How do Different Pedagogies, Locus of Control, and Worldview Impact the Environmental Habits of High School Students?

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Abstract

This study investigates the effect of introducing an environmental education (EE) in three classrooms (C1, C2, C3) using three different pedagogy methods and if student's personalities determine how the information is perceived. A teacher-focused classroom (C1), a student-focused classroom (C2), and a third classroom used labs and hands-on activities (C3) to identify changes in the students' perception and behavior toward the environment. A pre- and post-survey was used to identify changes in student environmental perception. An unpaired t-test was performed for each class, showing different pedagogical approaches did not significantly impact students' environmental perceptions. The student's behavior was measured by pulling recyclables out of a recycle bin and the trash daily for the duration of five weeks. Both C2 and C3 showed an increase in the students' recycling habits. The second question, “How does a high school student's locus of control affect their relationship with the environment?” was answered by comparing a locus of control survey and the post-environmental perception survey. A t-test and correlation test were performed, and no significant difference was found between the two survey means. A correlation test was also performed, and a positive, very weak correlation was found. The third question, “Does the students’ locus of control correlate with their ecocentric or anthropocentric environmental worldview?”. A locus of control survey and a worldview survey were used to answer the third question. A Pearson’s Correlation Coefficient test was performed and showed a moderate correlation between the two scores.

Dedication

This paper is dedicated to all of my friends and family who supported me every step of the way. They always understood why I could not do things with them and never made me feel forgotten; instead, they let me know all of my work would be worth it in the end. They all kept me going, even when I thought I could not. A friend and coworker, Sharon Jones, always watched my classroom without hesitation and allowed me to put my research first. Also, I thank my husband, who kept the household going and would bring me whatever I needed so I could focus on my paper.

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Chapter I. Introduction

Background of the Problem

It is not uncommon to hear something about the environment daily. It could be anywhere from hearing about global warming, an out-of-control fire somewhere in the world, above the average number of hurricanes, and flooding in one place while there is drought in another. For a high school student, those issues seem far away and out of their control; not realizing their environmental footprint contributes to the problems. Consider a well-known soda company commercial indicating it is ok to buy their product in a plastic container as long as it is recycled when done; problem solved. A high school student who has yet to have environmental education will assume a solution exists to the plastic problem and choose a product out of habit without considering the packaging. If choosing to recycle takes the same amount of energy and effort as throwing it in the trash, the product might be recycled. However, if there is no recycle bin, and as one student in the research stated during the plastic lecture, “My single plastic bottle will not make a difference,” the bottle ends up in the trash.

Even an experienced environmentalist faces difficulties with choosing a product with different types of packaging and deciding which one will do the least harm to the environment. Due to the environmentalist’s awareness of the harm caused by the packaging, they have adopted practices to minimize or eliminate its damage. These practices have been built over time with little to no environmental education during the primary and secondary school years. These environmental practices are the passion and lifestyle choice of the environmentalist, something that not everybody possesses. However, everybody will leave an ecological footprint. The complexity of environmental issues and the lack of knowledge and resources can often leave students feeling helpless and overwhelmed with no desire to adopt healthy ecological habits. Incorporating an environmental education program in school would help to ease the anxiety of building these habits. However, in a public school system, teachers are specialized

and teach only the content and grade level of their certification. In Texas, no EE certifications are issued by the state. Therefore, an environmental education course is taught by a certified science teacher. However, an interdisciplinary approach can be implemented in the curriculum to incorporate lessons from different subjects. While all teachers understand the importance of delivering accurate information, a teacher who is an environmentalist understands that anthropogenic activities influence the environment's health. Consequently, the information will remain the same, but the subject's delivery and passion will differ. Thus, the issue arises due to different pedagogical approaches. This research will take three different pedagogical approaches to three different classes, but deliver the same information. The three pedagogies used are behaviorism (teacher-centered), social constructivism (student and teacher working together), and constructivism (student-centered). The purpose is to identify how different pedagogies impact high school students' connection with the environment. The students in the study had little to no previous environmental education, which allowed them to have similar knowledge about the environment.

Environmental Education History

The Environmental Protection Agency was passed through Congress in 1970 after Rachel Carson published *Silent Spring* in 1962 (Environmental Protection Agency, 2023). Her book cultivated national awareness of environmental issues like air and water pollution. In 1990, twenty years after the enactment of the EPA, the National Environmental Education Act (National Environmental Education Act, 2023) was established after Congress ordered the (EPA) to initiate and support an Environmental Education (EE) program. According to the National Environmental Education Act, the EPA must " provide national leadership to increase environmental literacy" (EPA, 2023). Section 2 of the act states that Congress recognized the growing "environmental problems such as global warming, ocean pollution, and declines in

species diversity and that these problems pose a serious threat to human health and the environment on a global scale" (Sec. 2(a)(2)).

The government recognized that Americans must consider how they affect the environment. By sanctioning the National Environmental Education Act, the Federal Government identified the importance of implementing an environmental education program in schools but left it up to the states to decide what to do with EE in schools. Unfortunately, the states did not require schools to establish an EE program, and school districts left it up to each school to decide how to secure the students' environmental literacy. Teachers can take the time to implement a self-funded EE program in their classrooms. However, as teachers are aware, the program could quickly become costly and may be short-lived. Federal Grants are accessible through the EPA for non-profit organizations, such as schools, to undertake a large-scale EE program (Environmental Protection Agency, 2024). However, obtaining these grants takes much work and is complex and competitive. According to the EPA website, grants have been awarded to applicants at a ratio of 1:10 to 1:30. There have been 3,922 grants awarded by the EPA (Environmental Education Agency, 2021), totaling a combination of $91,483,978. However, of the 3,922, only 595 of those grants went to either a school, district, or school board. According to the National Center of Educational Statistics (2021), during the 2017/18 school year, there were 98,469 K-12 public schools in the United States, indicating that public education institutions are not applying for these grants. While other grants are available through states or private organizations, it has been observed that the government's efforts to address environmental concerns need to be revised to reach school-going children. This suggests a gap between an issue the government and educational institutions identified. This gap leaves students with an undeveloped appreciation for the environment and irresponsible environmental behavior (for example, overuse of single-use plastics, not recycling, overconsumption of goods, and overexploitation of resources). Due to the impulsive nature of teenagers, they are prone to

develop negative environmental habits and perceptions by the time they reach high school. An EE program can help mitigate this problem. A successful Environmental Education program incorporates all schools in the district, is consistent, has the support and cooperation of the administration, and goes beyond the classroom.

For this study, Environmental Education (EE) will be defined as any environmental information introduced to students that allows them to think critically and develop an understanding of environmental issues. The primary objective of EE is to promote responsible environmental behavior by equipping fundamental ecological education to improve attitudes toward conservation (Bogner, 1998) with the central goal of promoting connectedness with nature to benefit both the next generation of learners and the planet (Barrable, 2019). Since the enactment of the NEEA, environmental education has branched off into different terms. Ecological Education and Education for Sustainable Development are the most common terms. Ecological Education is the study of reducing an individual's environmental footprint. Education for Sustainable Development is studying the effects of the overexploitation of natural resources. This study will use the combination of Bogner's (1998) and Barrable's (2019) definitions of environmental education. The EE for this research followed the state of Texas's Environmental Education high school curriculum requirements and provided recycling bins.

Introduction to Environmental Education

Typically, students in kindergarten through fifth grade are exposed to environmental education. This is partially because teachers have more time to include EE in their curriculum. As students progress to middle school, EE is often left out of their curriculum. If teachers at the secondary level decide to incorporate EE into their teaching, it is usually integrated into their existing curriculum. However, many students would benefit from more exposure to EE to better understand their impact on the environment. By building a stronger connection and understanding of the effects of their actions on the environment, students are more likely to

recognize their role in preserving it. The behaviors of children and adolescents are neither stable nor fixed; instead, their experiences and teachings help develop their pro-environmental behavior patterns (Krettenauer, 2020). A lack of environmental literacy during childhood may cause adolescents to view the convenience of single-use plastics as beneficial despite their potential harm to the environment.

The utility of single-use plastics differs from person to person. However, on average, a person uses a plastic bag for about 12 minutes, yet it can take around 500 years to degrade in the landfill ("10 Facts About Single-use Plastic Bags"). Unfortunately, we live in a society that has become dependent on plastics. Students in upper secondary schools understand that plastic bottles will stay in the environment for many generations, yet single-use plastic bottles go into the trash. Students who have yet to connect with the environment will toss recyclables into the trash without a second thought. It is an “out of sight, out of mind” presumption most people have adopted. Through environmental education, students will understand that while the journey of the plastic bottle is undetermined, it will continue to break down, leach chemicals, and remain in the environment long after its disposal. In 2016, 23 million metric tons of plastic waste were introduced to the world's aquatic system, making the ocean a potential location for plastic bottle disposal (Borrelle et al., 2020).

More than introducing environmental education into the classroom is required for students to achieve responsible environmental behavior. The program that accompanies EE is the critical component to allow opportunities for students to make a connection with the environment. The program introduced into the classroom will depend on the needs of the students and the resources available to the teacher. Recycling is a standard program that can easily be added to a classroom. Adding a recycling bin in the classroom and informing students to recycle their paper, metal cans, and plastic bottles will get some students to recycle. However, recycling alone can be misleading. A misinformed individual would assume they are

doing something good for the environment because they recycle. The word recycling often connotes the symbol of three circling arrows and leads us to believe we are accomplishing a positive action. Unfortunately, not all plastics are made equal. There is a common misunderstanding of what the numbers inside the recycling symbol on plastics mean, making it difficult to know what to throw in the recycle bin and what should go into the trash. Emily Petsko (2020) found that consumers ended up “wish cycling” because they did not understand the symbols on the plastic and ended up throwing it in the recycle bin, hoping it would get properly recycled. She stated that the Resin Identification Code (RIC), of which there are seven, at the bottom of plastics does not guarantee that the plastic will get recycled. It is intended for recycling facilities to identify the type of resin in the plastic.

Additionally, Roy et al. (2023) found that the stakeholders involved in the production, selling, disposal, and recycling of plastics approached issues such as the harmful effects of plastics on the environment in a linear manner rather than a circular one. This has resulted in a lack of cooperation and clarity between the stakeholders, and they often need to acknowledge the responsibility of cleaning up the damaging effects of plastic, which leads them to shift the blame to another stakeholder. The blame usually ends up in the hands of the consumer, who is left responsible for properly disposing of the plastic. Waiting for the industry to make the necessary changes to help protect the environment will take too long, and the responsibility lies with the consumer.

Learning how to reduce and reuse plastic takes much work to implement as it requires changing habits. However, people have forgotten that recycling is the last “R” in the 3 R's when caring for the environment: reducing consumption, reusing items as much as possible, and recycling. Additionally, the recycling rules vary between cities, and most cities only accept plastics with RIC one and two. Contamination in the recycling facilities occurs when the wrong

type of plastic is included in the bin. Additionally, trash and food waste contaminate the recyclable plastics, which could ruin the entire batch and will be hauled to the landfill.

A key element in choosing a program that works for the students is the teaching style presented by the teacher. Over the years, different EE-focused pedagogies have emerged. North American Association of Environmental Education (2023) found a 200% increase in nature-based preschools between 2017 and 2022 in an estimated 800 schools in the U.S. However, data for high school students in the U.S. taking environmental education has been overlooked. Moroye (2009) found that the reasoning for this is that teachers in the US traditional public schools specialize in one subject, and most are non-environmental. She found that ecologically-minded teachers' environmental beliefs emerged naturally during their lessons, regardless of their specialty subject.

While students may understand how plastics affect the environment, they may not understand the importance of making the correct environmental changes. High school students may see that they can make a difference by introducing a recycling and environmental education program. Students' connectedness with the environment is essential to protecting their community and environment and slowing down environmental damage.

When individuals become disengaged from nature, they lose sight of its significance and role in sustaining life. Despite the numerous measures that can be taken to make Earth cleaner and more sustainable, people often prioritize convenience over environmentally friendly choices. For instance, they may grab a plastic water bottle instead of taking the time to fill a reusable one, even though plastic waste is a significant threat to our planet. However, by educating students about the vulnerability and complexity of municipal natural resources and the long-term consequences of plastic pollution, they may develop a deeper understanding of their environmental impact. Environmental education coupled with an EE program can inspire

students to make better decisions and take proactive steps to protect our planet's natural resources.

Rationale & Significance of the Study

As environmental concerns have increased throughout the years, it is important to educate students about the life cycle of the products they purchase and their impact on the environment. When students become aware of how their choices affect the environment, they can make an educated decision to make better environmental choices. For instance, there is an abundance of information available about the cautions of smoking cigarettes, yet people still choose to smoke. It is also common for smokers to be around other smokers. Whether it is due to the peer pressure felt to smoke or they picked up the habit from watching friends or family, smoking habits were adopted despite all of the warning signs. The same could be said about environmental concerns; despite all available information, students could choose not to change their behavior that would benefit the environment. However, if one student changes their habits, it may help persuade others to do the same. Education can help change the attitudes and behaviors of students toward the environment, and that is why environmental problems are educational problems (Ugulu, Yorek, & Baslar, 2015). Through EE, students could actively participate in solving environment-related problems, understand the relationship between humans and their interactions with the environment, and gain appropriate behaviors to protect the environment. Also, to keep students engaged in the curriculum, it is equally important for teachers to become environmentally literate by attending Professional Development that is focused on EE. This will ensure that they are adequately prepared to teach the information.

