

THE EFFECTS OF CONDUCTING COMMUNITY CONSERVATION PROJECTS IN
MIDDLE SCHOOL LIFE SCIENCES

by

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of

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in

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ABSTRACT

The purpose of this study was to understand how connecting middle school science students with community conservation projects would impact their learning and attitudes towards natural resources. Research shows that children with limited access to natural environments have fewer pro-environmental behaviors in the future (Louv, 2008; Yamanoi et al., 2021). This study was inspired by the closing of salmon fisheries in California due to population declines and the removal of old growth oak trees for levee improvements in Sacramento. Pretreatment consisted of a fall field trip to observe spawning salmon and to collect native oak acorns. Students also participated in raising salmon and trout in a classroom aquarium and growing acorns into seedlings. The treatment for the 12-week study took place during two subsequent field trips to learn about urban fisheries and forestry management. The winter field trip to a fish hatchery helped students understand where our classroom eggs originated and the role hatcheries play in managing fish populations. On the final spring field trip, students released fish into the American River and participated in a community service clean-up. The impact of the treatment was assessed using a mixed-methods design. Pre and post surveys measured changes in students' attitudes towards science and conservation work. Open-ended survey responses highlighted shifts in pro-environmental values and behaviors. Pre and post assessments measured changes in content knowledge with Concept Maps. Data showed an increase in the mean, median, and mode from the pre to the post assessment Concept Maps. The mean increased by 40% after the treatment. Post Survey results determined that students would like to participate in similar community service and conservation work in the future. Students responded, "I loved raising the fish because it felt like having a class pet and we had an in-person interaction with our subject." These findings suggest that students took ownership of their learning because they played a role in helping their community. Conservation work has proven to be an effective tool that elevates science education.

CHAPTER ONE

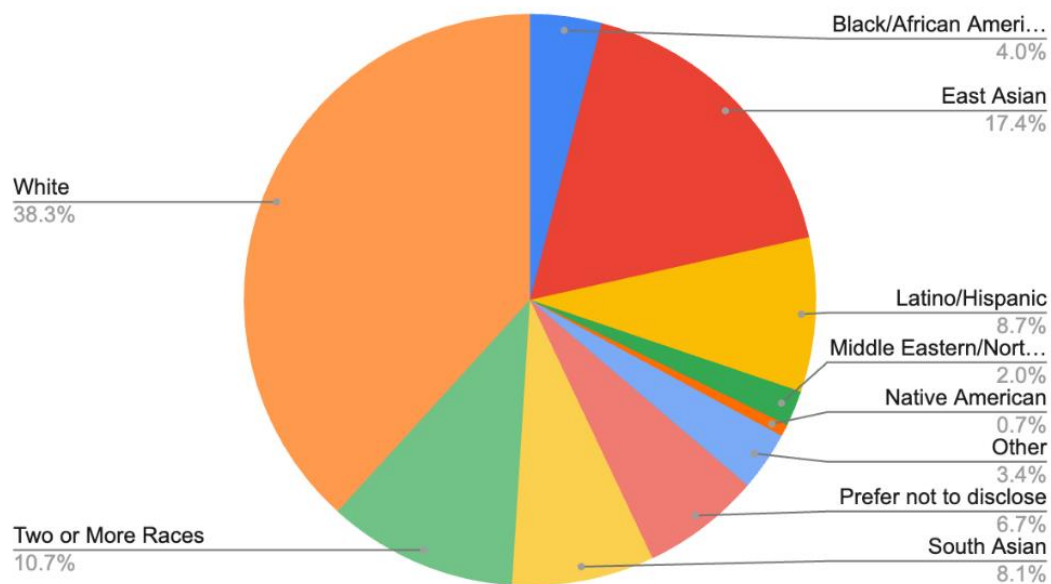
INTRODUCTION AND BACKGROUND

School Demographic and Culture

My community and primary teaching responsibility is with the seventh grade life science class at Sacramento Country Day School, a pre-K through 12th grade independent school located in Sacramento, California. The school opened in 1964 with 33 students enrolled. Today, there is a total of 593 students enrolled, comprised of 268 in the lower school (pre-K to grade 5), 146 in the middle school (grade 6 to 8), and 179 in the high school (grade 9 to 12). Families from the surrounding urban, suburban and rural communities in the central valley and foothills of the Sierra Nevada mountains choose this diverse and inclusive private school. The 2025-2026 tuition cost for middle school was \$32,300 and 40% of our students received financial aid. Our school culture centers around the philosophy of the habit of helping, which is demonstrated by mandatory community service hours for high school students and service events for middle school. We have a quarter-acre organic farm that grows food for our school community and donates over 1500 pounds to local food banks. Affinity and alliance groups have been established in the middle and high school, as well as within our faculty and staff. The athletics program has a no-cut policy to encourage students to try new sports. There are also optional but encouraged outdoor education trips offered in the middle and high school (Vargo, 2024).

Our students take the computer-adaptive Measures of Academic Progress (MAP) Growth assessment in the fall and spring semesters to measure their academic growth over time and compare their results to similar students across the country. The current grade 7 results place our

students into the 72nd percentile range in Math, 80th percentile range in language usage, and 78th percentile range in reading. Less than 10% of this class fall below the ideal range for the grade level (Vargo 2024). There are two full-time learning specialists to support these students in successfully accessing our academic curriculum. The student population of the middle school is diverse: 38% identify as White, 17% identify as East Asian, and 10% identify as two or more races (Figure 1).



appro

Figure 1. Overview of the ethnicity of Sacramento Country Day students in the Middle School, (N=146).

Context of the Study

The purpose of this study was to connect students with their community in the school environment and with the local riparian ecosystem of the American River. The class engaged in two conservation work projects collectively called Salmon to Sea Under the Oak Trees. For the Salmon to Sea portion, the class partnered with California Department of Fish and Wildlife in the California Aquarium Education Program to raise and release salmonid fish from egg to fry. For

the Under the Oak Trees project, the class worked with Sacramento Tree Foundation (STF) to collect acorns within 10 miles of campus to germinate and plant seedlings in our community. Students engaged in authentic inquiry investigations, service learning, and citizen science in our own community. I hoped that this project will help align curricular goals with the school's community service culture, adding a science focus on conservation of our local natural resources.

Country Day's proximity to the American River provides diverse opportunities for students to contribute to local conservation. The American River Parkway stretches 23 miles along the river with 4,800 acres of urban natural parks throughout the city of Sacramento. The lower stretch of the river terminates at the Nimbus dam with the Nimbus Fish Hatchery just below the dam. The California Department of Fish and Wildlife runs a Classroom Aquarium Education Program to support educators in raising Chinook salmon (*Oncorhynchus tshawytscha*) and Steelhead trout (*Oncorhynchus mykiss*) in the classroom for release into the river. There were also service-learning opportunities for students to help our community with river clean-up days. Students also collected native oak acorns with the Sacramento Tree Foundation in their seed to seedling program.

