend with my students each day is contributing to the greater good.

The data collection methods I have begun throughout the course of this research will serve as a good foundation for continued evaluation of PBE in my classes. In the first year, it shows promise, but it will take several years of attempt to isolate its true value and see if it is actually worth continuing. All preliminary indications suggest that it is a valuable method worth improving over the next few years of implementation.

REFERENCES CITED

A Framework for K-12 Science Education. (2012). National Academies Press. https://doi.org/10.17226/13165

Allensworth, Elaine & Easton, John Q. (2007). What Matters for Staying On-Track and Graduating in Chicago Public Schools. Uchicago Consortium on School Research.

Charnley, S. & Donoghue, E. (2007). Forest Communities and the Northwest Forest Plan: what socioeconomic monitoring can tell us. P*acific Northwest Research Station Science Findings.* 1-5.

Fletcher, R. (2007). *Drift boats and river dories: their history, design, construction, and use*. Mechanicsburg, PA: Stackpole Books.

Gallay, E., Marckini-Polk, L., Schroeder, B., & Flanagan, C. (2016). Place-Based Stewardship Education: Nurturing Aspirations to Protect the Rural Commons. *Peabody Journal of Education*, 00.

Gautreau, Brian T., & Binns, Ian C. (2012). Investigating Student Attitudes and Achievements in an Environmental Place-Based Inquiry in Secondary Classrooms. *International Journal of Environmental and Science Education, 7*(2), 167-195.

Harackiewicz, J. M. & Hulleman, C. S. (2010), The Importance of Interest: The Role of Achievement Goals and Task Values in Promoting the Development of Interest. Social and Personality Psychology Compass, 4: 42-52. doi:10.1111/j.1751-9004.2009.00207.x

Johnson, Brian, Duffin, Michael, & Murphy, Michael. (2012). Quantifying a Relationship between Place-Based Learning and Environmental Quality. *Environmental Education Research, 18*(5), 609-624.

Joy, Lacey. (2018, March). *The Every Student Succeeds Act and Students Experiencing Homelessness: McKinney-Vento and Title I: McKenzie School District.* Presented at a training, McKenzie School District, Finn Rock, OR.

Le, Phuong. (2014, November). "Filtering rain runoff reduces its threats to salmon, study suggests." *The Seattle Times.* Retrieved from https://www.seattletimes.com/

Liberman, F., & Hoody, L. (1998). Closing the achievement gap: Using the environment as an integrating context for learning. Poway, CA: Science Wizards.

"Retired teacher shares why JGEMS students outperform." (2014, Dec. 9). *Statesman Journal*. Retrieved from https://www.statesmanjournal.com/

Milfont, Taciano & Duckitt, John. (2010). The Environmental Attitudes Inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*. 30. 80-94. 10.1016/j.jenvp.2009.09.001.

Oregon Department of Fish and Wildlife. (2005). *2005 Oregon Native Fish Status Report: Volume I species management unit summaries.* Retrieved from http://www.dfw.state.or.us/fish/ONFSR/docs/volume-1-final.pdf

Sobel, D., & Orion Society, publisher. (2013). *Place-based education : Connecting classrooms and communities* (Second ed., Nature literacy series).

Starnes, B. A. (1999). The Foxfire approach to teaching and learning: John Dewey, experiential learning, and the core practices(ERIC digest). ERIC Clearinghouse on Elementary and Early Childhood Education (EDO-RC-98-6).

U.S. Census Bureau. (2017). *2017 American Community Survey.* Retrieved from http://www.towncharts.com/

Wethern, B. (2001). *The Creel: McKenzie River Edition*. Portland, OR: Frank Amato Publications, Inc.

Whipple, A. (2007). *Riverwater: a natural and social history of Oregon's McKenzie River*. Portland, OR: Riverwater.

Wigginton, E. (1972). *The Foxfire book: Hog dressing ; log cabin building ; mountain crafts and foods ; planting by the signs ; snake lore, hunting tales, faith healing ; moonshining ; and other affairs of plain living*. Garden City, N.Y: Doubleday.