Purpose of Study

Over the years, several studies have examined the benefits of environmental education (EE) programs at the primary school level. These studies have consistently

demonstrated that such programs can positively impact children's habits and perspectives toward the environment. However, there remains a gap in our understanding of the effects of implementing EE programs in high schools. This is where a mixed-method study can prove helpful. This study aims to identify any changes in high school students' behavior resulting from the introduction of various EE and recycling programs. By doing so, the study seeks to determine whether such initiatives can effectively influence students' beliefs and behaviors toward the environment. Additionally, the study aims to identify the students' locus of control (internal or external) and their worldview (ecocentric or anthropocentric) and how these factors relate to the recognition of environmental education. It is important to note that high school students are generally more resistant to behavioral changes than younger children as they already have established notions about the world around them, and their habits and personalities have been developed. This study seeks to determine if high school students can develop new habits and what impact their personalities have on such changes. While researchers have studied students' locus of control or worldview separately, little research has been conducted on both. Therefore, this study considers both to identify if there is a correlation between the internal locus of control and ecocentric worldview and a correlation between the external locus of control and anthropocentric worldview. This study will also provide valuable insights into the effectiveness of EE programs for high school students. It will also help us understand how high school students' beliefs and personalities affect their response to environmental education. Ultimately, the study's findings can inform the development of more effective EE programs that target high school students.

Theoretical Framework

Current literature agrees that great teachers have similar qualities, including respecting students, using evidence-based instructional strategies, strong leaders, and compassion for their students (Benekos, 2016; Mears & Docheff, 2010; Stein, 2020). Based on

the summation of the literature, competent educators' objective is to establish a meaningful link between their pupils and the subject matter they are presenting. This mixed-method study examines whether different pedagogical methods will impact a high school student's environmental perception. As mentioned earlier, the purpose of environmental education is to have students make a connection with the environment. Over the years, many different nature-based education programs have emerged. Research has demonstrated that when students are taken outside to learn, they have a better experience (Sprague et al., 2022), better attitudes (Collado et al., 2020), and retain information better (Vaughn et al., 2003) than a traditional classroom setting. Place-Based Education (PBE) uses a unique concept where the purpose is not only to connect students with the environment but also to have students recognize the importance of the resources found in their community (Gruenewald & Smith, 2010). PBE looks different in every "classroom" because not every town has the same needs and resources. Sobel (2004) takes it a bit further and describes place-based education as

"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. Community vitality and environmental quality are improved through the active engagement of local citizens, community organizations, and environmental resources in the life of the school." (p.6)

Sobel's (2004) definition is the most relevant to the design of this study due to the emphasis on improving community vitality and environmental quality. While using Place-Based Education as a framework for this study would be ideal, the school where the research is taking place does not allow students to leave the building during school hours. Instead, this study's

main objective is to find ways for students to connect with their environment and community by combining different nature-based environmental education as a lens for the theoretical framework. The parameters of this study were conceptualized as the vital component of teaching to connect.

Research Questions

The primary aim of this study is to investigate the extent to which the implementation of an Environmental Education (EE) and recycling program may impact student behavior. The research aims to comprehensively explore three key questions of interest:

1. How do different pedagogies in Environmental Education impact high school students' recycling habits?
2. How does a high school student's locus of control affect their relationship with the environment?
3. Does the students' locus of control correlate with their ecocentric or anthropocentric environmental worldview?

By answering these questions, the study seeks to provide valuable insights into the effectiveness of EE and recycling programs in promoting sustainable behavior among students. A mixed-method approach is most appropriate to answer the questions due to the different instruments required. Quantitative measurements will be taken by comparing the different types of recyclable material from the recycle bin versus in the trash bin. This will help to identify any behavioral impact (BI) the environmental education had on high school students. Qualitative measures will be taken to determine if there is any change in the student's perspective toward the environment. This will be accomplished through the use of surveys. The initial survey will be distributed on the first day of the five-week data collection period. The second survey will be distributed on the final day of the collection period.

Definition of Terms

To address the first research question, it is essential to provide a clear definition of the term "impact". The purpose of this study is to identify two distinct types of impact that may arise after the implementation of environmental education. Specifically, this research aims to investigate any change in students' perception of the environment, as well as the change in their behavior towards the environment.

Within the scope of this research, it is imperative to explore two fundamental concepts: the locus of control (internal and external) and worldview (ecocentric and anthropocentric). It is essential to provide clear and concise definitions of these terms to ensure a comprehensive understanding of their relevance to the study.

The term "Locus of Control" refers to whether individuals internalize the events happening in their lives (something they did to themselves) or if external factors cause the events. There are two types of locus of control: internal and external. Engqvist and Nilsson (2014) described this concept as an internal locus of control that occurs when people hold themselves accountable for the events that happen in their lives, while an external locus of control occurs when individuals attribute external factors as responsible for the events.

Thompson and Barton (1994) proposed a classification system for worldviews, which categorizes them into two main types: ecocentrism and anthropocentrism. The ecocentric worldview values nature for its own intrinsic worth, independent of its usefulness to humans. Those who hold an ecocentric worldview believe that nature has its own inherent value and should be preserved and protected for its own sake. The anthropocentric worldview, on the other hand, places value on nature solely for its utilitarian or material benefits to humans. Those who hold an anthropocentric worldview believe that nature exists primarily to serve human needs and desires, and that its value is determined solely by its usefulness to humans.

This classification system can be a helpful tool in understanding the different perspectives people may have regarding nature and its significance. By recognizing the underlying values and beliefs that shape these worldviews, we can better understand why people may hold certain attitudes towards the environment and the natural world. This, in turn, can help us work towards finding common ground and developing effective strategies for protecting and preserving the natural world for future generations.

Subjectivity & Researcher Positionality

From the late 1970s to the early 1990s, the United States was at its peak in environmentalism. Big issues like the depletion of the Ozone layer, the disposal of contaminated soil in North Carolina's rural areas (Ayers, 2020), and the publication of *Silent Spring* (1962) helped to bring awareness to environmental issues. These issues carved a pathway for environmental education to be taught in schools from the 1980s to the early 1990s. The researcher, then in middle school, was exposed to these issues at an early age which led to an over two-decade advocate for the environment. The researcher recalls having environmental discussions and watching videos of environmental degradation in the classroom. One video in particular that stood out was regarding the overflowing landfills. The footage of human-generated waste was the defining moment of environmentalism. Taking partial responsibility for the overflowing landfills helped the researcher realize that they wanted to be part of the environmental solution and not part of the problem.

Ten years later, while volunteering at a sea turtle research hospital, the researcher was exposed to further desires to protect the environment. Through this experience, the researcher encountered both inspiring and distressing events that intensified environmental concerns. Many of the endangered sea turtles entering the hospital had been injured by boats, entangled in fishing wire, or had fishing hooks in their mouths. A memorable experience was performing a necropsy on a Kemp's Ridley sea turtle (*Lepidochelys kempii*) and removing a

plastic bag from its mouth. During another necropsy, a sponge-like material was removed from the throat of a Hawksbill sea turtle (*Eretmochelys imbricata*). Both of these sea turtles are endangered species and protected by the Endangered Species Act of 1973. The findings of foreign objects in the body cavities of the sea turtles evoked the thought of whether the plastic bag and sponge were the intentional or accidental results of improperly disposing of waste. It is reasonable to assume that the offenders were unaware that their waste would end up in a sea turtle's body, ultimately causing its death.

The researcher's experiences are different from most, with everything starting from a video shown in school. While unable to recall receiving any additional environmental education beyond that video, it left an indelible impression, resulting in a significant attitude and life change to improve personal awareness and positive environmental contributions. It is unclear why the researcher was more influenced by the video than other peers and if they would have been affected had they received more environmental education.

Being an educator for ten years, the researcher has been incorporating environmental education into daily activities and discussing experiences, opportunities, and environmental lifestyle habits with high school students. Unfortunately, many schools in the area do not have a comprehensive environmental education program. When nearby schools were asked if they had any EE programs, their response was often "Of course," followed by a gesture towards the recycling bins.

Taking all of their experiences, the researcher seeks to find the extent of environmental education needed for high school students to make environmentally conscious decisions. Additionally, the researcher would like to investigate whether the student's personality traits (i.e., locus of control and worldview) play a part in recognizing and adjusting their environmental habits.

This study will attempt to understand what type of personality is more susceptible to making environmental changes in their lives. Also, will high school students change their environmental habits once they understand the impact of their ecological footprint, or are their environmental practices solidified. Two important aspects that must be included in EE is that one person cannot make a difference, and it is hard to change habits. Through proper EE, however, students can learn that it is not just one person doing the work; they would be joining millions of people who work hard every day to make the change. The researcher has found that people are natural followers after witnessing a positive action. If one person is seen making a change, then it is likely that others will make the change as well.

Chapter II. Literature Review

In the field of environmental education, it is essential to recognize that students need guidance on how to contribute to a better environment. However, they often need to be made aware of how they can accomplish this change and taught that their actions will make a difference. Research has shown that empowering students to recognize their control over their behavior and the long-term value of their actions is crucial for fostering positive changes (Mannetti et al., 2004).Therefore, if a student is to make an environmental change, they must understand they have a choice, can change their habits, and value the environment. To implement effective environmental education programs in schools, it is important to engage students in activities that foster a connection with the environment. Nature-based education, upcycling materials for art projects, and outdoor experiences have been identified as effective methods for achieving this connection (Otto, 2017; Girak et al., 2019; Lankenau, 2016).

Utilizing students' past experiences and emotions to build environmental literacy has been found to be a highly effective approach. Past experiences and values play a significant role in shaping students' environmental literacy and learning outcomes (Barbaro, 2016; Borg et al., 2019; Gravoso et al., 2002).

A well-studied (and most effective) approach for students to connect with the environment is using their past experiences to build on environmental literacy (Barbaro, 2016). When asked, students used their own past experiences, emotions, and values to describe how they related to their environment (Borg et al., 2019). Gravoso et al. (2002) showed that students' environmental literacy learning outcomes depended on their prior experiences, which the researchers found helped shape how they would approach the new information. From the 119 college students tested, the authors found that inter-relating learning approaches had a positive outcome. The learning approaches included collaborating learning experiences with real-life situations and knowledge construction. However, students who approach learning by only absorbing the information or using surface learning can negatively affect their learning outcomes. Also, Boerschig and Young (1993) found that inter-related learning approaches help to promote positive behavioral changes in the environment when the knowledge of issues, action strategies, and action skills are included in the curriculum. Another study stresses the importance of using past information to teach new information (Myhill & Brackley, 2004). The researcher video-recorded 54 class sessions in South England. The recordings were then coded for the number of times a teacher used the student's prior knowledge to teach a current lesson. The research demonstrated that when a teacher employs their prior knowledge to connect the students with their environment, it is quintessential that the connection is tangible to the students. The "obvious connection" to the teacher may not necessarily be apparent to the student.

Before 2013, literature indicated a gap in understanding how to apply a workable environmental policy in the school system (Aikens et al. 2016). While the policy gap is still evident in recent literature, studies have shown that a good development plan and relationship between staff and students will help build a successful EE program (Ahbabi,2018). Additionally, Rotas' (2019) study in Toronto, Canada, in a public school with children ages 4-12, noted the

importance for teachers, staff, administrators, and students all involved in starting an EE first to put together a policy they could all follow. It is also important to reevaluate the policy every couple of years to ensure it aligns with the school's vision.

Meeuseen (2014) found a generation gap in parents' inability to pass environmental habits on to their children. However, Vaughan et al. (1999) found that parents' environmental literacy and habits increased when their children brought home environmentally friendly habits that they had learned in their EE classes at school. When it comes to making environmental life changes, children can significantly impact their parents. Current research does not indicate why children have a higher environmental impact on their parents but demonstrates the importance of a successful environmental education program in the school.

This study aims to expand on previous research that has exhibited positive outcomes for implementing an effective environmental program in schools. Based on the current literature, it has been identified that three significant components are essential for ensuring the success of an environmental education program. Firstly, having a solid policy framework that outlines clear objectives, targets, and guidelines for the program is crucial. This policy should be well-communicated to all stakeholders involved in the program, including school administrators, teachers, and students. Secondly, students should be encouraged to connect strongly with their natural surroundings through hands-on learning opportunities like field trips and outdoor activities. This connection can instill a sense of responsibility and appreciation for the environment among students. Finally, it is imperative to understand the long-term benefits of the program and its impact on the school community. Program benefits could include identifying the potential improvements in student academic performance, school culture, and overall community well-being. Considering these three components, the study aims to provide a comprehensive framework for establishing and maintaining a successful school environmental education program.

School policy

Despite how much a school would like to implement an environmental program, without a strong policy to support it, the environmental education program can weaken and unravel over time. Aikens et al. (2016) research showed that since the 1990s, many articles focused on teaching and learning EE but not on how to develop a strong policy. The study indicated that regardless of how well the EE was taught, teachers showed low compliance when policies were weak and unclear. Teachers have also stated they do not have enough time to implement it into their overcrowded curriculum. The authors analyzed 215 research articles with different methodologies from 71 countries that were published between 1974-2013. The qualifying criteria for the articles to be considered for the study included articles that were policy-focused research in the area of environmental and sustainability education. Quantitative analysis was conducted through the application of methodological and geographical trends, while qualitative analysis was performed using content-based themes. The authors identified two reasons that drove a school to develop an EE policy. The first factor was the need to educate students in sustainability education, specifically focused on climate change and the prevention of natural disasters. The second was the school had a desire to align with international environmental education policy. The reviewed literature indicated that several whole-school sustainability policies had difficulty implementing the program due to teachers refusing the policy or viewing it as not mandatory and unimportant. The tension between sustainability education and core subjects increased in schools with unmandated policies because teaching sustainability took time away from preparing students for examinations. Overall, teachers in the Akins et al. (2016) study still indicated an interest in implementing environmental education policies as long as the policy made time in their current work and received proper training.