The continued encroachment of urban development into green spaces has created barriers for my students to experience the local environment. Freeways and shopping centers block river access; parking lots replace vernal wetlands. Changes in the environment to improve the economy have long-term consequences for all of us. These changes have impacts on the way parents raise children, how students interact within the school community, and how these students think about the world around them. My goal was to expose the students to safe and accessible outdoor spaces to help them develop connections to our local ecosystem. The salmon and trout raised in the classroom will spawn years later as students begin their college journey. I

hoped this project would inspire reflection about how our behaviors and actions impact our environment.

Science class is a great opportunity to make concepts more relevant for students and remove the distant experience of outdated case studies and environmental issues from other places. There are numerous teachable moments all around our school community to engage in scientific inquiry to learn about where our resources come from and how to conserve these resources for future generations. This study is an attempt to understand the impacts of urbanization and our changing world on student attitudes. By empowering students to take action to improve habitat for local flora and fauna, I aimed to understand how this impacts their values and performance in science.

Focus Question

My focus question was, How does engaging in active conservation work impact middle school students' content knowledge and values?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Effects Of Urbanization

Our world is changing. We have replaced natural spaces with developed structures, and this has had a negative impact on children. There are terms like nature-deficit disorder and extinction of experience that describe the loss of interactions between humans and natural outdoor spaces (Louv, 2008; Yamanoi et al., 2021). Increased urbanization has led to decreases in accessible green space for people to explore and learn about the natural world. There are fewer opportunities for students to directly experience nature, hence the extinction of experience. Studies show children improve their emotional connection with nature when they spend more time outside. Health benefits are also associated with increased interactions with nature (Soga & Gaston, 2016).

A study in Japan determined multiple factors that influence the frequency and duration of nature-oriented educational activities in K-8 science classes. Surveys show elementary teachers spent more time observing nature and discussing ecology, but this declined with middle school teachers. In addition, schools with more green space resulted in teachers spending more time outside, and teachers spent more time discussing ecology in schools with urban surroundings. These findings suggest increasing ecological knowledge for teachers to enhance nature-based education in schools and maintaining and restoring natural environments within school environments to increase students' engagement with nature. The results suggest a lack of nature experience in one generation will lead to further decline in nature-oriented people in the next generation (Yamanoi et al., 2021).

Role of Environmental Education

Humans use resources and produce waste faster than Earth's ecosystems can regenerate, and this environmental degradation continues to accelerate today. Our negative impact on the environment became more well known and acknowledged with literature, like *Silent Spring* by Rachel Carson (1962) and *A Sand County Almanac* by Aldo Leopold (1949). Leaders worldwide met to identify possible solutions, and education was identified as important part of the solution (UNESCO, 1977). Environmental education provides knowledge and skills to help students participate in addressing these problems by making informed decisions and taking responsible actions that positively impact the environment (U.S. Environmental Protection Agency, 1996).

Environmental education has been shown to improve student behaviors and academic performance. The American Institutes for Research conducted a study to measure the impacts of California residential outdoor education programs on middle school students' behavior and learning. The findings show higher ratings of cooperation and conflict resolution skills, as well as improved self-esteem and motivation to learn. Science scores improved by 27% from pre and post surveys. Parents reported positive environmental behaviors at home, like recycling, after attending the outdoor school programs (Parrish et al., 2005). When educators used published environmental education curriculum, like Project WILD and Project WET, this also improved environmental literacy (EL) in middle school students. The amount of time students spent outside also positively correlated with EL. Teachers with Master's degrees at charter and private schools also significantly improved EL and pro-environmental behaviors for students (Stevenson, 2013).

Conservation Education Impacts

Conservation education is influential in promoting pro-environmental behaviors and attitudes for students in K-12 schools. Survey data shows most students agree that environmental issues are important to empower them to make responsible impacts in the future. Teachers and specific classes were identified as having the most influence on students' environmental attitudes, according to 64% of students surveyed. Students identified science classes as the primary source of conservation education, which suggests opportunities for other subjects to engage in conservation issues. Expanding conservation education to other subjects would help students who struggle with science to better connect with conservation. Field trips, inquiry, guest speakers, and discussions were students' preferred methods of learning conservation education (Sutherland, 2017).

There is a lack of conservation biology classes offered in K-12 schools. The biggest impediment to including conservation education to secondary schools was the difficulty in where to incorporate it into the curriculum. State and national standards guide the curricular mandates making it difficult for educators to implement. One problem with conservation instruction was a focus on exotic locations, as opposed to local conservation issues. When students connect their everyday behaviors to environmental issues, they increase knowledge of the complexity of those issues. Connecting daily habits to ecological disruption helps students understand how ecosystems function and how human actions trigger cascading environmental effects. As climate change progresses and biodiversity declines, our society needs as many people as possible to understand and practice sustainability (Wyner & DeSalle, 2010).

Place-Based Education

Place-based education (PBE) focuses on practices that prioritize local communities and environments. School campuses and local parks are areas where students can interact with greenspaces, while making observations and collecting data. Science educators play an important role in helping students build knowledge about local ecology and making connections from science class to the surrounding community (Adams et al., 2017). A sense of belonging is a core principle of PBE, and the experiences tie into student engagement and motivation. Students discovered purpose through local community-based projects after struggling with traditional educational settings. Deep and meaningful learning can come from students asking questions about their environment and seeking answers through carrying out investigations (McClennen, 2024).

Wright et al. (2021) investigated how middle school teachers in Colorado made decisions about using (PBE) to study urban ecology. They found, with additional support from environmental agencies, teachers could increase students' environmental literacy and civic engagement. Local wildlife experts were identified as supportive in addressing academic standards using local examples. Findings show when teachers were able to demonstrate curricular agency to meet the needs of students, their use of PBE was more likely to be sustained. Adaptability and collaboration from teachers result in the same characteristics in students. When students believe their efforts positively impact their local community, they were more likely to change in behaviors that favored conservation strategies and increased civic engagement.

Citizen Science and Environmental Behaviors

Nature-based citizen science (NBCS) is a learning experience for students to collect authentic scientific data from nature observations such as counting species and monitoring environmental factors, like water quality. NBCS studies show an increase in participants' knowledge and pro-environmental behaviors. When volunteers are involved in data collection, they change their perception of the natural world by learning about the structures and functions of the system. Technology also incentivizes NBCS with apps that motivate participants to unlock achievements. With the ability to carry multiple field guides on their phone, technology also increases peoples' access and knowledge of the natural world. Participants of NBCS report higher feelings of satisfaction from their contributions to science, and they develop a stronger connection and sense of place (Schuttler et al., 2018).

Citizen science combines the goals of environmental education with science education curriculum goals. Students learn to ask questions, carry out investigations, analyze data, and communicate information. Students report feeling motivated with citizen science projects because they feel like they are contributing to science. Citizen science participants reported and increased interest in environmental issues they were involved with (Pitt et al., 2019). Studies from the Czech Republic on citizen science in primary and secondary schools found that students strengthened their relationship with the environment when they investigated and presented their own observations within the community. Students would refer to their own data to excitedly discuss bird populations on the school grounds (Zárybnická et al., 2017).