APPENDICIES

APPENDIX A

INSTITUTIONAL REVIEW BOARD EXEMPTION

MONTANA
STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

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MEMORANDUM

TO: Nathaniel Day and Marcie Reuer

FROM: Mark Quinn Mark Quinn Chj
Chair, Institutional Review Board for the Protection of Human Subjects

DATE: November 6, 2017

RE: *"Place-Based Education as a Motivator of Student Achievement, Attendance, and Attitude"* [ND110617-EX]

The above research, described in your submission of November 6, 2017, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

___ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

_____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

STUDENT ATTENDANCE SURVEY

School Attendance Survey

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.

Your username will be recorded when you submit this form.

1. **Overall, I enjoy attending school.**
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

2. **I attend school 95% of the time. I miss 8 or fewer school days per year.**
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

3. **Attending school is important for my future options.**
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

4. **I attend school more this year than I did last year.**
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

5. **When I am absent from school, it is for reasons beyond my control.**
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

6. **If I am absent from school, it is usually a choice I make.**
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly disagree

7. **If I had to name three things that make me excited to come to school, they would be:**

_____

Rank the following choices based on how strongly they influence your desire to attend school. Choose "Strongly negative" if a topic makes you want to avoid school and "Strongly positive" if it makes you really excited to come to school. "3," the central value, would mean it has no effect.

8. **English class**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

9. **Math class**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

10. **Social Studies class**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

11. **Environmental science class**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

12. **Finn Rock Reach visits**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

13. **Fly fishing casting practice**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

14. **Textbook reading**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

15. **Tying flies**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

16. **Reading about ecology in Oregon**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

17. **Reading about ecology through fishing**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

18. **Reading about ecology in Connecticut**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

19. **Planning and carrying out field research**
Mark only one oval.

	1	2	3	4	5	
Strongly negative	◯	◯	◯	◯	◯	Strongly positive

APPENDIX C

PLACE-BASED EVALUATION

Place-based Evaluation

Participation is voluntary. You can choose to stop at any time. You can choose to not answer any questions you do not wish to answer. Participation or non-participation will not affect your grade or standing in the class.

* Required

1. **This class was personally relevant to me.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

2. **This class was experiential or hands-on.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

3. **This class promoted my understanding of content on a larger scale.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

4. **This class used the local environment as a context for learning.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

5. **We worked both individually and in groups.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

6. **Our work was based around a central project.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

7. **Our work was supported by school leadership** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

8. **Our work contributed to authentic community needs.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

9. **Our work touched on content from more than one class; that is, it wasn't just a "science" class.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

10. **Our work was tailored to my individual learning style.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

11. **Our work promoted attachment to a local place or attachment.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

12. **Our work included a service component.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

13. **Our work included structured reflection opportunities for me and my group.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

14. **Our work used existing or created new local partnerships.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

15. **Our work fostered collaboration with the local community.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

16. **Our work was driven by students.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

17. **Our work was supported by the local community.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

18. **Our work was initiated by students.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

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APPENDIX D

ENVIRONMENTAL ATTITUDES SURVEY

Environmental Science Survey

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.

* Required

1. **I am the kind of person who loves spending time in wild, untamed wilderness areas.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

2. **I really like going on trips into the countryside, for example to forests or fields.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

3. **I find it very boring being out in wilderness areas.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

4. **Sometimes when I am unhappy, I find comfort in nature** *
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

5. **Being out in nature is a great stress reducer for me.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

6. **I would rather spend my weekend in the city than in wilderness areas.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

7. **I enjoy spending time in natural settings just for the sake of being out in nature.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

8. **I have a sense of well-being in the silence of nature.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

9. **I find it more interesting in a shopping mall than out in the forest looking at trees and birds.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

10. **I think spending time in nature is boring.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

11. **Industry should be required to use recycled materials even when this costs more than making the same products from new raw materials.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

12. **Governments should control the rate at which raw materials are used to ensure that they last as long as possible.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

13. **Controls should be placed on industry to protect the environment from pollution, even if it means things will cost more.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

14. **People in developed societies are going to have to adopt a more conserving life-style in the future.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

15. **The government should give generous financial support to research related to the development of alternative energy sources, such as solar energy.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

16. **I don't think people in developed societies are going to have to adopt a more conserving life-style in the future.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

17. **Industries should be able to use raw materials rather than recycled ones if this leads to lower prices and costs, even if it means the raw materials will eventually be used up.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