A successful environmental education program policy is built with the collaboration of teachers, students, and administrations (Rotas, 2019). The qualitative research focused on building a strong policy and observing not only how the elementary school-aged children responded to the introduced program but also how the teachers responded. The policy the researchers developed consisted of how teachers would allow students to explore their environment without intervening with the children as they play with various objects. Included in the policy was what they deemed “Supporting Play.” Supporting Play was when the teachers were observing the students play, they were to watch first to see what was going on, wait to see if there was any actual risk, move closer to see if children would manage the situation differently, and finally, if there is an actual danger for the child, they are permitted to intervene without shutting down the play. This encouraged teachers to rethink their supervisory role and allow students to explore their environment how they see fit, as long as the child was not in any danger. The Canadian-based research found, through observation, that the children questioned their environment and thought of possible outcomes to solve different problems. Once the teachers allowed students to explore on their own and allow their curiosity to lead their learning, the students were more involved in their education and were more inquisitive about their surroundings.

It is also important for a strong policy to include proper training for teachers because, regardless of the subject, if teachers are not prepared to teach a section of the curriculum they will often leave the information out of their lessons (Crim et al., 2017). As teachers are receiving their certification in their chosen field, the Texas-based researchers indicated many college institutions leave out EE in their coursework, leaving new teachers unprepared when entering a classroom. Crim et al. (2017) found that in a nationwide survey of 211 teachers out of 748 (28% response rate), 85% of the 211 teachers reported their state either did not offer or did not know if their state offered any form of licensure in environmental education. Of the responding

teachers, 62% were from public institutions, and 38% were from private institutions of higher education, both of which offer multiple degrees, certifications, or licensure. Teachers indicated the institution they attend for their teaching certification did not inform, did not encourage, or did not discuss the possibility of acquiring licensure in EE. Even when an institution offered a license in EE, 70% of the respondents indicated the institution did not recommend a license in EE. Additionally, 57% of the programs in the institutions recommend that future teachers do not receive endorsements in EE, and less than 15% of the teachers were required to take courses related to EE while taking their classes. Once in their classrooms, many teachers admitted to only partially including EE into their curriculum, most of which occurred at the elementary level. More than half of the respondents reported that there was no structured approach within their school for the inclusion of environmental education (EE) into educator preparation programs (EPPs).

Just as students need the support of their teachers, teachers need the support of the administrators to succeed. Ernst (2012) surveyed 287 K-12 U.S. teachers to explore what influences administrators have when supporting teachers in an environment-based education (EBE). Environment-based education is a pedagogy that uses the environment as a framework to combine subjects and real-world learning experiences. The researcher found that when administrators supported environmental education, teachers had a strong influence and attitude on the programs as well. Ernst (2012) found:

Positive environmental attitudes, environmental sensitivity, and receptiveness to EBE are important in efforts to encourage administrator support for EE, whether EBE or other forms of EE. Professional development, such as mentoring, observations, conferences, and self-study, as well as reducing the obstacles of safety/liability concerns, appears to be particularly important when encouraging administrator support for EBE. (p.73)

With the support of the administrators, schools were more successful when carrying out the policy. When people are inspired by others, it motivates them to do better. Researchers investigated the success of an environmental and conservation program implemented in a Colorado school district in the Rocky Mountain area (Schelly et al., 2012). The qualitative case study collected data by attending focus groups consisting of teachers, staff, and students, individual interviews, and observation of the classrooms and the school as a whole. Along with a policy to support the programs, the school found they were able to better teach EE through modeling positive environmental behaviors for the programs. Teachers and staff modeled behaviors such as recycling, turning lights off when the room is not in use, or reminding students to do things like recycling. The researchers also found there was a strong relationship between the students' attitudes and behavior towards the environment. The main facet that drove the successful program was the collective support of the principal, teachers, and students, also reminding others to communicate the expectations of the whole school about being environmentally conscious. What made the program successful was the policy implication. According to the policy, teachers had to receive proper training in teaching EE courses, and everyone played the vital role of expecting others to follow the policy and not allowing the expectations to deteriorate over time. The principal is the primary leader and role model for teachers and staff. Teachers are essential role models for students, and students are role models for each other. Synergism is important for teachers, students, and administration to ensure the success of an EE program.

Reid (2020) found that the problem with some environmental policies is schools have diluted the policy to the extent that it is no longer effective. He explains that the reason for this is that environmental education not only tries to educate students but also attempts to change their habits, which is a difficult task. He concluded the best way to get this accomplished is to have an EE policy that is just as strong as the policy for other subjects to intertwine the

ideas and practices of the school. A strong policy should also include teachers and administrators demonstrating positive environmental habits. For example, they could use less single-use plastics and make an effort to recycle.

Connecting students with the environment

For an environmental change to occur, the student needs to make a connection with their environment. Some students, however, need clarification about the environment and whether or not they can make a difference. Ugulu et al. (2015) indicated that when students had misconceptions about the environment and were enrolled in a recycling education program (REP), the misconceptions about the environment increased. A quasi-experimental design model for the research consisted of a sample size of 68 high school students in a Turkish province. Students in the experimental group took the Ecosystem Ecology Conceptual Understanding pretest, and 62% of the participants correctly defined the water cycle. After the REP, 72% of the students correctly defined the same test. However, 38% of the students who answered incorrectly for the pretest had a 4% increase on the posttest. The students' fallacies about the environment increased after REP was introduced. This study suggests that students' environmental misconceptions must be corrected to help them understand environmental issues. The researcher also indicated that as teachers or administrators introduce an environmental program into the school, it is important to be aware of any misconceptions the students may have because eliminating their misconceptions will allow them to have a better understanding of their environment and be able to make a connection and change their behavior.

To begin making changes in someone’s behavior, it is first important to understand their beliefs. Wynveen et al. (2012) wanted to understand the change (if any) a college student experiences after a study abroad program. A group of 623 college students from ten different U.S. universities participated in the study. The students traveled to Australia or New Zealand

between 2008 and 2009. The Study Abroad courses at each of the universities all had similar visions for the courses, which were to “modify their values, promote pro-environmental behaviors, and change the way they viewed themselves, the world, and their role as an Earth Citizen” (p.339). The school’s program hoped to accomplish this through working in a classroom, doing fieldwork, service learning, and learning about and attending cultural activities. The researchers used qualitative measures by utilizing a pre-survey given to each student on the first day of their program and a post-survey on the last day of the program. The pre/post-test was a questionnaire on a 7-point Likert Scale; one strongly disagreed, four neither agreed nor disagreed, and seven strongly agreed. The researchers had six separate categories they were testing. All six categories indicated an increase in the student's environmental awareness at the end of their study abroad experience. The highest increase was in the Ecological Conscious Consumer Behavior category. The mean for the pretest was 4.04 with a .87 Cronbach’s alpha level of reliability. The post-test had a mean score of 5.14 and a .92 Cronbach’s alpha level of reliability, indicating good internal consistency. The student's experience while studying abroad consisted of fieldwork and working with the environment, which allowed them to make an environmental connection. Students who choose to study abroad and have the opportunity to do environmental field work indicate they already have some kind of connection with the environment. Hungerford and Volk (1990) call this behavior environmental sensitivity. The researchers have identified environmental sensitivity as an entry-level variable, the first of three variables that help predict environmental behavior change. The second is the ownership variable, which requires in-depth knowledge and personal investment in environmental issues. The third is the empowerment variable, which is using their expertise and building environmental skills and strategies. Environmental sensitivity helps describe how quickly someone can connect with the environment. While not everyone will make the

connections, this study indicates that when people are sensitive to the environment, they are more likely to make a connection and change their behavior.

Another way students can make a connection with the environment is through the use of art. A method called A/r/tography was used as a lens for research to see if students would question their ecological footprint through the use of art with discarded materials (Girak et al., 2019). A/r/tography combines art, research, and teaching to identify if art encourages the practitioners to a moment of self-reflection. The Australian researchers aimed to find out if twelve-year-old students would develop a greater awareness of their carbon footprint by making art using materials headed to landfills as a way to connect with the environment. During the ten-week study, the researchers interviewed twenty 12-year-old students. The first interview was conducted during the first week of the project, the second during the fifth week, and the third and final interview during the tenth week of the research project. Students' names were not revealed. Instead, students were given a distinct code to identify their independent answers throughout the interview process. A thematic analysis was conducted to determine if specific patterns or themes emerged from the interviews. The majority of the students reported experiencing positive attitudinal shifts towards the environment and expressed enjoyment in utilizing various mediums for their projects. As the project concluded, the students had a better understanding of the unsustainability of their actions. They discussed implementing self-initiated lifestyle changes to reduce their ecological footprint for themselves and their families. The utilization of materials that would have otherwise ended up in a landfill taught the students that their actions can have a significant impact on the environment.

The scope of a person's moral circle could be used to predict how a person might accept environmental changes. One study found a person's moral circle is positively associated with pro-environmental activities (Bratanova et al., 2012). The study consisted of sixty-nine women with an average age of twenty-six. To measure the participants' moral circle, they were

given a list of 28 living and non-living things. They were then asked to circle the things they felt morally obligated to protect. The more they circled, the larger their moral circle. The study showed the willingness of a person to make environmental changes could be predicted by the size of their moral circle, but only if they feel it would make an impact on the environment. However, if they did not feel their change would positively impact the environment, the size of their moral circle was not a factor.

Another factor that has been found to connect students with the environment is having a field-based curriculum. Breunig et al. (2013) found that through a field-based curriculum, students acquire connections with the environment. The Canadian-based school consisted of roughly 950 students who spent 75% of their school day outside learning about the environment. The data collected was derived from a focus group that consisted of 13 students who were interviewed and asked questions about their knowledge, attitudes, and actions toward the environment. The students' values, beliefs, and emotions also play a large part in how and what they see and experience and whether they decide to act. While students made the environmental connection, many failed to see a real-world application. The research was done to identify why some human values played a part in connecting to the environment while others did not and what part the person's locus of control plays (Engqvist & Nilsson, 2014). The study consisted of 92 participants,73% female, of students and employees in a Swedish university. A four-part questionnaire was used to measure the participant's locus of control, self-transcendence, pro-environmental behavior, and some background information. Using hierarchical regression analysis, the researcher found a positive correlation between self-transcendent and pro-environmental habits as the participants' locus of control moved from external to internal. However, if the participant had a high self-transcendent value, then the participant’s locus of control did not play a part in their environmental behavior, and they considered it their responsibility to care for the environment.

Benefits of Environmental Education

Parents play an essential role in the students' environmental literacy. Meeusen (2014) surveyed 3,426 students along with their parents to identify if the parents affected their child's environmental habits. The students were approximately 15 years of age and attended one of 61 randomly selected secondary schools in Belgium. The study found that in households where parents had environmental concerns, their children did not have the same intensity for the environment, indicating a generation gap. However, an important finding was that the more parents spoke to their children about the environment, the more their children cared for and protected the environment.

Vaughan et al. (1999) found an added benefit of having environmental education in schools: not only do the students increase their ecological literacy (71%), but so do their parents (38%). The study included 60 3rd and 4th graders and their parents in Costa Rica. The participants were given a pretest and two post-test questionnaires for four weeks. One post-test was given immediately after the data-gathering period, and the second was given eight months later to identify how much information was retained. Students retained 67% of the information, while the parents retained 52% of the information.

When students do think about how they affect the environment, Maurer and Bogner (2019) found when studying a student's personal views towards the environment, they saw themselves as anthropocentric but felt people, in general, should have an ecocentric worldview. The study consisted of 464 Swiss German first-year college students. The students were given a questionnaire that consisted of three open and two closed questions. The researcher found that students are essentially putting the responsibility on others to care for the environment. However, there was a moderate correlation ($r=0.48$) between the participant's connection with nature and human perception, demonstrating when their connection increased, so did their human perception while their self-perception decreased.

Students do not reject the idea of an environmental education program in their schools. A study showed that when EE was implemented in a school, students had positive feelings toward EE (Ardoin, 2017). A meta-analysis using 119 peer-reviewed studies found that 94% of the articles showed that students had positive feelings towards EE. The remaining 6% of the articles indicated no change in the students' feelings toward the environment. When the articles were broken up into domains, 81 addressed the students' positive knowledge of EE (98%). Within the behavior domain, 83% of the 24 articles had a positive outcome. Another common theme in 50 articles was that students had an increase (94%) in positive feelings towards non-environmental outcomes such as academic, civic, social, personal, and health after implementing an EE program. One researcher found that low-income students have been shown to have improved health-related quality of life and inspired curiosity through the introduction of nature-based education and STEM education (Sprague et al., 2020). The participants consisted of 122 children ages 10-15 in an urban low-income area. The data collection time was fifteen weeks, and the students were given a survey on the first day of the class and then again on the last day. At the end of the fifteen weeks, the researchers found that the students' overall health improved in physical, emotional, school, social, and family functioning. Darner (2009) also found when students are active participants in the environmental learning process, they have a greater chance of incorporating it into their daily lives. The author of the study discovered that when students are environmentally educated, they do more for the environment. However, the study also found that every individual deals with information differently. For example, one student can choose to recycle because it is good for the environment, another will do it for some benefit (money, convenience, others may be recycling), and yet another will choose to not recycle at all.

When students are involved in an EE program at the beginning of high school and college years, there is a strong intention toward future environmental involvement (Ernst et

al., 2015). The quasi-experimental study consisted of 103 students in the United States who attended the Student Climate and Conservation Congress Program (Sc3). The Sc3 is a week-long program in which students train to become leaders for their community to inspire change and help combat the increasing climate temperatures. All attending students received an invitation to participate in the study, and ninety-eight respondents were part of the data collection. The respondents were entering 8th-12th grade. Each participating student took a pre/post-5-point Likert scale survey to identify their future involvement in environmental action. The mean score for the survey was 4.41, with a standard deviation of 0.5, indicating high future involvement.