What Comes Next

The growing isolation from the natural world because of urbanization and modern lifestyles presents an opportunity for educators to include more conservation education with a focus on place-based learning through nature-based citizen science programs in the classroom. Educators could prioritize positive outdoor experiences for children to provide equity for urban, suburban, and rural communities. It is important for secondary schools to help mitigate the extinction of experience by emphasizing nature-related education. There is an opportunity for educators to address nature-deficit disorder by connecting students through civic engagement with important issues close to home.

CHAPTER THREE

METHODOLOGY

Demographics

Throughout my 18 years of teaching in this growing community and changing environment, eco-anxiety has become more common amongst students in the middle school and high school. This study was conducted with seventh graders in my life science class during the 2025-2026 school year to understand the effects of conservation work. There were 46 students in three different sections. The classes had 15 to 16 students in each section with 60% females and 40% males in the grade level. There were documented learning plans for 28% of this grade level and these students received support from the learning specialist on campus. Some students commute from outside our surrounding community on a school provided shuttle service, the farthest distance being 28 miles from campus, and 63% of students live within 10 miles of the campus ($N=46$).

The school year is divided into quarters, and there are no final exams in the middle school. Class periods are 52 minutes, and we have a rotating schedule. For example, first period will meet in the first class of the day. The next day, that class will meet in the second class of the day. In the first quarter, science content focused on identifying the characteristics of life through an ecological lens. We spent time outside making observations to gather evidence of the interdependence of biotic and abiotic factors within our own community. This set us up for the conservation work in the second quarter when this study began. The conservation work was a series of field trips to support the work surrounding salmonids and acorns. In the third quarter, the lens of the curriculum zoomed microscopically to investigate cell processes, genetics, and

evolution by natural selection. Finally in the fourth quarter, we dove into the inner workings of anatomy and making comparisons to structures and functions of different organisms.

Treatment

The treatment for this study occurred right after a project called scientists in the field, a book series about scientific field research. Each student worked with their own book to learn about field research and showcase their learning to our school community and their caregivers. We brought in guest speakers to talk about the conservation work they conduct with elephants, salmon, and oak trees. There were lessons on philanthropy and making informed decisions about choosing organizations to support with donations from our school budget. Finally, the students made presentations from the scientists' perspectives to educate and request funding from the guests who acted as investors with checks to vote on the most prepared student. This determined the outcome of the school donation to the scientific organization of the student's choice from each class period that walked away with the most checks during the final science class symposium. The Advancement Department donated \$450 to four different organizations of the student's choice, including the Sacramento Tree Foundation.

There were three field trips to the river for students to conduct conservation work, but the treatment only included two of the field trips. In the fall, we observed the spawning Chinook salmon to prepare for raising the eggs in the classroom over the winter. Students also worked with the Sacramento Tree Foundation (STF) to collect native valley oak and interior live oak acorns to support reforestation in our region. In the winter, we toured the Nimbus Fish Hatchery to understand how dams impact migratory salmonid populations. Each student also planted their own acorn and cared for the seedling throughout the study. In the spring, we released the trout

raised in the classroom and participated in community service by removing trash from the American River Parkway.

The treatment data was compared to a nontreatment unit involving a case study of the Klamath River dam in northern California and the effects on salmon populations. Students recorded observations and conducted analysis in the classroom based on data provided by Fish and Wildlife Services. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for work with human subjects was maintained (Appendix A).

Data Collection and Analysis Strategies

This study aimed to collect data on the content knowledge gained during the field trips and any changes in values and attitudes from the conservation work in our science class. This mixed-methods approach focused equally on qualitative and quantitative data from surveys, formative assessments, observations using a teacher journal, and student interviews. The name of the data instruments follows the lifecycle of the salmonids we were working with in class, so the first instrument implemented in this study was the Egg Stage Pre Survey (Appendix B). This survey was conducted before we went on our second field trip to the river and it was distributed in class using Google Forms to begin this study in January. The survey consisted of Likert scale survey ratings of (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. These ratings were quantitative measurements of the student attitudes based on their prior experiences in science class. This data was analyzed using summary statistics, such as mean, median, mode, and reflected as a percent to compare frequencies in student responses of each rating.

Prior content knowledge data was collected using the Fry Stage Pre Assessment (Appendix C). This formative assessment consisted of 15 vocabulary words to use in creating a

Concept Map. A response earned a 5 if it had all 15 vocabulary words with linking words that accurately showed connections between concepts and contained specific examples that demonstrated understanding of the vocabulary. A score of 1 meant the concept map was missing vocabulary words, linking words, and specific examples. Students completed the Fry Stage Pre Assessment (Appendix C) before the field trip in January to the fish hatchery.

The treatment concluded in the spring after releasing the trout and donating the seedlings to our pre-K class to study. Students completed the Smolt Stage Post Survey (Appendix D). It consisted of five Likert scale survey statements that followed up from the Egg Stage Pre Survey to understand the effectiveness of the conservation work and field trips. There were two 1-10 rating questions about the conservation work with salmonids and acorns. A rating of 10 indicated a strong engagement level with the conservation work, while a rating of 1 indicated no interest. Finally, there was an open-ended response question to understand the justification for the conservation work rating. I used averages to compare the ratings, and thematic analysis was used to find themes to discuss the frequency of each rating.

The data collection concluded with the Adult Stage Post Assessment (Appendix E). This was nearly identical to the Fry Stage Pre Assessment (Appendix C) with 15 vocabulary words to use in a concept map. The Adult Stage Post Assessment (Appendix E) was compared to the Fry Stage Pre Assessment (Appendix C) to determine normalized gains. The normalized gain was calculated to determine differences in student knowledge. Normalized gains of less than .3 were considered low, gains .3 to .7 were considered a medium gain, and normalized gains greater than .7 were considered high (Hake, 1998). Results from the Pre and Post Assessments were also analyzed using a paired t-test.

I also collected observational data using a Teacher Journal (Appendix F). I was recording information about student engagement and quantifying the percentage of the class not engaged, somewhat engaged, and really engaged in the conservation work. I was also looking for how well students understood the tasks and I recorded data about behaviors like asking questions, working independently, or when collaborating. Finally, I conducted two group interviews with six students in each group. Participation in the group interviews was voluntary, and the students were carefully selected to ensure the groups were diverse and inclusive with respect to gender, ethnicity, and academic performance. Each group of six students were asked the same questions (Appendix G). An overview of the data collection methods can be found in the table below (Table 1).

Table 1. Data Triangulation Matrix.

Research Question	Data Source		
	1	2	3
How does engaging in conservation work impact middle school students' content knowledge and values?	Pre and Post Assessment Concept Map	Pre and Post Likert scale surveys and open responses	Student interviews and teacher journal observations

CHAPTER FOUR

DATA ANALYSIS: CLAIMS AND EVIDENCE

Results

The results of the Adult Stage Post Assessment (Appendix E) demonstrated that students improved in their ability to make connections between concepts and use evidence to demonstrate their understanding of vocabulary ($N=36$). The scores were averaged for both the Pre and Post Assessment Concept Maps to determine a mean score for each. Both assessments consisted of 15 vocabulary words to create a concept map with examples and explanations to show how the vocabulary words relate to each other. Assessments were scored on a scale of 1 to 5 points, with 1 representing the lowest and 5 as the highest possible score. The Pre Assessment average was 2.52, and the Post Assessment average was 4.25. The difference in scores between the assessments represented a 40% increase in the student scores. Student scores on the Pre Assessment ranged from a low of 1, to a high of 5, with a median score of 2.5. Half of the students scored 1 to 2 points in the Pre Assessment compared to 53% scoring 4 points in the Post Assessment (Figure 2).