18. **It is wrong for governments to try and compel business and industry to put conservation before producing goods in the most efficient and cost effective manner.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

19. **I am completely opposed to measures that would force industry to use recycled materials if this would make products more expensive.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

20. **I am opposed to governments controlling and regulating the way raw materials are used in order to try and make them last longer.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

21. **If I ever get extra income I will donate some money to an environmental organization.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

22. **I would like to join and actively participate in an environmentalist group.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

23. **I don't think I would help to raise funds for environmental protection.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

24. **I would NOT get involved in an environmentalist organization.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

25. **Environmental protection costs a lot of money. I am prepared to help out in a fund-raising effort.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

26. **I would not want to donate money to support an environmentalist cause.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

27. **I would NOT go out of my way to help recycling campaigns.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

28. **I often try to persuade others that the environment is important.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

29. **I would like to support an environmental organization.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

30. **I would never try to persuade others that environmental protection is important.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

31. **If things continue on their present course, we will soon experience a major ecological catastrophe.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

32. **The balance of nature is very delicate and easily upset.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

33. **The earth is like a spaceship with very limited room and resources.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

34. **When humans interfere with nature it often produces disastrous consequences.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

35. **Humans are severely abusing the environment.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

36. **The idea that we will experience a major ecological catastrophe if things continue on their present course is misguided nonsense.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

37. **I cannot see any real environmental problems being created by rapid economic growth. It only creates benefits.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

38. **The idea that the balance of nature is terribly delicate and easily upset is much too pessimistic.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

39. **I do not believe that the environment has been severely abused by humans.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

40. **People who say that the unrelenting exploitation of nature has driven us to the brink of ecological collapse are wrong.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

41. **It is all right for humans to use nature as a resource for economic purposes.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

42. **Protecting peoples' jobs is more important than protecting the environment.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

43. **Humans do NOT have the right to damage the environment just to get greater economic growth.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

44. **People have been giving far too little attention to how human progress has been damaging the environment.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

45. **Protecting the environment is more important than protecting economic growth.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

46. **The question of the environment is secondary to economic growth.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

47. **The benefits of modern consumer products are more important than the pollution that results from their production and use.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

48. **The idea that nature is valuable for its own sake is naı̈ve and wrong.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

49. **It makes me sad to see natural environments destroyed.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

50. **One of the worst things about overpopulation is that many natural areas are getting destroyed.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

51. **I do not believe protecting the environment is an important issue.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

52. **I don't get upset at the idea of forests being cleared for agriculture.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

Untitled Section

53. **We should strive for the goal of "zero population growth".** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

54. **The idea that we should control the population growth is wrong.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

55. **Families should be encouraged to limit themselves to two children or less.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

56. **A married couple should have as many children as they wish, as long as they can adequately provide for them.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

57. **Our government should educate people concerning the importance of having two children or less.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

58. **We should never put limits on the number of children a couple can have.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

59. **The world would be better off if the population stopped growing.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

60. **We would be better off if we dramatically reduced the number of people on the Earth.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

61. **The government has no right to require married couples to limit the number of children they can have.** *
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

APPENDIX E

STUDENT INTERVIEW

Interview questions:

Section I: General questions.

1. Please describe your experience in environmental science class so far.
2. Now, thinking back to Biology class last year, what is different so far about the way we approach class?
3. What effect do you think these differences have on you as a student?

Section II: Questions about environmental attitude.

1. Have you found yourself thinking about the environment outside of class hours? If so, please share a specific instance. Followups: is this usual for you?
2. Think about the readings we've done so far this year. Which was your favorite and why?
3. This week, we read selections from the textbook. Describe your motivation for reading them. How is this different from how you normally approach a textbook?
4. Describe your relationship with fly fishing.

Section III: Questions about attendance.

1. How has your attendance been so far this year? How would you compare it to last year?
2. (followup) If you think it's different than last year, what might be some reasons?
3. Does Environmental Science have any effect, positive or negative, on your willingness to attend school?

Section IV: Open ended or academic achievement.

1. Explain to me as best you can what you know about our research project second semester.
2. How are you feeling about that research project?

3. Do you think the process will benefit you, and if so, how?
4. What aren't you looking forward to about the project?

Closing questions:
Is there anything else you'd like me to know about this class, fly fishing, or our projects?