Education Theory

How a student receives information depends on the teacher's pedagogy. Kurt and Sezek (2022) did a study in two schools in the Provence areas of Turkey to find if there was a correlation between different teaching methods and studying strategies to predict academic achievement. The study focused on teaching cell division and force and energy to 185 seventh graders. The students were grouped in classrooms with the different teaching methods of Multiple Intelligence, Peer Instruction, Problem-Based Learning, Combined Group, and Comparison Group. Each student was given a survey to identify their learning strategy. The different study strategies were Metacognitive, Critical Thinking, and Scientific Process. The researchers found a highly significant correlation between problem-based learning and Critical Thinking ($r=.54$, $p<0.05$).

Environmental education is usually incorporated into core subjects rather than a class on its own, leaving many teachers unprepared and often misinformed about the environment (Rickinson, 2001). However, there is a link between science educators and wanting to incorporate EE in their curriculum. Rickinson (2001) conducted a critical analysis report of 110 publications in the field of environmental education. The study investigated learners' learning

and when learning occurs in primary and secondary schools. The 110 articles chosen by the author were published between 1993-1999. A common theme throughout the research was that there was a distinction between science educators and environmental educators. Both teachers taught the information; however, the science teachers provided possible solutions for environmental problems using the scientific method. The study also showed that despite their best efforts, many teachers had misinformation about the environment, which was passed on to their students. Additionally, Osborne et al. (2003) indicated that teachers play a vital role in determining the student's perception of subjects. If a teacher does not like science, the dislike will be evident during their instruction. However, This does not mean that teachers certified in different fields would be unable to properly teach or are uninterested in EE.

The teacher has to take great care when teaching any subject, especially science (Stone, 2020). A study developed at Northern Arizona University found that teachers felt pressured to teach only the required curriculum from the state. The mixed-method research consisted of 79 students in two science classrooms from two different schools. Classroom A was in one school and consisted of 27 students, while classroom B was in the second school and consisted of 52 students. Qualitative measures were done through observation and interviews of Classroom A and Classroom B for a total of 23 hours over ten weeks. The observations and interviews were then coded to identify any themes within the collected data. Both classrooms were taught in a traditional school setting where direct instruction was primarily delivered. Teachers followed the curriculum, leaving no time for students to ask questions or engage in conversation, ignoring the students' innate curiosity. The researcher wanted to know what happens when students begin to question the teacher's science information. The author called this type of questioning "primal inquiry" where students are allowed to question, explore, and be creative with the scientific information being taught. What the researcher found, in both directly taught classrooms, students were not allowed to question or explore their surroundings,

leaving most of the students from both classrooms disengaged and uninspired in science. The only time students showed interest in science was when they were able to pick, research, and make a project with any topic they chose.

Summary

When individuals are presented with an opportunity to improve, they tend to make an effort to do so. It is human nature to want to progress and achieve better results. However, achieving such progress can be a significant challenge without the necessary knowledge and understanding. This is particularly true when it comes to learning and education. If a student lacks the fundamental knowledge and skills required to excel, it becomes challenging for them to perform well or improve their performance. Therefore, it is essential to provide students with the necessary tools and resources to help them learn and understand better, enabling them to achieve their potential. The responsibility should not just be left up to the parents. Caring for the environment and having eco-friendly habits is something that should be done both at home and reinforced at school. That is why environmental problems are educational problems (Ugulu et al., 2015). Education helps to change the attitudes of students towards the environment. Through environmental education, students could actively participate in solving environmental-related problems. Students can understand the relationship between themselves and their interaction with the environment and gain the appropriate behaviors to protect the environment. This could not be accomplished without a well-written policy that includes the collaboration of administrators, teachers, and students (Rotas, 2019). Having different opportunities to make a connection with the environment written directly in the policy will ensure teachers and students are consistent.

Having environmental education in the classroom not only helps the student to become more environmentally literate but also helps increase environmental literacy in their parents. Children take home the habits and information they learned about the environment and

encourage parents to make changes. Before having EE in the classroom, parents and children may have felt their actions would not have an impact on the environment. They learn that they can make a difference and begin to change their habits, and it is probable that they will continue these habits in the future.

How a person is taught is just as important as what they are taught. When students are placed in a Problem-Based Learning classroom and use critical thinking to complete lessons, students get the most out of their learning experience. This is also true with an environmental education program. It is important to allow students to ask questions throughout the lesson and be encouraged to think critically. However, care must be taken if the teacher does not know or is unsure how to answer a question. When students receive wrong information, it is more likely that it is what they will remember.

Chapter III. Methodology

The purpose of this chapter is to introduce the methodology for this mixed-method research. By using both qualitative and quantitative data, the researcher will be able to utilize strengths from both methods. The researcher intends to find whether or not different pedagogies impact high school students while teaching Environmental Education. The term “impact” will be investigated using two separate approaches. The first approach will examine the impact of the students' environmental perspective after the various teachings. The environmental impact will be analyzed using each classroom's pre/post survey. The second approach will be the behavioral impact students have towards the environment after the different types of teachings. The behavioral approach will be measured by collecting the plastic and metal cans in the recycle bin from each classroom and comparing them with the plastic and metal cans found in the trash.

Additionally, the researcher would like to determine the role the students' locus of control and worldview play in the student's ability to develop environmental literacy and ability to change ecological habits. The study is designed to understand better the students' relationship with the environment and what curriculum will motivate students to make environmentally friendly choices. Furthermore, this research seeks to find if there is a correlation between the ability to acquire environmental literacy in the students' locus of control and their worldview. This chapter will describe, in detail, the process taken to ensure the validity and reliability of the research.

Research Questions

1. How do different pedagogies in Environmental Education impact high school students' recycling habits?
2. How does a high school student's locus of control affect their relationship with the environment?
3. Does the students' locus of control correlate with their ecocentric or anthropocentric environmental worldview?

Research Design

This study will use a mixed-method approach to answer the research questions. By utilizing the mixed method approach, the researcher can combine the strengths of both methods (Ross & Onwuegbuzie, 2010). A limitation of quantitative research is that it does not consider the participant's motivation and attitude (*Organizing Your Social Sciences Research Paper,* 2021). The qualitative method will help to eliminate that limitation by taking the participants' motivation and attitudes towards the environment into consideration through the use of the survey.

The term “impact” must be defined to answer the first research question. The impacted change's primary meaning is the student's perception of the environment. Quantitative data will be collected to identify the environmental education that affected the student's behavior most. Environmental education will be introduced to three classrooms. The ecological education curriculum will meet Texas Essential Knowledge and Skills for Texas schools for Science concepts in chapter 112.37, titled Environmental Systems for high school, which is the standard required curriculum in Texas. The curriculum and material in the lesson plans will be the same for each classroom and act as the study's independent variable. For group C1, a curriculum will be provided, limited to the standard curriculum approved by the state of Texas for high school credits. This classroom was chosen as it will function as the control group for this experiment. The curriculum will be taught to group C1 using a teacher-centered instructional strategy, which will help evaluate the effectiveness of any changes made to the other two classrooms that use a student-centered instructional strategy. Additionally, after each lesson, the teacher will allocate 5-10 minutes for question and answer time, where students can clarify doubts or ask any questions regarding the lesson. The extra time will help ensure that the students clearly understand the lesson and can learn at their own pace without confusion.

The second curriculum encourages students to think critically about how human activities can impact the environment. The curriculum modification for C2 will involve incorporating topics related to environmental issues and discussing their potential causes and effects on a broader level. At the end of each lesson, students will have the opportunity to have an open discussion on this topic. They will be encouraged to share their thoughts and insights on how humans can affect the environment and what steps they can take to help mitigate the negative impact. This discussion will last 5-10 minutes, giving students ample time to express their ideas and engage in meaningful discourse. The idea is to instill a sense of responsibility and stewardship in students toward the environment.

Modifying the third curriculum aims to instill a sense of environmental responsibility and use critical thinking skills among students. The curriculum will be presented to the students in C3, and they will be encouraged to consider how their actions directly or indirectly contribute to the degradation of the environment to gain a deeper understanding of the topic. Gaining a more profound understanding was accomplished by asking students to brainstorm ideas and discuss possible solutions to environmental issues during each lesson. The brainstorming allowed students to have an open discussion. It encouraged students to think creatively and engage in constructive dialogue, be part of the learning process rather than only participating at the end of the lesson, and allow the students to drive the discussion and lesson to give them more control over their interests.

The timeframe for the data collection period will take five weeks. Lessons will be taught on Tuesday and Thursday for thirty minutes each day. The total time students will be receiving instruction will be five hours for the duration of the data collection period.

RQ1: How do different pedagogies in Environmental Education impact high school students' recycling habits?

The first question will be answered using two different methodologies due to the different definitions of the word impact. The primary question being asked is if the various teaching methods will impact the student's perception of the environment. Two surveys will be used to measure the student's perception of the environment. The first survey is the Environmental Perception Survey 1 (EP1) and will be distributed on the first Tuesday of the data collection period before the lesson begins. On the last Thursday of the data collection period, after the lesson is completed, students will be given the Environmental Perception 2 (EP2). Both surveys have the same questions. However, EP2 has three open-ended questions that allow students to discuss any changes they think they will make after receiving environmental education. Students will be asked to write their names on the survey to identify any change in

their perception of the environment by comparing the pre-and post-surveys. A key will be used to answer the questions on the survey.

Access to Google Sheets would only be allowed by entering a username and password for the researcher's email and Google Drive. To ensure the validity of the student's answers, a second teacher will compare hand-graded surveys and make sure the data was entered correctly into Google Sheets. If any errors are found, the researcher will make the corrections. Since the answer key for the survey is straightforward, there should be no disparities between the researcher and the second teacher. The hard copies of the surveys will stay securely locked in the researcher's classroom in a cabinet to which only the researcher has access.

The second part of RQ1 will identify the extent of the student's behavioral impact that may occur after receiving different environmental education methods. Before the first day of instruction, one recycle bin will be placed in each classroom. All of the recycle bins will be visible to the students and will be placed near the teacher's desk. The student's behavioral impact will be measured by tallying the plastics and metal recyclables from each classroom's recycle and trash receptacle at the end of each day. The researcher's objective is to collect all the recyclable plastic and metal materials from three classrooms. The recyclables will then be sorted through the contents of the recycling bin of each classroom, and the plastics and metals will be tallied and counted separately. The trash bins will also be examined to identify any recyclable materials. Finally, all the recyclables will be collected, counted, and properly recycled.

RQ2: How does a high school student's locus of control affect their relationship with the environment?

This question aims to identify if the student's locus of control plays a part in the extent to which the student makes environmental changes. To answer the second question, Julian

Rotter's Locus of Control (1966), which will be identified as SV1, will be distributed during the third Tuesday of the data collection period. Students will be asked to write their names on the survey, which will be scored according to the key. The results will be recorded on Google Sheets. The percent change of the environmental perception survey (EP1 and EP2) from RQ1 will be compared to the student scores of SV1.

RQ3: Does the students' locus of control correlate with their ecocentric or anthropocentric environmental worldview?

To address the third question, SV2 will be distributed on the fourth Tuesday of the data collection period. The primary objective of this survey is to determine whether the student's worldview leans towards ecocentrism or anthropocentrism. In order to identify their worldview, each student will include their name on the survey. The survey will be assessed based on the corresponding key. The resulting worldview of each student will be compared with their score from the locus of control survey to discern the presence or absence of a correlation between the two. The two surveys are descriptive, meaning that they aim to provide a detailed snapshot of students' LOC (Locus of Control) or worldview. It is important to note that there is no cause-and-effect relationship between the variables measured. For this reason, no direct or indirect variables are considered, ensuring that the results obtained are purely descriptive in nature. This approach allows a more accurate and objective understanding of the student's worldview.

Participants & Sampling Technique

The research will be conducted in a charter high school in central Texas. Before the first day of the data collection period, recycle bins will be placed in each of the classrooms and clearly labeled. The school has five classrooms; each room can hold twenty-five students. The three classes used for this research will be the freshman, sophomore, and junior classrooms. The participants are chosen for convenience as it is the researcher's place of

employment. The students enrolled on the first day of the data collection period will be considered active participants in the study. Due to the turnaround of student enrollment, any student who enrolls in the school after the study begins will not be included in the study. To get a clear progression of the student's perception of the environment, only the students that stay throughout the data collection period will be part of the study.

The school currently serves 120 students in grades 9-12 and between the ages of 14-19. According to the school demographics, 55% of the students are female, and 45% are male. The schools' race is 88% white, 10% Hispanic, and the rest of the population is a combination of African American and Asian. Approximately 20% of the student population is in the Special Education program, and 14% is part of the 504 program. The 504 program assists students with learning disabilities who do not qualify for the Special Education program. The rest of the students are part of the general education population.

There are a total of ten faculty and staff members in the school: five teachers, a secretary, a special education teacher, an aide, a nurse, and one director. The faculty and staff consist of eight females and two males all with an average work experience of fifteen years. Their ages range from twenty-two to sixty. This study will focus on the environmental progression of the students, and the only role the teachers and administration will have is to explain the purpose of recycling bins. They are not to push students to recycle; students will make their own choices.

Ethical Considerations

Ethical considerations will be taken throughout the research. The safety and well-being of every student will be the researcher's priority. One issue that could potentially arise when working with students is unintentionally revealing a student's name or identity without their consent. This will be avoided as best as possible by fully disclosing the intentions of the

research to the parents. Beneficence will be taken at every step to ensure the students' respect for privacy. No names will be published in the research that could identify any one particular student. Students will be asked to put their names on the surveys to identify the EE's impact on the participants. Once the researcher has collected all the data needed, all surveys will be scanned and uploaded to a USB flash drive that only the researcher can access. Once uploaded, the surveys will be shredded to protect the student's identity. All data will be stored on the same USB flash drive and will be kept for three years. Students will not be forced to do anything to make them feel uncomfortable. To ensure the validity of the research, students will not be persuaded to participate. The researcher and all that are involved will adhere to the AERA Code of Ethics to ensure the safety and integrity of the students and the research.