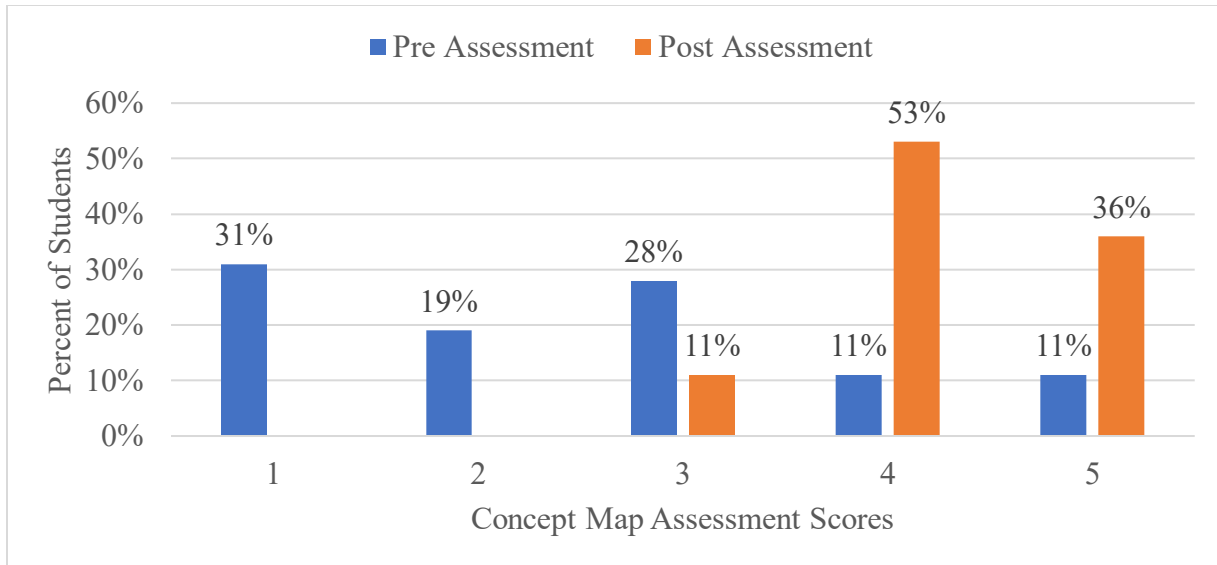


Figure 2. Pre and Post Assessment score frequency, ($n=36$).

Thirty-one percent of students had Pre Assessment scores of 1. Figure 3 represents a Pre Assessment score of 1. The concept map was missing most of the vocabulary words, with only food web represented. There were no linking words to accurately show connections between the concepts. In the first quarter before the treatment, students learned how to create concept maps. This student demonstrated an understanding of energy flow through the ecosystem but lacked the details of the effects of biotic and abiotic factors on populations. I observed this student looking around anxiously and confused as they worked on the Concept Map. They were able to get started once I made some suggestions and we talked through their understanding of explaining food web with some examples. This Concept Map is missing the more difficult vocabulary, like heterotroph to describe energy flow in the ecosystem (Figure 3).

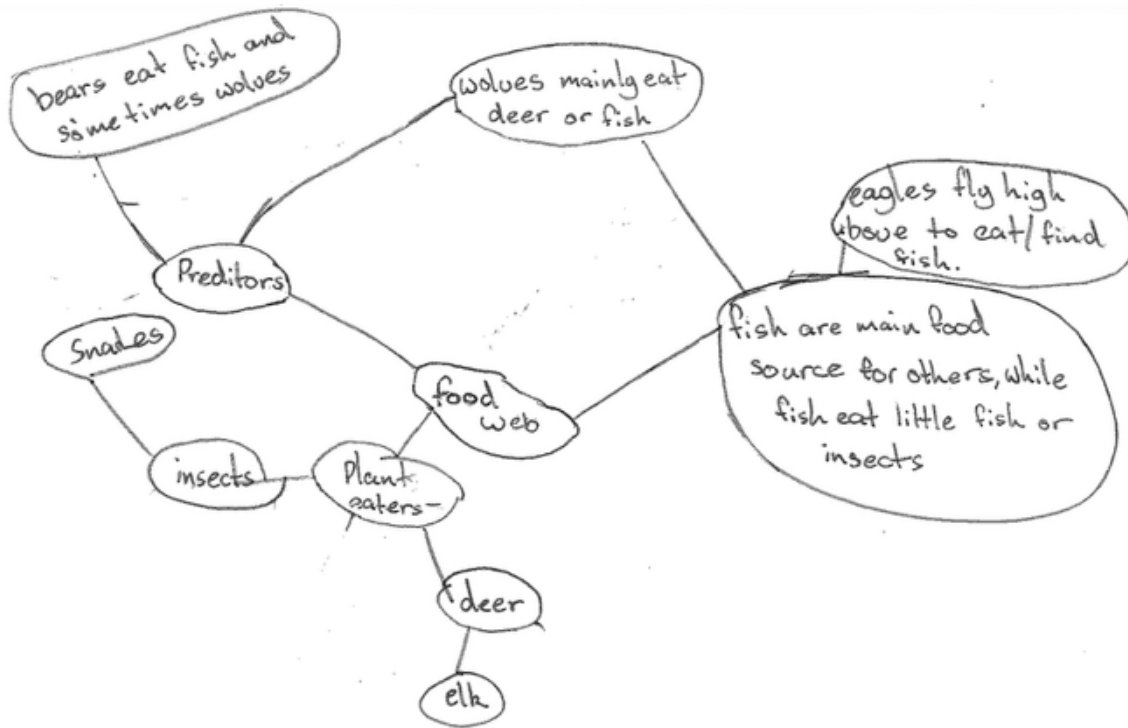


Figure 3. Pre Assessment Concept Map with a score of one, (N=46).

On the Post Assessment, student scores ranged from 3 to 5, with a median score of 4.

Figure 4 shows the same student after the treatment with conservation work. This Concept Map includes all the vocabulary with specific examples and linking words that accurately show the connections to each concept. This Concept Map included the interactions among organisms, including energy flow, and the effects of changing biotic and abiotic factors on dynamic relationships in our own local ecosystem. There are even sketches to show specific examples from the treatment field trips. This student was productive and engaged while working, and they handed in the Concept Map at the end of class with a smile (Figure 4).

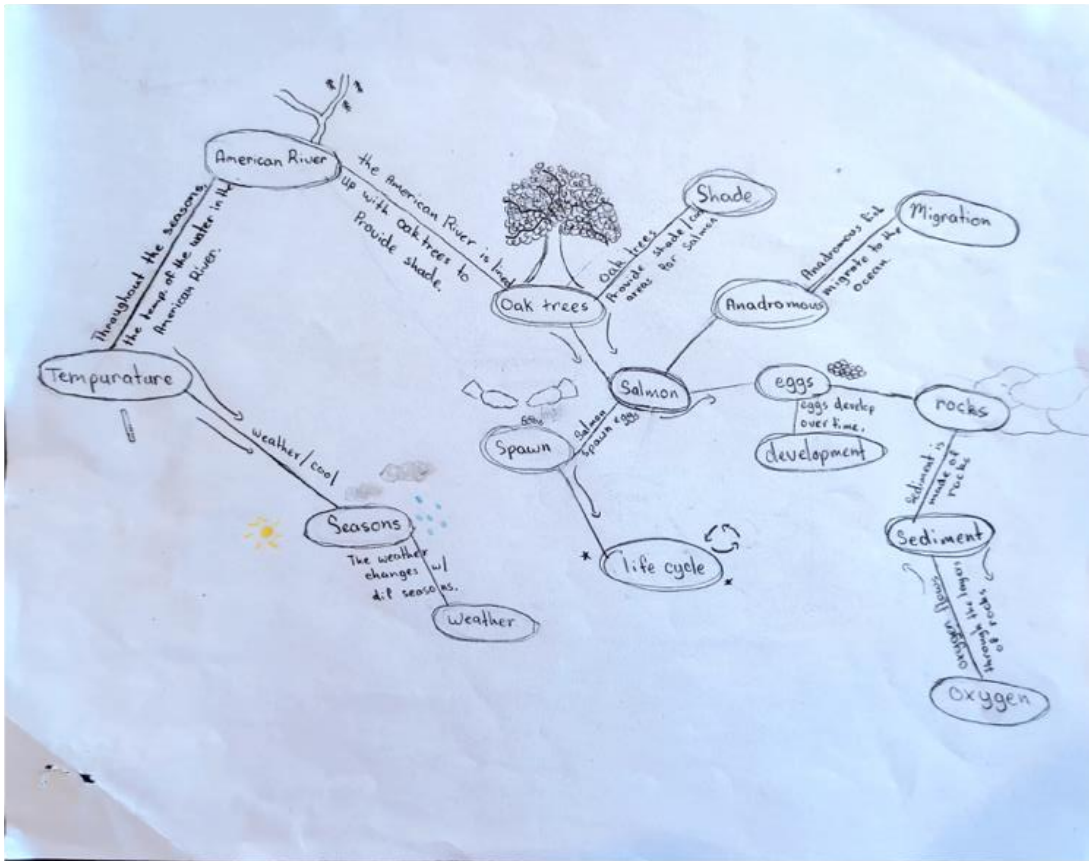


Figure 4. Post Assessment Concept Map from the same student with a score of five, ($N=46$).

A normalized analysis of the Pre and Post Assessments showed a gain of .6, which is considered a medium gain (Hake, 1998). A paired t-test comparing the two assessments resulted in a p value of 3.7×10^{-9} . This value allows for a rejection of the null hypothesis, and an acceptance of the alternative hypothesis that there is a statistical significance in the variation between the Pre and Post Assessments (Figure 5).

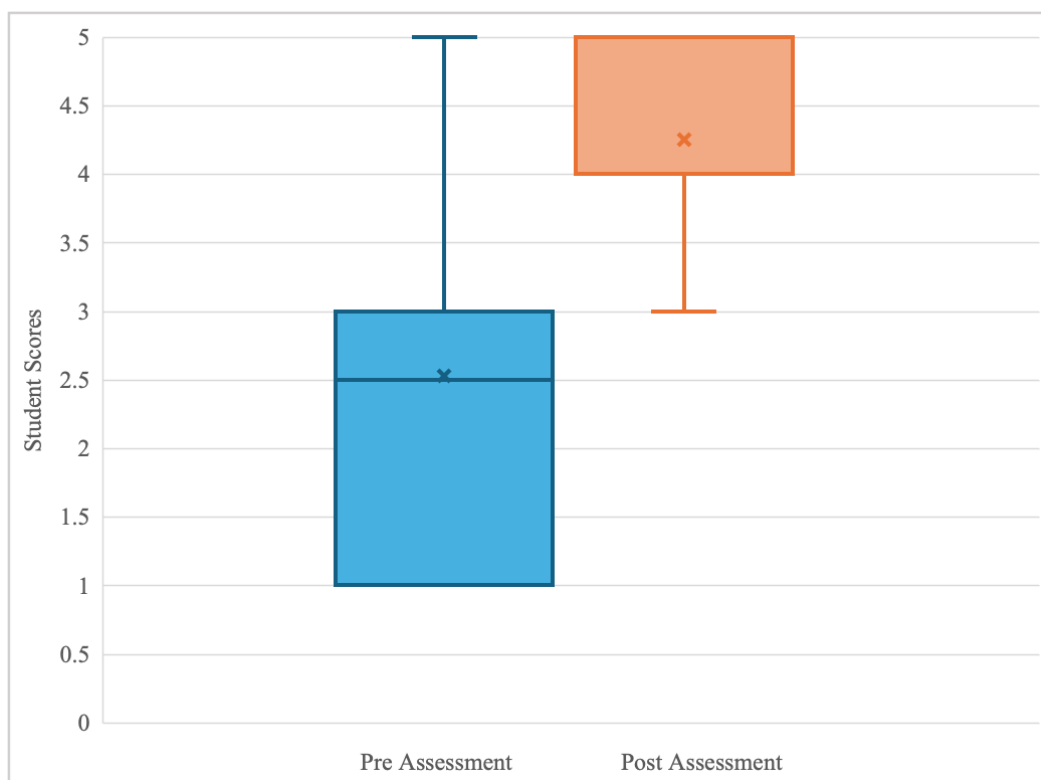


Figure 5. Box and Whisker plot of student results for the Concept Map Assessment, ($n=36$).

Before the treatment, students took the Egg Stage Pre Survey ($n=36$). The purpose of the survey was to determine the attitudes and values towards science class and the environment. The presurvey results revealed all the students enjoy learning science with only 20% saying science is not one of their favorite classes. Almost all students, 97%, prefer when science class happens outside and 100% of students like going on field trips. Ninety-five percent of students view themselves as having a positive impact in their community compared to 17% viewing their impact in the community as negative (Figure 6).