The integrity of the research will be done through a methodical approach to the collection of data. To ensure the number of recyclables is taken accurately, two people will work together and double-check the calculations.

Instrumentation & Data Sources

Four surveys will be utilized to address the three research questions. The first two surveys are aimed at gauging any changes in the students' environmental perception and will be instrumental in answering RQ1. The initial survey, pre-Environmental Perception (EP1), will be administered on the first day of data collection, while the second survey, post-Environmental Perception (EP2), will be conducted on the last day of class instruction. The surveys are almost identical, except for the last three open-ended questions in EP2. The surveys were developed by the researcher based on Kelley et al.'s (2003) practices and recommendations to keep the tools simple and appropriate for the intended respondents. The survey consists of ten questions that ask students about their level of concern for environmental issues such as recycling, pollution, global warming, and endangered animal extinction. The questions are phrased in a way that is easy to understand and answer for high school students.

All questions start with "How concerned are you with..." and have the same answer options. The survey should take about three minutes to complete. During the 2021/22 school year, a pilot study was conducted using a cohort of students who were not part of the current research. The pilot study aimed to identify any issues with the clarity or strength of the survey questions. Four questions were rephrased or changed because they appeared too lengthy for high school students, too closely resembled other questions, or were not relatable to high school students. The new survey was distributed to the same students participating in the pilot study to gather feedback. After the second pilot study, the researcher determined that the survey was fit for the research.

Rotter's Locus of Control Survey will measure the locus of control. The survey was obtained through the University of Wisconsin Research Center. Julian Rotter developed it, and the survey has been well-studied. According to Haggbloom (2002), Julian Rotter ranked number 18 in the 25 Most Frequently Cited Professional Psychological Journal Literature with 3,001 citations. Julian Rotter (1966) describes a person's locus of control as how a person perceives whether a reward or reinforcement is either contingent on their behavior (internal) or is controlled by external forces that are outside of their control (external). Rotter’s final locus of control survey consists of 29 forced-choice questions, which include six filler questions to make the test ambiguous to the participants. Rotter did a one-month test-retest reliability period and found a one-drop point in the means of the second administration of the test, which is satisfactorily correlated with other methods. Rotter’s locus of control survey was chosen for its validity and simplicity. The importance of simplicity is that high school students will be taking the survey. The survey must be short enough for the students to keep their attention but long enough to get accurate data. For this study, Rotter's locus of control survey will be identified as SV1 throughout the research. It is a twenty-nine-question survey where the participant chooses a scenario they agree with the most. The survey will then be scored to identify if the students

have an internal or external locus of control. This survey will help to answer the independent variable of RQ2 and RQ3. The students will only take this survey once during the research as it is expected that individuals' locus of control does not change. Another questionnaire, SV2, will be given to the students to identify whether they have an ecocentric or anthropocentric worldview. According to Cocks and Simpson (2015), anthropocentrism is described as a person's attitude that is based on the value of nature's benefit to humankind. Also, protecting the environment ensures that future generations of humans can enjoy nature for recreational purposes rather than for intrinsic value. Cocks and Simpson (2015) also describe ecocentrism as a person’s attitude that sees humankind as a part of nature and not above it. They also describe ecocentrism as nature having intrinsic value, which is independent of its value to humans. The questionnaire used for this study has been used in multiple previous studies to identify whether a person is ecocentric, anthropocentric, or numb to the environment. One study, in particular, was done by Gagnon and Barton (1994), who found that the survey was able to predict conserving behaviors, apathy for environmental issues, and whether or not someone is associated with any environmental organizations. The survey is based on questions that help identify which classroom students lean more toward an ecocentric or anthropocentric worldview. The five-point scale survey gives the choices of strongly agree, agree, neutral, disagree, and strongly disagree. Twelve of the questions are ecocentric, and the environment positively affects their life and their appreciation of nature. Another twelve of the questions are anthropocentric and are concerned about nature because of how it affects humans. The last nine questions on the survey are apathetic questions, and the person does not care about nature either way and feels the environmental issues are exaggerated. The survey will be handed out during the fourth Tuesday of the data collection period.

Data Collection Procedures

All of the students involved in the research will be chosen out of convenience. The students are enrolled at the charter school where the researcher is employed. The data collection time will be five weeks during the 2022/23 school year. The EP1 will be distributed on the first Tuesday of the data collection period and EP2 will be distributed on the last Thursday of the data collection period. The purpose of distributing the EP1 at the beginning of the five weeks and then EP2 at the end is to identify if the students' environmental perspective was impacted after EE. The students' answers will be scaled from 0-4. A scale of zero will indicate the student needs a better environmental connection. A score of two would indicate a fair connection, three indicates a good connection, and four is an excellent connection with the environment. A second person will be trained on how to scale the surveys, and they will independently score. The researcher and the second person will compare scores to ensure they match.

The locus of control survey will be distributed during the third week of the data collection. Depending on the answers the students choose will indicate their locus of control. A high score will suggest an external locus of control, while a low score on the survey will suggest the student has an internal locus of control. The survey is not environmentally based and will not affect the environmental education lessons.

The worldview survey will also be distributed to the students during the third week. The students will answer the eight questions to indicate their worldview. Each survey will be scored using the corresponding rubric. Every question will be ecocentric or anthropocentric and scored 1-4. The lower number indicates a more anthropocentric worldview towards the environment. The students could get a score between 0 and 40. The higher score represents that the student has more of an ecocentric worldview.

The primary objective of the researcher is to collect all recyclable plastic and metal materials from the recycling and trash bins of three classrooms. The process entails entering Classroom 1 (C1) and carefully sorting through the contents of the recycling bin. The

researcher meticulously removes every recyclable item from the bin and places them on a nearby table. Plastics and metals are counted separately, and the researcher makes a tally of each item. All the recyclable items found in Classroom 1 are then put into a large sack.

Next, the researcher proceeds to examine the contents of the classroom trash bins, with a particular focus on identifying any recyclable plastics and metals. Once again, any recyclable items found are placed onto the table, counted, recorded, and added to the same sack. This sequence of tasks is then repeated for Classroom 2 and Classroom 3, with the researcher carefully examining the contents of each recycling bin and trash can. At the end of the process, all the recyclable plastic and metal materials are collected, counted, and recorded.

Finally, the researcher ensures that all the collected recyclables are appropriately recycled to minimize any environmental negative impact.

During the initial two weeks of the collection period, students will not receive any communication regarding the availability of the recycle bin or be requested to recycle. In situations where students inquire about the bin, it is recommended that teachers inform them that they have the option to recycle if they choose to do so. In the final three weeks of the collection period, classroom announcements will be made to prompt students to remember the recycle bin.

The environmental education curriculum will follow the Texas Education Knowledge and Skills (TEKS) to find if students are impacted by the introduction of EE. The concepts will follow §112.37. Environmental Systems Science concepts. The student will learn the interrelationships among the resources within the local environmental system. The student is expected to:

(A) summarize methods of land use and management and describe their effects on land fertility;

(B) identify the source, use, quality, management, and conservation of water;

(C) document the use and conservation of both renewable and non-renewable resources as they pertain to sustainability;

(D) identify renewable and non-renewable resources that must come from outside an ecosystem, such as food, water, lumber, and energy;

(E) analyze and evaluate the economic significance and interdependence of resources within the environmental system, and

(F) evaluate the impact of waste management methods such as reduction, reuse, recycling, and composting on resource availability.

Recyclable materials will be gathered from each classroom and measured on a weekly basis. To accommodate time constraints, the focus of the study will be on the measurement of plastic and metal cans. Any paper, cardboard, or waste will be disposed of in the appropriate manner, either through recycling or the trash bin. The researcher will thoroughly examine each classroom's trash bin from Monday to Friday during the data collection period, singling out any plastics and metal cans for daily tallying. The recorded data will be kept separate from the recyclables in the recycle bin. The objective is to compare the amount of recyclables found in the trash bin with those found in the recycle bin, with the aim of determining the extent to which students recycle versus how much they discard. The collection of recycling material is intended to identify any changes in student behavior arising from the introduction of a recycling and environmental education program.

Data Analysis

The first research question asks whether environmental education impacts high school students. This study intends to identify if the introduction of EE in a high school will

impact the student's perception of the environment and if it will impact the student's responsible environmental habits. To identify if the student's perception of the environment is affected after the introduction of EE will be answered by distributing the EP1 at the beginning and the EP2 at the end of the collection period. Students will be asked to write their names on the survey to find out if there is any difference in their scores. The scores of the pre-and post-test of the survey will be compared using a paired t-test with alpha =.05 to identify if there was any impact on the student's perception of the environment after the introduction of environmental education. However, in the event that enough students do not write their names on the survey and not enough names are written on both surveys, an unpaired t-test will be done instead.

Identifying if the introduction of EE will impact a students environmental behavior, recyclables will be collected on a daily basis during five weeks of instruction. The recyclables will be collected from the recycle bin and trash bin. Throughout the research period the mean number of recyclables from the recycle bin will be compared to the mean number of recyclables found in the trash. This data will be analyzed to identify if the rate of student recycling is increasing or decreasing as environmental education is introduced. A simple linear regression analysis will be done on both the plastics from the trash and the recycle bin.

To answer RQ2, the locus of control survey will be distributed to students during the second block of the collection period. It will be scored and recorded on Google Sheets. The difference between the students' pre- and post-tests of the EPS will be recorded, and the mean will be calculated. The mean of the LOC and EPS will be compared using a paired t-test with alpha=.05.

To answer RQ3, the ecocentric/anthropocentric survey will be distributed during the second block of the data collection period. Once complete, the survey will be scored and recorded on a spreadsheet. The mean of the scores will be calculated. A paired t-test with alpha=.05 will be applied using the locus of control survey calculated from RQ2 and the

ecocentric and anthropocentric worldview survey to identify any differences between the two groups.

Assumptions

To ensure an impartial perspective, the study will be reviewed by individuals who do not possess expertise in the field. Moreover, the study will be crafted to facilitate its reproducibility, thereby enhancing its reliability and validity. This methodical approach will enable other researchers to scrutinize and corroborate the study's findings in the future.

Trustworthiness

The trustworthiness of this study is of utmost importance, as it will serve as the foundation on which its findings will be based. The study will collect surveys and data with the approval of both the dissertation committee and chair to ensure validity. Furthermore, the researcher will seek approval from the Institutional Review Board (IRB) to ensure that the study respects the rights and welfare of all participants involved.

The data collection period will be planned and executed with care to ensure that the study's findings and research questions are adequately addressed. The researcher will utilize their extensive experience of more than twenty years in studying environmental issues to ensure the study's credibility. The researcher will remain impartial and allow the data to speak for itself without imposing any preconceived expectations on the study's results.

To ensure a neutral and unbiased perspective, the study will be reviewed by individuals who are not experts in the relevant field. Additionally, the study will be designed to be replicated, thus ensuring its reliability and validity. This approach will facilitate the study's reproduction in the future, allowing other researchers to evaluate the study's findings.

Chapter IV Results

This research investigates potential shifts in high school students' perspectives on the environment following five weeks of environmental education using three distinct teaching approaches. Alongside assessing students' ecological views, the study will explore whether their perceived control over environmental issues will impact their willingness to embrace ecological change. Additionally, the investigation aims to uncover any links between a student's locus of control and their ecological values, including whether they prioritize nature for its intrinsic worth (ecocentric) or its practical benefits to humans (anthropocentric). Both quantitative and qualitative research methods will be utilized to address these research questions. Chapter III discusses, in detail, the methodology and design to answer three research questions:

RQ1: How do different pedagogies in Environmental Education impact high school students' recycling habits?

RQ2: How does a high school student's locus of control affect their relationship with the environment?

RQ3: Does the students' locus of control correlate with their ecocentric or anthropocentric environmental worldview?

Three different classrooms were chosen for this study to present the different pedagogies used to instruct the environmental education curriculum for five weeks. The Texas Educational Knowledge and Skills (TEKS) is the required curriculum for Texas. This curriculum was used to build lesson plans and deliver instruction to each classroom.

Instrument Validity and Reliability

Four instruments were used to answer the research questions. The first two surveys, EP1 and EP2 (see Appendix C), were developed using Kelley et al.'s (2003) recommendations

to help ensure validity and reliability. Additionally, a pilot study was conducted during the 2022 school year, where EP1 and EP2 were handed out to get the student's perspective. Students pointed out any inconsistencies, which helped clarify the questions. The Locus of Control (LOC) is the third instrument used in the research. It is assessed through Rotter's survey, which Julian Rotter developed. Locus of control refers to an individual's perception of whether a reward or reinforcement is based on their behavior (internal) or controlled by external factors beyond their influence (external). Rotter also conducted a test-retest reliability study over one month, which found a minor one-point decrease in means during the second test administration.

The fourth and final survey was designed to gauge the environmental views of the students, specifically to identify if they hold an ecocentric, anthropocentric, or apathetic perspective. The survey's ability to predict environmental behavior has been demonstrated by Thompson and Barton (1994). The questionnaire consisted of 33 questions, divided into three categories: 12 ecocentric questions, 12 anthropocentric questions, and nine apathetic questions. Ecocentric questions measured nature appreciation and the student's perception of the environment's benefits. Anthropocentric questions were intended to measure the students' perception of the environment's impact on human beings. Finally, apathetic questions were included to determine the proportion of students who demonstrated a lack of interest in nature.

The survey was administered to all students, and the data collected was analyzed to identify the students' environmental views. The results were expected to aid in developing programs and initiatives that would encourage environmental awareness and behavior within the student population.