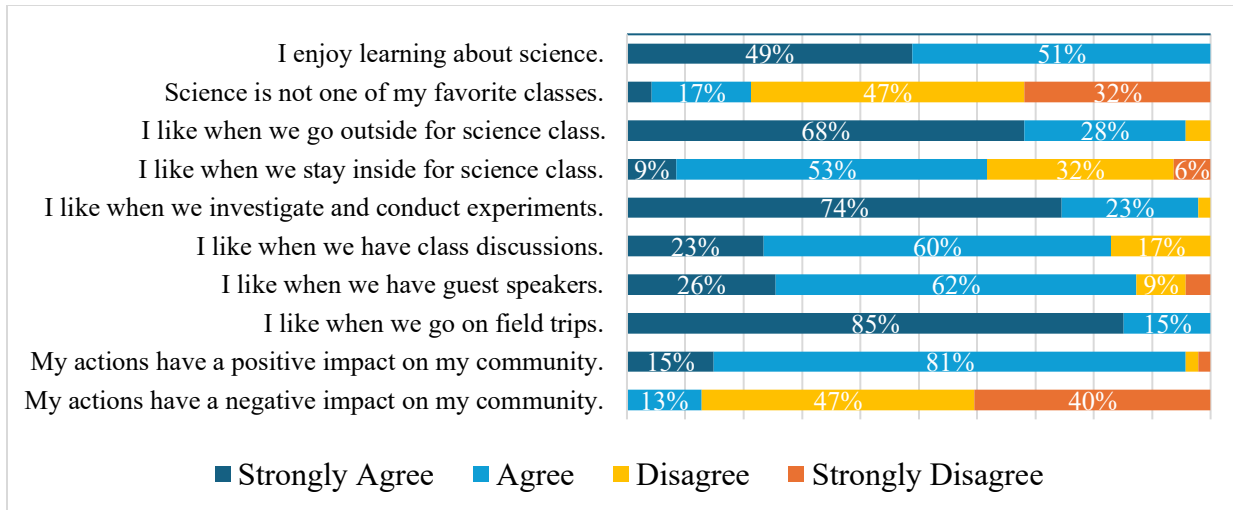


Figure 6. Egg Stage Pre Survey results, (N=46).

On the Smolt Post Survey (Appendix D), the average rating of the trout in the classroom experience was 9 out of 10. Students reported “it felt like having a class pet” and “it felt enjoyable to have a role in the life of a living thing”. The average rating of the acorns in the classroom experience was 8.4 out of 10. Students reported lower ratings if their seedling died, but they also “liked growing the acorn because I was responsible for a living thing” and “enjoyed watching the acorn grow roots and leaves”.

There were four students that agreed with the statement, “I feel like I didn’t learn about science from the conservation work we did”, but 90% of students disagreed or strongly disagreed with that statement. In the Smolt Post Survey (Appendix D), students also provided feedback about improving the river day conservation work. There was one student who suggested replacing the river days with a regular school day, but others suggested more river days. Many students requested more time to look at bugs, more time to pick up trash, and more time in the river and hiking around the river. During the final treatment field trip, one student shouted out, “Can we do this every Friday?”

All but one student reported their actions of community service and conservation work as having a positive impact on our community. All students surveyed would like to do more of this type of conservation work in the future. During an interview, a student shared a story of noticing lots of trash in their neighborhood and working with neighbors to sign a petition to start a community cleanup effort. Other students shared perspectives of noticing the beauty in gardens and protected wildlife areas in their communities (Figure 7).

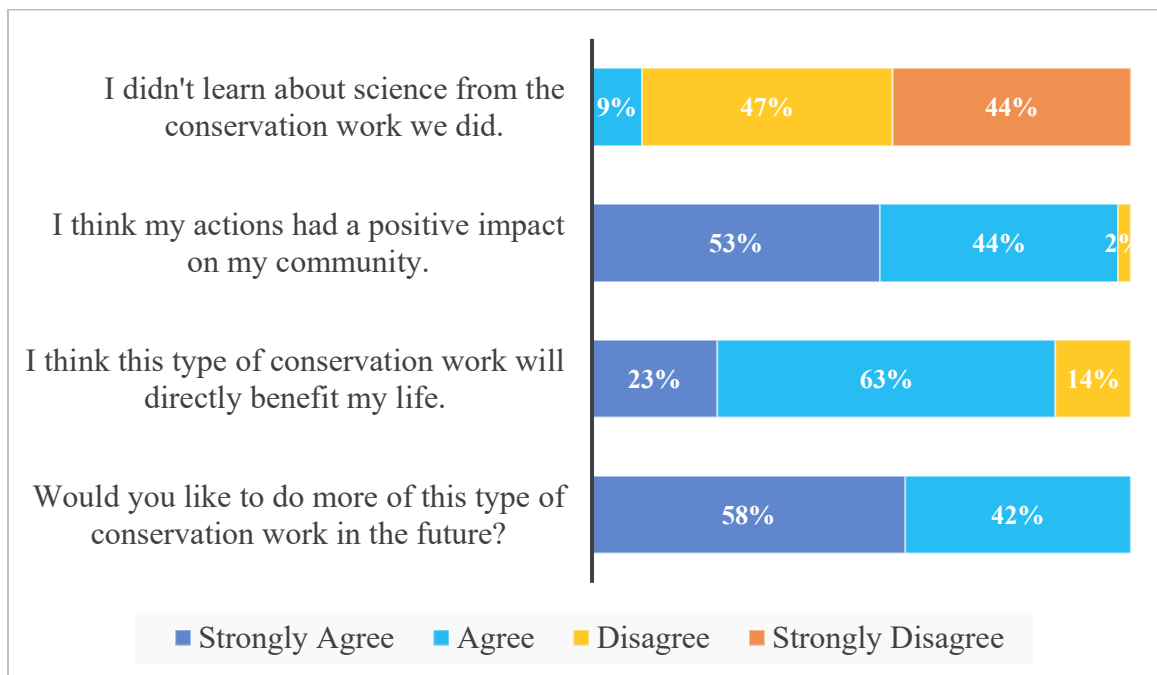


Figure 7. Post Survey responses from the treatment, ($n=43$).

In the nontreatment component of the study, students worked independently to complete a case study investigating the Klamath River dams and their effects on salmon populations. While students read through the study and completed self-guided worksheets, I observed them taking their time to obtain information and analyze the data provided. Most students appeared focused and worked independently for the first 20 minutes of class, using side discussions to develop their thinking. Towards the end of class, however, student engagement dropped and more redirection was necessary. This stood in contrast to my observations of students naturally

immersed in navigating the resources at the fish hatchery. Assessed content knowledge was similar between the nontreatment and treatment. On the case study nontreatment worksheet, students scored a class average of 4.65 out of 5; compared to the winter treatment field trip worksheet average of 4.60 out of 5 (Figure 8).

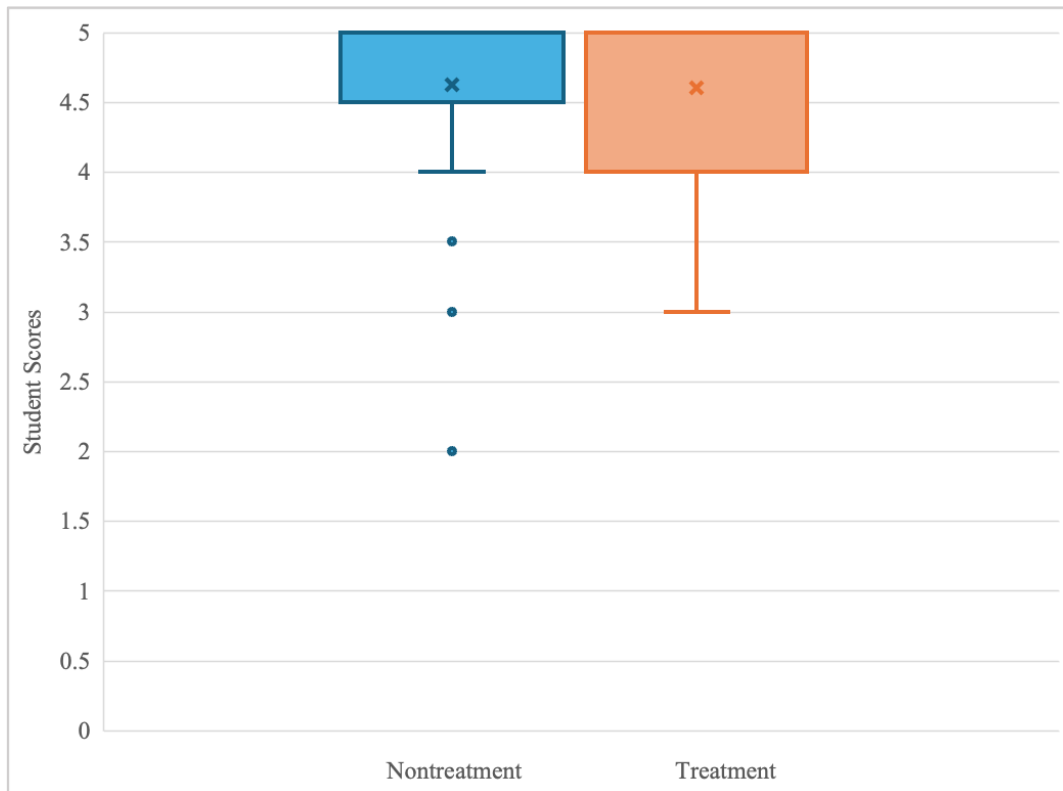


Figure 8. Box and Whisker plot of student results for the nontreatment and treatment, ($n=36$).

CHAPTER FIVE

VALUE: REASONING AND REFLECTION

Claims from the Study

The conservation work helped students improve content knowledge as measured through the concept map assessments. Eighty-nine percent of students improved their score from the Pre Assessment to the Post Assessment, and 31% of those improved by over three points. During an interview, a student reported “I think these river days helped me learn a lot about the area around me and helped me understand the importance of conservation”. Student written responses on the Adult Stage Post Assessment Concept Map (Appendix E) included accurate linking words to show connections between concepts and specific evidence that demonstrated a strong understanding of the vocabulary. Research conducted by McClennan (2024), suggested that outdoor learning environments helped students who struggle with more traditional classroom methods. This is what I observed with my students. Students improved in their ability to use vocabulary and make connections to evidence and observations during our field trips and this growth was measured in the Concept Map assessment scores improving by 40% after the treatment.

Students also increased connections to our local community and how their behavior impacted the environment. The Egg Stage Pre Survey (Appendix B) data showed a strong environmental advocacy attitude, and this increased by 38% who strongly agree their actions have a positive impact on the community to 53% in the Smolt Stage Post Survey (Appendix D). One student said, “on river day we got to spend time helping the community and we still had fun and got to go into the water while learning”. Parrish et al. (2005) reported similar findings in

residential environmental education settings. This conservation work improved students' motivation to learn because they were actively contributing to our community with helping fish populations and community clean-up efforts. My students would visit the fish in the classroom and care for their acorn saplings before school, during recess breaks, and at the start of class. We had a countdown for the river field trips, and they would cheer excitedly when it was updated.

Traditional teaching methods, such as using case studies in the classroom, are just as important as getting children outside. The results from the case study conducted in the classroom and the field trip to the fish hatchery show similar performance in content knowledge, but the students were much more engaged during the field work. This tells me there is value in both teaching practices. Using these techniques together will improve overall student engagement and performance with using vocabulary in Concept Maps. Traditional teaching methods help strengthen science practices, like engaging in argument from evidence and developing models to explain phenomena. Experiential teaching methods help students analyze and interpret data and construct explanations about what they are experiencing.

Value of the Study and Consideration for Future Research

This study helped me connect with my students by connecting my students to their local community. Conservation was a theme throughout the school year, and I observed a shift in attitudes and behaviors. There was wonder and curiosity about the natural world rather than fear and concerns about getting dirty outside. Students shared observations and concerns about human impact, like fishhooks and trash along the river and fish ladder, during the field trips. One student shared regular updates on the number of flood gates open on the Nimbus Dam after the fish hatchery field trip. Another student reported multiple family trips to the American River Parkway during spawning season. There were also many excited students sharing the progress of

their acorn seedlings. One seedling dried out during a hot spell in the spring, but the student didn't give up on their acorn. Early one morning a few weeks later, they requested a new name tag to rename the tree "Phoenix" since it grew a new shoot from the dried out remains. Schuttler et al. (2018) reported stronger connections to the environment and a sense of place. My students also made stronger connections with our fish and acorns. They would ponder and predict the fates of these organisms they helped raise. They would celebrate new growth, like color patterns emerging on the fish or new leaves on their seedlings.

My students took ownership of their learning throughout this study. Questions like, "is this for a grade" or "is this going to be on the test" were replaced with questions about the natural world and our impact on natural resources. They would refer to their own acorn seedlings by name as evidence in claims, and they made predictions about how the changes in the environment would impact the growth and development of the seedlings. My students were seeing themselves as part of the environment rather than being removed from it. The improvement between students and their relationship to the environment are echoed in other studies (Zárybnická et al., 2017). "I liked that we were able to benefit the ecosystem ourselves".

This study provided equitable opportunities for my students to access safe outside green spaces. When children spend time outside, they develop more pro-environmental behaviors in the future to prevent the extinction of experience and limit nature deficit-disorder (Louv, 2008; Yamanoi et al., 2021). There are future considerations to understanding this type of research within other grade levels. I would like to scaffold river day community projects for the entire middle school grade levels next year. Our school also provides some opportunities for cross division collaboration between the lower school, middle school, and high school faculty and students. Future research could focus on the impacts of working with other grade levels in lower

and high school with conservation in the community. It could benefit students to learn from high school mentors and through mentoring lower school students. Finally, I am interested in how community conservation projects could take place in collaboration with other grade level departments.

Impact of Action Research on the Author

This study helped me achieve my primary goal as a science educator, to make learning genuine and authentic. Students would crowd around their seedlings on the cart outside of my classroom every morning before school and during lunch. They would excitedly compare the growth and development of the two species of oaks. More students shared experiences with their families utilizing our local community resources, like the county parks. Multiple families shared stories about spending more time by the river watching the spawn and fishing for salmon or trout. One student shared, “I looked forward to seeing the fish and plants in class and knowing we had something to contribute to the river community.”

My students also helped inspire the next generation of scientific thinkers. Students from pre-K to seniors visited our classroom asking about the conservation projects and taking interest in our local natural resources. As acorns germinated, our space became the daily stopping point for our campus’s youngest students. One day, a list of questions – Pre-K Wonders – showed up in my mailbox for our class to answer. We created an optional committee of student volunteers to visit them and educate them about the natural history of oak trees and their importance in our community. One fourth my students chose to participate in this extra opportunity, and the pre-K students took over caring for the oak seedlings until they can be planted next year. This project also sparked the curiosity of my colleagues. Teachers of all subjects stopped to discuss local

environmental issues and organizations, offering suggestions about further collaborations and networking.