Student Characteristics and Population

The Texas-based high school is one of 54 campuses around Texas. The schools are fully accredited and focus on credit recovery and credit acceleration. The school follows a

personalized learning style. Personalized learning characteristics include students learning at their own pace and demonstrating domain proficiency before moving on. Due to the school being self paced, a hardworking and dedicated student can acquire up to ten credits in one year, more credits if they get permission from the school board. The town has two Independent School District (ISD) high schools. The first school has a student population of 2,340, while the second school has 1,949 students. The research was conducted in a school that has an average of 90-120 students. This school has a smaller population and is attractive to students who find it difficult to cope in larger instructional settings. The school has a high turnaround, with an average capacity of 66%. At the time of the research, there were around 80 students. The school's model does not allow for student interaction, as there are no classroom changes during the day. Two classes have students for six hours, and two have students for four hours.

On the first day of the study, 89 (55.5% female and 38.1% male) students were enrolled. Students are divided into classrooms by their age and grade. The first classroom was labeled Classroom 1 for the study and, from this point forward, will be called C1. The C1 classroom had a maximum capacity of 20 students. At the time of the study, 15 students were assigned to classroom 1. However, of those 15 students, only 12 completed two or more surveys. This classroom held primarily first-year students and some sophomores with an age range of 14-16 with an average age of 14.8. The attendance requirements were Monday through Friday, 8 am to 2:30 pm. The lead teacher had been in education for six years, two of which had been at this school.

The second classroom was labeled Classroom 2 for the study and will be identified as C2 from this point forward. The max seating capacity for C2 classroom was 25 students, and only 20 were assigned to classroom 2 at the time of the study. Fifteen students out of the 20 assigned to C2 filled out two or more of the surveys. The classroom held some sophomores but mostly juniors. The age range for this group was 15-18, with an average age of 16.5. The

students in C2 attendance requirements were Monday through Friday, 8:00 am to 12:00 pm. The lead teacher for this classroom had been employed by this school for one year and had not previously worked in the education field.

The third classroom was labeled Classroom 3 for the study and will be identified as C3 from this point forward. At the time of the study, C3 had a max capacity of 20 students, with 11 students enrolled and eight students completing two or more surveys. Classroom 3 student classification was mainly juniors but mostly seniors aged from 17-20 and an average age of 18.5. The students in C3 had four hours of attendance requirements. Classes began at 12:30 and ended at 4:30 pm Monday through Friday. The lead teacher for C3 was the same teacher for the second classroom.

The researcher was the lead teacher for the fourth classroom. To avoid any bias, the fourth classroom was excluded from the research. The researcher discussed environmental issues with the classroom during the classroom morning meetings. A recycle bin had been in the classroom since the first day of school. Students in this classroom were encouraged to recycle and were educated in proper recycling methods according to the city recycling requirements. The teachers in C1, C2, and C3 were not certified in any teaching content. In Texas, teachers in a charter school are not required to have a teacher certification but must obtain at least a bachelor's degree. Both teachers held a master's degree from an accredited college.

Pedagogical Approaches and Instruction

During the five-week study, five environmental education topics were introduced. The environmental topics presented were ecosystems, natural resources, energy flow, population, and natural environmental changes. A lesson plan was designed for each topic. For C1 and C2 the weekly lesson plan was divided up to be delivered Tuesdays and Thursdays for 30 minutes, including time for questions. The lesson plan for classroom three was designed to have

instruction time on Tuesday and a lab on Thursday and leaving time for open discussion on both days. The lessons were delivered using Google Slides. The presentations for each classroom were similar, aside from the last slides, which consisted of additional questions for C3 to dive deeper into the topic.

Three pedagogical approaches were used to deliver the environmental information to the students. Classrooms one and two had instruction delivered on Tuesday and Thursday for 30 minutes. Classroom 1 took on a teacher-centered approach. Google Slides was used to deliver the based lessons. Students were asked to hold their questions until the end of the lesson so the teacher can get through the lesson. The presentation lasted roughly 27 minutes, giving students the opportunity to ask questions for clarity and understanding for the remaining three minutes. Classroom 2 was a combination of teacher and student-centered approach. The Google Slide presentation was delivered in roughly 23 minutes, leaving the last seven minutes for students to have an opportunity to ask questions and dive deeper into the content. They were allotted extra time during the open question session. Students were also asked to reflect on the environmental topic and discuss which anthropogenic activities related to the lesson were advantages or disadvantages to the environment.

The third classroom (C3) was designed to help the student connect with the environment. Due to the constraints and limitations of the school, using Place-Based Education was infeasible. In an attempt to make a connection with the environment, each lesson addressed a local environmental area and how its unvarying regulations and usage could affect the future community. On Tuesdays, the main points of the environmental topic were presented to the classroom. Specific time limits were not set aside to deliver the lessons. Instead, only objectives and key terms were presented. Open discussion was encouraged, and students were allowed to lead the conversation and lesson. Thursdays were dedicated to addressing an environmental area in the community and tying it to a hands-on lab.

Week 1

The first week of instruction was the ecosystem. Before starting instruction on day one of the study, the teacher read the implied consent form to the classroom. A copy was also sent home to each student so that parents could have an opportunity to ask the researcher questions. No parents contacted the researcher. Students needed to be made aware of what the researcher was investigating. However, they were told the topics to be discussed. The pre-Environmental Perception Survey is also distributed on the first day of the study. The students in each classroom took an average of five minutes to complete the form. On the second day of the study, the teacher was ill and unable to present, and no data was taken.

Classroom 1

During the first week of instruction, C1 students were quiet and attentive except for the second day, when they seemed more restless, and instruction was interrupted several times. The teacher noted that the students needed help understanding the nitrogen and carbon cycle within an ecosystem. At the end of each day, students did not have any questions.

Classroom 2

During the lesson, the students were attentive but struggled to grasp the interrelations of the carbon and nitrogen cycles. When prompted to discuss ways to protect the local rivers, one student suggested refraining from using them as restrooms, while another proposed recycling or properly disposing of waste. However, a second student expressed skepticism towards recycling, claiming that it ultimately ends up in landfills and thus serves no purpose beyond creating a false sense of environmental responsibility.

Classroom 3

During the first week of C3 instruction, the class was remarkably silent but attentive for both lessons. The instructor noticed that students did not have any questions or try to dig deeper into the topic at the end of the lessons. On the second day of the instruction, the class was divided into four groups, which included three groups of three and one group of two. The instructor provided each group with materials such as soil, rocks, moss, and small animal and tree toys and asked them to build a mini ecosystem. The groups were instructed to create the ecosystem they wanted and then explain how everything played a part in the ecosystem. Two of the groups included animal toys lying down, which indicated that the animals had died and their bodies were decomposing. The students did an excellent job explaining the cycle of the ecosystem they built. The instructor then asked if wearing sunblock and entering the river would affect ecosystems. One student responded, "I had never thought about that, but yeah, all of the people in the river tubing every summer wearing sunblock, there has to be some effect." Overall, the class was engaged and understood the concept of ecosystems well.

Week 2

The topic for week two was natural resources. The lesson's purpose would be for the student to understand the interrelationships among the resources within the local environmental system. The students were to evaluate the impact of waste management methods such as reduction, reuse, recycling, upcycling, and composting on resource availability in the local environment. By the end of the lesson, students will be able to understand the importance of conserving our natural resources. Furthermore, students will know the proper procedures for residential recycling within the city recycling division. The presentation began with an explanation of the different types of natural resources and the differences between renewable and non-renewable energy. For C1 and C2, air and water were discussed in detail on Tuesday, and on Thursday, soil and oil were discussed, along with the source of city water and air quality.

Classroom 3 received a condensed version of the presentation on Tuesday and on Thursday, did a lab on the tragedy of the commons.

Classroom 1

During week 2, C1 had no comments or questions at the end of either lesson. Local aquifers were discussed as the city's main source of water. The extraction, cleaning, and delivering of the water used in homes was explained. Some of the students were quiet and attentive throughout the lessons, while others were quiet but drawing or working on schoolwork. It was unsure if they were paying attention or focusing on what they were working on.

Classroom 2

In week 2 for C2, before starting the lesson, the students appeared disengaged at first, but became interested as the topic about the caves and caverns was discussed. During this lesson, the local karst aquifer and recharge zones were discussed. Central Texas has a unique watershed that includes caves, caverns, and underground rivers. They were surprised to hear the water from the Edwards Aquifer is naturally filtered through the karst limestone and marble rock (Smith, 2016). Water from the aquifer is extracted and exported to a wastewater treatment plant, where it is treated and delivered to homes. Upon hearing this information, students became more engaged in the lesson. A short video of an exploration of the Edwards Aquifer's caves was shown to the class. After the video, students became more engaged and interested in how water from caves gets to their houses. One student said they did not know where we got our water and took it for granted, while another student mentioned they would have liked to be made aware of the caves and the delicate ecosystems it support.

Classroom 3

On Tuesday of week two, all of the information given in other classes in two days had to be delivered in one. Critical information was discussed while focusing on the local aquifers

and recharge zones. Students were attentive and focused on the information. One student asked, "Isn't our town growing fast? What is going to happen if we run out of water?" Another student indicated the unfairness of whether someone is knowledgeable and actively protecting our water while others, knowledgeable or not, will not protect our aquifers or limit their water usage. On Thursday, the lab done was the Tragedy of the Commons. Students were in groups of three and used candy to represent fish. Students could "fish" for themselves and "family" during the first round without regulations. The fish left in the pond doubles at the end of each round until all the "fish" are gone. The purpose of the lab is so students can understand what happens with our natural resources when there are no regulations. Each of the groups ran out of "fish" at different times. One group finished in three turns, and one student said, "I saw everyone getting the fish, and I got worried that my family would starve, so I fished for as much as I could, thinking the other fisherman would take as much as they could for their family." The ponds were replenished, and students could fish again for their families. This time around, students did not overfish, and the pond was not depleted from "fish." When asked what was different this time, one student said, "When we all worked together and only took what we needed, it was clear we would not run out."

Week 3

The topic for the third week was energy flow. The content standard for this lesson was for students to know the sources and flow of energy through an environmental system. The lesson's purpose is for the student to understand and explain the flow of heat energy in the ecosystem, including conduction, convection, and radiation. The student will also be able to identify and describe how energy is transformed and conserved as it flows through the ecosystem. At the end of the lesson, the hope is that students will be able to describe how energy flows through our environment using conduction, convection, and radiation. Additionally,

students will be able to explain how humans can disrupt the natural energy flow. This lesson will be delivered by using Google Sheets Monday through Friday and not to exceed 30 minutes.

Classroom 1

In the third week, C1 students were quiet yet appeared attentive. During both days of the lecture, students were asked if they had any questions or comments. There were no comments, and students were allowed to return to their regular school work.

Classroom 2

During the third week of lessons, it was observed that C2 and C3 displayed similar levels of progress. Although the students did not initially voice any questions, the subject of bioaccumulation arose during a discussion about unidirectional energy flow. As the lesson continued, one student asked about the near extinction of the California Condors (Gymnogyps californianus). The discussion of bioaccumulation of pesticides, metals, and chemicals builds up as it moves up the food chain. As the conversation continued, students appeared to grasp a more comprehensive outlook of how bioaccumulation impacts the environment and contributes to the near extinction of the condors.

Classroom 3

During the third week of data collection, students in C3 were quiet yet attentive on Tuesday. On Thursday of the same week, an energy flow lab took place to help the students understand how bioaccumulation occurs as a contaminant moves up the food chain. The lab started with four opaque 24 OZ containers, three containing uncontaminated water, while the fourth containing water and small grain sand, which was contaminated. Twelve students participated in the lab and were divided into three groups, each representing a trophic level. Group one consisted of six students who were primary consumers. The second group comprised four students who were secondary consumers, while the final group consisted of two

students who were tertiary consumers. The lab began with group one randomly selecting one of the 24 OZ opaque containers, shaking it up, and pouring 0.33 cups into their 16-ounce opaque container. Group Two would then randomly choose one student from Group One to "eat," and group three would choose someone from Group Two to "eat." Students with empty containers would get refills. This process would continue until the tertiary consumer's containers were full. At the end of the lab, students weighed the sand from the tertiary consumers to determine the amount of bioaccumulated contaminant.

Week 4

Students learned about the population in the fourth week of the data collection lesson plan. This lesson aimed to help students understand the relationship between carrying capacity and changes in population and ecosystems. Students used graphical representations to compare and contrast exponential and logistic population growth. Furthermore, students were taught to identify factors affecting carrying capacity, such as disease, natural disasters, and availability of food, water, and livable space. By the end of the lesson, students were expected to be able to identify the impact of surpassing the carrying capacity of the ecosystem on the environment, as well as how the human population can alter the earth's carrying capacity. The lesson was delivered through Google Slides from Monday to Friday, and each session lasted at most 30 minutes.

Classroom 1 and Classroom 2

Both C1 and C2 remained silent during week four's lessons and had no questions or comments. Although many students in both classrooms were attentive and quiet, some were found to be engaged in other activities, such as working on their school assignments, having quiet conversations, or drawing.

Classroom 3

During the fourth week of data collection, the students in C3 exhibited quiet behavior. At first, it was uncertain whether or not they would participate in the lecture. However, once the lesson began, many students became attentive, actively listened, and participated. For the Thursday lab, the students played an online game called Avril Gulf Tuna Population Simulation, where they adjusted different variables that could affect the tuna population. After playing the game, the students discussed why they thought the scenario played out as it did. They gave reasonable grade-level responses to explain the different variations of populations.

Week5

The lesson for the fifth week was natural changes in the environment. The goal of this lesson is for students to comprehend that while there are natural cycles in the environment, how could humans interrupt the cycles? The students will understand and explain how regional changes in the environment may have global effects. They will also be able to understand and analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures. The anticipated outcome for this lesson was for students to be able to explain how temperature inversions have short-term and long-term effects. Students will also be able to analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures.

Classroom 1 and Classroom 2

During the final week of the data collection, C1 and C2 students did not engage during or after the lesson. Once the lesson was completed, students returned to their regular work.

Classroom 3

During the fifth week of data collection, the students in C3 were attentive but did not ask any questions. However, on Thursday, they were given an assignment to explore natural

changes happening in the environment using a website created by the Science Education Resource Center at Carleton College (2024). The students remained engaged with the website for the entire class period. The purpose of this lab was to allow the students to explore various topics related to natural changes in the environment that they found interesting. Although the students did not share the information they discovered, the activity served as an opportunity for them to learn and gain more knowledge about the natural world.

Research Question 1

How do different pedagogies in Environmental Education impact high school students' recycling habits?

This study evaluates two methods by which environmental education can impact a high school student. First, the study will measure if five weeks of environmental education will impact a student's perception of the environment. This will be done by using the EP1 and EP2 surveys to measure any changes in the student's perception of the environment. Second, the study will evaluate if environmental education will impact the classroom's responsible environmental behavior. This impact will be measured by implementing a recycling program in each classroom.

Perception Impact

Three different teaching styles were introduced to separate classrooms to determine if teaching styles impact a student's environmental perception. Classroom 1 (C1) adopted a teacher-centered approach, where students received instruction every Tuesday and Thursday through Google Slides and various videos. Students were encouraged to ask questions only in the last few minutes of each session. Classroom 2 (C2) followed the same schedule as C1 but added an additional five minutes to the end of each session to provide students with ample time to ask questions and obtain more in-depth knowledge of the curriculum. In C1 and C2, students

were instructed to hold their questions until the end of the lecture and were not encouraged to ask questions during the class. In contrast, Classroom 3 (C3) only had a lecture on Tuesdays. On Thursday, the students participated in a lab that corresponded with the lecture presented the previous Tuesday. The purpose of the labs was to provide students with a different learning style to promote a deeper understanding of the environmental topic and an opportunity to connect with the environment. The labs were designed to be different every week but always related to the topic of the lecture. This approach was aimed at increasing student motivation and enjoyment during the learning process.

Classroom Findings

The three classrooms in the study received the Environmental Perception Survey 1 (EP1) on Tuesday of week one and the Environmental Perception Survey 2 (EP2) on Thursday of week five. Students from all three classrooms were asked to write their name on the surveys to compare their pre and post scores and identify whether or not the environmental education presented affected the students perception of the environment and inspired a change in their perception of the environment. A total of 59 students completed at least one survey. Twenty-one students from all three classes completed both the EP1 and EP2 surveys. However, only eight students completed the EP1 survey while nine students completed the EP2. Since the missing survey scores were nearly evenly divided and it was known what classroom each student belonged to, all scores were entered into the corresponding classrooms and an independent t-test was performed. The pre and post survey scores were entered into Google Sheets and the function formula feature was used to perform the t-test.

Classroom 1

An independent t-test was calculated to identify any difference between a student's EP1 and EP2 surveys from C1. Table 1 shows the descriptive statistics between the two

surveys. An unpaired, two-tailed t-test was conducted using Google Sheets. All groups were assumed to be normally distributed. To test for normal distribution of the two surveys a Shapiro-Wolk test was calculated and did not show a significant deviation from normality W(22)=.98,p=.91. The results of the t-test indicated the teacher-centered pedagogical approach did not have a significant impact on students' environmental perceptions t(20) = .11, p = .91.

Table 1

Environmental Impact for Classroom 1

	N	M	SD	P-Value
EP1	11.0	28.2	7.7	
Ep2	11.0	27.8	7.9	
				0.91

Note. N=number of students who took the survey. M=mean value. SD. standard Deviation
t(20)=.11

*p<.05

Classroom 2

The impact of introducing EE into Classroom 2 by using the pedagogical approach of combining teacher and student-centered instruction was tested by comparing the scores of EP1 and EP2. An independent t-test was conducted to investigate if there is any difference between the EP1 and EP2 surveys completed by the students. Table 2 represents the statistical results of the EP1 and EP2 surveys. A two-sample independent t-test was calculated using Google Sheets. All groups were assumed to be normally distributed, which was supported by calculating the Shapiro-Wilk test W(21) =.96,p =.434. The EP1 survey scores collected from eleven

students (M = 25.5, SD = 8.1) compared to the ten who returned the EP2 survey (M = 22.6, SD = 12.9) stated that different pedagogical approaches did not significantly impact students' environmental perceptions, t(19) = .61, p = .55.

Table 2

Environmental Impact for Classroom 2

	N	M	SD	P-Value
EP1	11.0	25.5	8.1	
Ep2	10.0	22.6	12.9	
				0.55

Note. N=number of students who took the survey. M=mean value. SD. standard Deviation
t(19)=.61

*p<.05

Classroom 3

Classroom 3 used a pedagogical approach that is intended to encourage a deeper understanding of environmental education and attempt to make a connection with the environment. This idea is supported by Otto and Pensini (2017), who found a direct relationship between environmental knowledge and connecting with nature. Despite their findings, the statistical analysis of EP1 and EP2 indicated no significant changes in the students' environmental perception after completing EE. Table 3 the descriptive analysis of both surveys for C3. The two groups were assumed to be normally distributed. The results showed that there was no significant difference in students' environmental perceptions between pedagogical approaches, with t(14) = .37, p = .71.

Table 3

Environmental Impact for Classroom 3

	N	M	SD
EP1	7.0	29.9	10.1
Ep2	9.0	31.3	5.5

Note. N=number of students who took the survey. M=mean value. SD. standard Deviation
t(14)=.37

p<.05

Behavioral Impact

The behavioral impact of the student's habits was measured by collecting plastic bottles and cans from the recycle bin and trash Monday through Friday during the five weeks of the data collection period. Recyclable plastics and cans were collected from C1, C2, and C3 at the end of each day. The recyclables from the recycle bins were counted, recorded, and removed from the bin to ensure they were not counted a second time the next day. Plastics with the chasing arrow recycling symbol with a number one in the center and the acronym PETE (polyethylene terephthalate) at the bottom were collected and counted. Generally, these bottles are for sodas and juice containers and have a larger bottom with a small neck. Metal cans and aluminum, steel, and tin bottles were also collected from the classrooms. The same type of plastic and metal recyclables were removed from all classroom trash cans. These materials were collected, counted, and recorded. At the end of the week, the total number of recyclables from the bin and trash were entered into Google Sheets. The rate of change was calculated for each day of the week. Calculations were done by dividing the total number of recyclables (nR) from the recycle bin by the total number of recyclables from the recycle bin and trash can.

During the first week, C1 had five recyclable items in the recycle bin and two recyclables from the trash can, for a total of seven recyclable items found in the classroom. The formula used to calculate the percentage of recyclables found in the classroom was ((T-nT/T)*100). Where T is the total number of recyclables found in a classroom for the week, and nT is the total number of recyclables found in the trash. The first week, C1 was calculated ((7-2)/7)*100=71.43. The same formula and calculations were used for each classroom and week. Table 4 shows the calculations for classroom and weeks. The percentages for Classrooms 1 and 3 rise and fall in the percent change of recyclables collected from the classrooms. Classroom 1 started with the highest percentage of 71.4% during week 1, while classroom 3 had the lowest at 37.5% for week 1. Other than week two, the percent changes of C2 changed very little during the remaining four weeks. During week 2, 100% of the students in the classroom recycled their plastic bottles and metal soda cans. After week 2, C2 dropped down and stayed within the mean percentage of weeks 1, 3, 4, and 5 (M = 56.3%). Classroom 1 was the only classroom that ended the five-week study with a negative behavioral impact. Classroom 1's first week had a behavioral impact of 71.4%, and week five's impact was 66.6% or a decrease of 6.9% (4.8 percentage points). Classrooms two and three ended week five at a higher percentage than when the study began. Classroom 2 had a marginal percent increase of 13.3% (7.1 percentage points). Classroom 3 ended the study with the highest percentage increase 52.5% (26.7 percentage points).

Table 4

Percent Change of Collected Recyclables

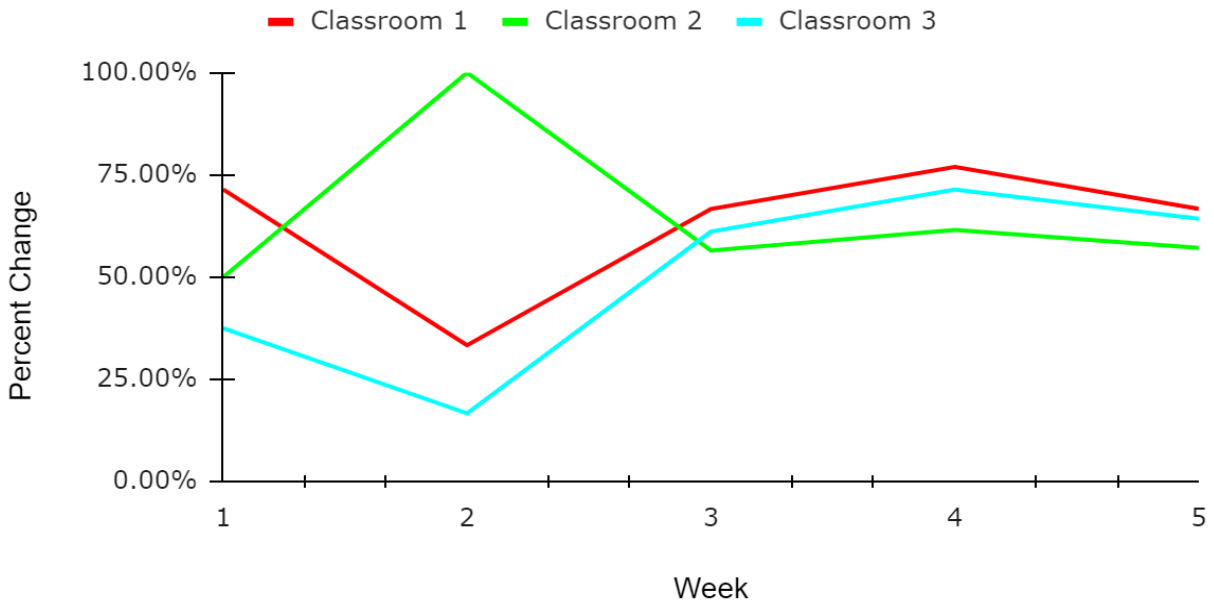
Week	C1	C2	C3
1	71.4	50.0	37.5
2	33.3	100.0	16.7
3	66.6	56.5	61.1
4	76.9	61.5	71.4
5	66.6	57.1	64.2

Note. Numbers shown are in percentages

The information contained within Table 4 has been visually represented in Figure 1 in the form of a line graph to provide a different representation of the data. Classroom 1 is represented by the red line, Classroom 2 is represented by the green line, and Classroom 3 can be depicted by the blue line. Upon examination, a similar pattern emerges between C1 and C3. While C1 and C3 begin the study with a difference of 33.9 points, by the end of the five weeks, the gap decreased to a 2.2 difference. During the second week, each class experiences a change in the student's recycling habits. As C1 and C3 drop, C2 doubles their percentage of recyclables. During week 3, however, the three classes approached the midsection of the graph and followed a similar pattern for the remaining weeks.

Figure 1

Perentage change of Recycing Habits per Classroom



Research Question 2

How does a high school student's locus of control affect their relationship with the environment?

To answer Research Question 2, Julian Rottinger's (1966) locus of control survey was handed to students on the third Tuesday of the data collection period before the lecture began. Each question has two statements: one internal and the other external. Five of the 29 questions are filler questions and are not calculated into the final score. The students mark the statement they connect with most, which then helps to identify whether they demonstrate an internal or external locus of control.

The comparison between the LOC survey and the students' post-environmental perception survey involved distributing LOC surveys to students C1, C2, and C3. Twenty-three students completed and returned the questionnaires. To answer Research Question 2, students

were asked to write their names on the LOC and post-EP survey, enabling a comparison of scores for each individual. Students who did not return the survey were excluded from the data. The post-EP scores were then organized in ascending order in Google Sheets. Students who scored between 0-12 in the EP survey were expected to have Low Environmental Perception scores, while those who scored between 13-24 were expected to have Medium Low Environmental Perception. Scores between 25-36 indicated a Medium High Environmental Perception, and those between 37-46 were expected to have a High Environmental Perception score. The LOC survey identified whether students had an internal or external locus of control. Students' LOC scores were between 7-21. A score of 12 and lower indicated the student's locus of control was more internal. The closer the score gets to zero the internal locus of control would be expected to become stronger. A score of 13 and higher indicates the students locus of control becomes external, and larger score indicates a stronger external LOC. The students' LOC scores were then paired with the corresponding EP scores.

The data presented in Table 5 provides valuable insights into the personality traits and environmental perceptions of the students who participated in the study. The table reveals that 23 students participated in the research, seven of whom (30%) demonstrated an internal locus of control, while the remaining 16 students (70%) exhibited an external locus of control.