Mertler (2020) described Action Research as a process to help improve school communities. I have created a river day model that can be replicated throughout our middle school to bring community service and place-based education for more students. This would also encourage further collaboration within our science department and throughout each grade level team. These different perspectives, ideas, and resources would benefit our whole school community. The focus of my study was conservation, but there could be many other field trip themes that would support the work we are doing in the classroom. Preventing nature deficit disorder is all of our responsibility. The Action Research process helped me provide equitable access to outside green spaces and to provide opportunities for students as a social justice advocate, another benefit according to Mertler (2020).

This research study gave me the confidence to shake up most of my curriculum to use new tools and best practices acquired in the core education and elective field courses. The entire MSSE journey helped model and scaffold my research. From networking with local organizations for conservation work, to the collaboration within my own school community that happened because of this study, I have leveled up as a science educator. Mertler (2020) suggested Action Research as a tool to structure reflective teaching and connect theory to practice. After 18 years of teaching in my school community, conducting this study helped provide a structured framework to develop a meaningful curriculum. I am excited to continue building opportunities for my students to experience and in our local environment. My professional growth has not gone unnoticed. My school administrative team asked me to lead the collaborative teaching professional learning community (PLC). This will be our first experience implementing PLCs,

and I will use the Action Research process to help guide our school in improving teaching and learning outcomes through a data driven mixed methodology approach.

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APPENDICES

APPENDIX A: IRB EXEMPTION

Protocol Information

Version # 1

Reference Number	2379		
Protocol Number	2025-2379-EXEMPT		
Protocol Title	Salmon to sea under the oak trees		
Protocol Type:	Original		
Principal Investigator:	Grunst, Aleitha	Approval Date:	1/9/2026
Submittal Date:	1/9/2026	Effective Date:	1/9/2026
Author:	Grunst, Aleitha	Renewal Date:	1/9/2031
Status:	Approved	Next Review Date:	1/9/2031
Inactive Date:		Expiration Date:	1/9/2031

Figure 9. Montana state university IRB protocol approval

APPENDIX B: EGG STAGE PRE SURVEY

Egg Stage Pre Survey

This survey is to help me with my teaching and to provide feedback so I can improve my teaching. This survey is completely voluntary and the responses to this survey will not impact your grade in any way.

1. I enjoy learning about science.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
2. Science is not one of my favorite classes.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
3. I like when we go outside for science class.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
4. I like when we stay inside for science class.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
5. I like when we investigate and conduct experiments.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
6. I like when we have class discussions.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
7. I like when we have guest speakers.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
8. I like when we go on fieldtrips.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
9. My actions have a positive impact on my community.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree
10. My actions have a negative impact on my community.
 - a. Strongly Agree
 - b. Agree
 - c. Disagree
 - d. Strongly Disagree

APPENDIX C: FRY STAGE PRE ASSESSMENT

Fry Stage Pre Assessment

Part One: Sense-tences

Write a sentence that makes sense of the vocabulary words and adds context for how they are connected.

Look at the first example.

1. Surface tension, water strider, cohesion

Example: Water striders can move on top of water because the water molecules create surface tension by sticking to each other with cohesion.

2. Food web, producer, heterotroph
3. Stimulus, response, flood
4. Homeostasis, temperature, migrate
5. Adaptation, bicolor, camouflage
6. Salmon, spawn, sexual

Part Two: Concept Map

Create a concept map with all the vocabulary words. Each word can be a main idea that branches, or a linking word that connects the main ideas. Add specific evidence that demonstrates how some of these concepts are connected.

Scoring Standard:

Table 2. Fry Stage Pre Assessment rubric for assessing student science content

1	2	3	4	5
Missing examples that demonstrate understanding and missing linking words between concepts or inaccurately connecting concepts	Missing examples that demonstrate understanding and some of the linking words between concepts are accurately connecting concepts	Partial examples that demonstrate understanding and most of the linking words between concepts are accurately connecting concepts	Some specific examples that demonstrate understanding and all linking words accurately show connections to concepts	Contains specific examples that demonstrate understanding and all linking words accurately show connections to concepts

APPENDIX D: SMOLT STAGE POST SURVEY

Smolt Stage Post Survey

1. On a scale of 1-10, how would you rate our river day conservation projects?

a. Raising Chinook Salmon in the classroom

(Hated it) 1 2 3 4 5 6 7 8 9 10 (Loved it)

b. Collecting acorns to grow into oak forests

(Hated it) 1 2 3 4 5 6 7 8 9 10 (Loved it)

2. Tell me why you picked that rating.

3. I would like to do more of this type of conservation work in the future.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

4. Conservation work will directly benefit my life.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

5. My actions have an impact on my community.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

6. The guest speakers helped me understand the purpose of conservation work.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

7. I feel like I didn't learn about science from the conservation work we did.

a. Strongly Agree

b. Agree

c. Disagree

d. Strongly Disagree

8. Please rate your engagement level during the conservation work.

Not Engaged

Somewhat Engaged

Into It

APPENDIX E: ADULT STAGE POST ASSESSMENT

Adult Stage Post Assessment

Part One: Sense-tences

Write a sentence that makes sense of the vocabulary words and adds context for how they are connected.

Look at the first example.

1. Surface tension, water strider, cohesion

Example: Water striders can move on top of water because the water molecules create surface tension by sticking to each other with cohesion.

2. American River, temperature, seasons
3. Rocks, sediment, oxygen
4. Anadromous, migration, development
5. Life cycle, spawn, eggs
6. Oak trees, shade, salmon

Part Two: Concept Map

Create a concept map with all the vocabulary words. Each word can be a main idea that branches, or a linking word that connects the main ideas. Add specific evidence that demonstrates how some of these concepts are connected.

Scoring Standard:

Table 3. Adult Stage Post Assessment rubric for assessing student science content

1	2	3	4	5
Missing examples that demonstrate understanding and missing linking words between concepts or inaccurately connecting concepts	Missing examples that demonstrate understanding and some of the linking words between concepts are accurately connecting concepts	Partial examples that demonstrate understanding and most of the linking words between concepts are accurately connecting concepts	Some specific examples that demonstrate understanding and all linking words accurately show connections to concepts	Contains specific examples that demonstrate understanding and all linking words accurately show connections to concepts

APPENDIX F: TEACHER OBSERVATIONAL JOURNAL

Teacher Observational Journal

- Rate student engagement – what percent is not engaged, somewhat, into it
- How well do they understand the task – asking clarifying questions, working independently, collaborating
- Quotes or notable behavior

APPENDIX G: STUDENT INTERVIEW QUESTIONS

Student Interview Questions

1. What did you like about the conservation work we did?
2. What didn't you like about the conservation work?
3. Can you share a story about your experience at the river?
4. Do you think about your own neighborhood differently after the conservation work we did?
5. What else can you tell me that I didn't ask about?