Table 5

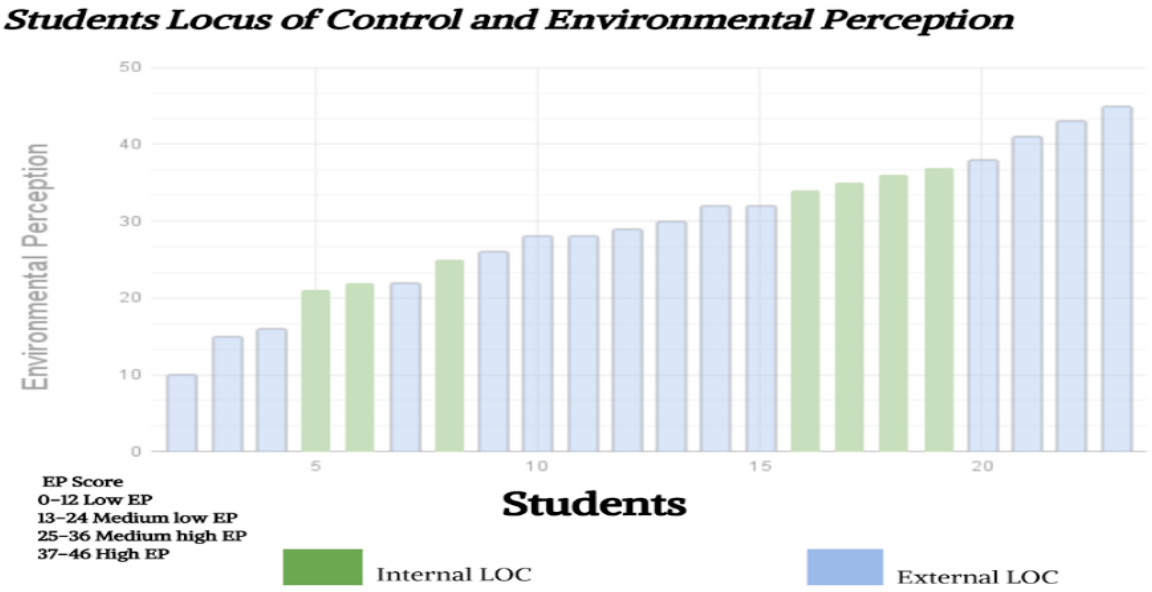
Locus of Control and Environmental Perception

Environmental Perception	Scores	Number of Students n=23	Internal Number (%)	External Number (%)
Low	0-12	2	0	2
Med - Low	13-24	5	3	2
Med - High	25-36	11	4	7
High	37-46	5	0	5
	Totals	23	7	16

Further analysis of the data shows that all seven students with internal LOC had scores that fell within the Med-low to Med-High range of Environmental Perception. According to Table 5, 23 students were tested, 7 (30%) demonstrating an internal locus of control, while the remaining 16 (70%) exhibited an external locus of control. All seven students with internal LOC fell within the Med-low to Med-High range of Environmental Perception. Notably, no students who scored within the internal LOC range were on either the low or high extremes of environmental perception scores.

Figure 2 represents a visual representation of Table 5. Research Question 2 (RQ2) proposed that their environmental perception would increase as students' locus of control became more internal. It was also anticipated that most students with an internal locus of control would fall within the Med-high to High range of the environmental perception scale. However, Figure 2 highlights the top four students with an internal locus of control were within the MED-High category (25-36) and none of the students who scored within the high range of the environmental perception survey expressed an internal locus of control. An unpaired t-test was performed on the data, which indicated there was no significant difference ($t(22)=.90, p<.05$) between the environmental perception scores of external locus of control scores ($M = 28.5$, $SD = 11$) and the environmental perception scores of the internal locus of control scores ($M = 28$, $SD = 8$). A Pearson's Correlation Coefficient test was calculated and found the data had a very weak positive correlation between the student's locus of control survey scores and the student's environmental perception scores from EP2, ($r(20)= .11$, $p = .63$) as shown in Figure 2.

Figure 2



Research Questions 3

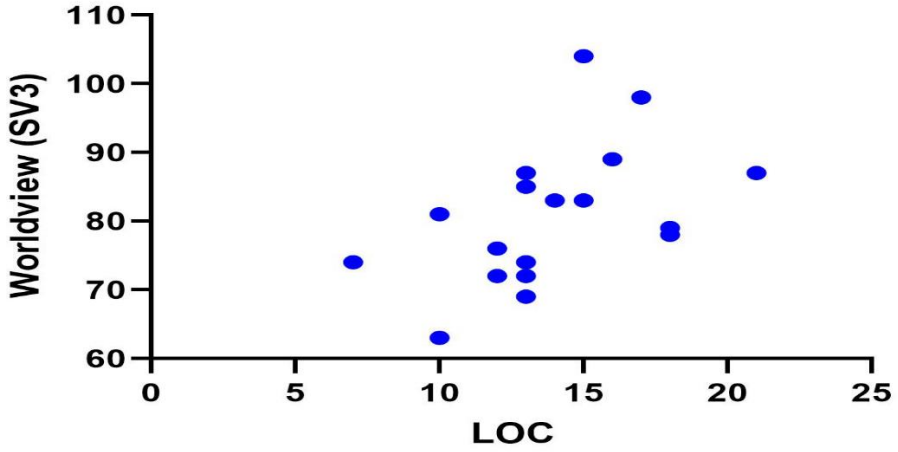
Does the students' locus of control correlate with their ecocentric or anthropocentric environmental worldview?

To answer Research Question 3, a survey was handed out to students in all three classes to determine whether the students had an anthropocentric or ecocentric worldview. While the original work for the survey was found, the survey has been used in multiple research (Diehm, 2022; Gagnon et al., 1994). Additionally, the student Rotter's Locus of Control scores used in RQ2 were used to answer RQ3. The results of both tests were entered into Google Sheets. Only the students who submitted both surveys were considered for data analysis. One student answered both surveys but failed to answer seven questions on the Worldview survey (SV2); their scores were also eliminated. Of the thirty-eight students in the study, only nineteen (50%) answered both locus of control and worldview surveys.

The scores from both the locus of control and worldview surveys were entered into Google Sheets for statistical analysis. A Pearson's Correlation Coefficient test indicated a significant positive moderate correlation between a student's locus of control and their worldview ($r(36) = 0.49$, $p = .03$). The worldview scores were then divided by their corresponding locus of control survey scores. The cut-off point for the locus of control score was if students had a score of twelve or lower, they were internal and students with thirteen or more were external. There were six worldview scores with an internal worldview and fourteen external worldview scores. The results of the unpaired t-test found there was a significant difference between the two means of the internal scores ($MD = 70.8$, $SD = 8.3$) and the external scores ($MD = 83.9$, $SD = 9.9$), when $p<.05$, ($t(18)2.6, p = .02$). Figure 3 shows the linear relationship between the two variables.

Figure 3

Correlation of Worldview and LOC



Summary

This research uses three teaching approaches to investigate the environmental perspectives of high school students after five weeks of ecological education. The study

assesses students' environmental views and explores the impact of their perceived control over environmental issues on their willingness to embrace ecological change. Additionally, it aims to uncover links between a student's locus of control and their ecological values. The research uses both quantitative and qualitative research methods. Three classrooms were chosen to present distinct pedagogies used to instruct the environmental education curriculum for five weeks. The lessons were delivered using Google Slides, and the study differentiates between teacher-centered and student-centered approaches.

Overall, the findings to answer RQ1 suggest that different pedagogical approaches did not significantly impact students' environmental perceptions. The research project aimed to investigate the impact of various teaching methods on students' perceptions of the environment. Three teaching styles were introduced to three separate classrooms, and a t-test statistical analysis was conducted using pre- and post-survey scores.

The primary objective of RQ1 was to explore the potential influence of pedagogical variations on the behavioral patterns of students. This five-week-long study used plastic bottles and cans collected daily from recycling bins and trash. The quantification of recyclable materials gathered from three separate classrooms was documented. Classroom 1 started off with the highest percentage of recyclables collected during week one but ended the study with a percent decrease of 6.9%. Classroom 2 had a rate increase of recyclables collected from week 1 to week 5 of 13.3%. Classroom 3 had the lowest percentage of recyclables collected in week one but ended the study with the highest percentage increase of 52.5%.

RQ2 examined the relationship between locus of control and environmental perception among students. The study involved administering a survey to the participants, which enabled the assessment of whether they had an internal or external locus of control and their environmental perception. The results show that all of the students who had an internal locus of control scored in the upper and lower middle range.

RQ3 found a positive correlation between students' internal and external locus of control and worldview. The results were based on surveys conducted on 38 students across three classes and analyzed using Google Sheets.

This research project compared three teaching methods in separate classrooms to investigate their effect on students' environmental perception. The results showed no significant difference in students' perceptions based on the teaching style. The study found that students with an internal locus of control had higher environmental perception scores. The researchers measured the amount of recyclable materials gathered from three classrooms over five weeks. They found that Classroom 1 had the highest percentage of recyclables in week one but ended with a lower rate. Classroom 3 had the lowest percentage of recyclables in week one but ended with the highest percentage increase. Finally, the study found a positive correlation between students' locus of control and worldview based on surveys conducted on 38 students across three classes.

Chapter V. Conclusions and Recommendations

In 1970, the EPA came into effect, and later, in 1990, Congress established the NEEA to bolster environmental education efforts. Despite this, schools are not mandated to implement such programs, leaving many students lacking in environmental literacy. The pervasive use of single-use plastics is causing extensive harm, making it crucial to prioritize the principles of Reduce, Reuse, and Recycle. However, this brings forth the dilemma of whose responsibility it is to teach environmental literacy. Surprisingly, Meeuseen (2014) found that parents do not pass down their environmental habits to their children; however, when parents educate their children on environmental issues, the children have a stronger desire to protect the environment compared to the parents who do not pass down their concerns. Collaborative efforts between parents and strong school policies are essential (Meeuseen, 2014; Rotas, 2019).

This chapter presents a comprehensive summary of the research conducted to address the initial research questions. Based on these findings, recommendations are identified, and the aim is to address areas requiring attention from environmental education. It will also expound upon the potential limitations and weaknesses of the study and draw attention to any unaccounted factors that could have impacted the results. Moreover, the report will acknowledge any unanswered questions and provide insightful recommendations for future studies to further advance research in the field.

Review of the Study

Society has approached a point where most of us are aware of the environmental issues we are currently facing and will face in the future. Regardless of the extent to which one believes the severity of the environmental issues, it is safe to say that most people are aware that an issue exists. One would assume that having this information is enough to make changes that would improve, or at least sustain, the current state of the environment, and more people would be taking action. However, the situation continues to decline, which indicates that it takes more than just knowledge to make environmentally responsible choices. In fact, past and current literature agrees that knowledge is only the prerequisite to making environmental changes. It will also take skill and experience to know what action to take in a given situation (Hines et al., 1987). Hungerford and Volk (1990) take it further and indicate they also have to feel they have ownership of the environment and want to take care of it, then feel empowered when they do. Connecting with the environment also shown to be an indicator of a person's ability to identify with nature and have a desire to change some of their habits (Lankenau, 2016). Connecting with nature has been found to be one of the main contributing factors as to why students become environmentally responsible (Otto & Pensini, 2017). Additionally, Otto and Pensini (2017) found that when students connected with nature through their education, they felt a stronger environmental responsibility even when their connectedness was compared to

environmental knowledge. The primary focus of this study was to examine whether different teaching styles impacted a high school student's environmental perceptions. Two different interpretations of the term “impact” were considered. The first interpretation of the term impact was to identify whether the students changed their environmental perception after the introduction of the environmental education lesson. A survey (EP1) was distributed to each classroom on the first day of the data collection. The second survey (EP2) was handed out on the last day of the data collection period. These surveys were intended to measure the impact of the students' environmental perception. An independent t-test was conducted from the results of the surveys from each classroom. All three t-tests showed there was no significant difference between the scores of the surveys. The second interpretation of impact was to identify any behavioral changes the students demonstrated throughout the five weeks of environmental education lessons. The student's behavioral changes were measured by taking the plastic and metal soda cans out of the recycle bin and the trash can. This was done for each classroom every day for the duration of the five weeks. When the data was collected and entered into a table, the percent changed to compare the difference between what recyclables were found in the trash and what was found in the recycle bin. An interesting finding was the changes that occurred during week 2. Classroom 2 doubled in the amount of recyclables found in the recycle bin compared to the trash and Classrooms 1 and 2 dropped during the same week.

The second question of the study investigated whether there was a connection between students' personality traits (i.e., locus of control and worldviews) and how receptive students were to environmental education lessons.

The third research question also investigates how students' personality traits impact their ability to adopt new habits. However, the third question examines if the student's receptiveness to environmental responsibilities is dependent on whether they have an internal or external locus of control.

This research incorporates both qualitative and quantitative data to evaluate high school student's understanding of environmental education and their behavior toward the environment. The study further investigates the influence of students' locus of control and worldview on their ability to comprehend environmental issues and modify their environmental habits.

Discussion

How do different pedagogies in environmental education impact high school students' recycling habits?

This research question investigates two ways high school students are impacted by different pedagogies when introducing environmental education. The first part of the question studied if students' environmental perception was impacted. The second part of the question was to identify whether a student's responsible environmental behavior would be impacted by introducing environmental education.

Environmental Perception

The findings for the first part of RQ1 showed there was no significant difference between the pre and post-environmental perception survey. These results were expected from Classroom 1. Classroom 1 was taught in the traditional teacher-centered style. The students were not engaged in the lesson during all five weeks of the study. They stayed quiet and listened but did not participate in the last three minutes at the end of the lesson to ask any questions for clarity. During week 2, students were not paying attention in the beginning. Some of the students were being a bit disrespectful and interrupting the lesson. The teacher reprimanded them for their behavior and got back to the lesson. This behavior from the students could also be a reflection of their age. Most of the students were sophomores and juniors and between the ages of 14-16. The interaction between the teacher and the students was minimal.

This did not allow for a teacher-student relationship to be built. Benkos (2016) describes a good teacher as one who is passionate and enthusiastic.

While Benkos description of a good teacher does not help to explain why Classroom 2 was not impacted by the EE lessons, it does help to explain why they were more talkative and more engaged in the lessons. Stein (2020) found that if a teacher would like students to be more engaged, the teacher has to lead the classroom into conversations rather than just manage their behavior. Classroom 2 asked more questions and discussed topics that brought out past knowledge. During week one, students asked questions about our local rivers. Many students remembered going to the river in the summer and were shocked by the amount of people tubing. One student mentioned, “I always complained about how many people were floating but never really thought about how they all were contaminating the river.” While the students did not show a change in their environmental perception, which could be due to insufficient time exposure to EE, it would be interesting to see if students will think about this lesson the next time they go to the river. Also, students could have been more talkative and more engaged because the school is normally quiet, and students do not engage with each other often.

The expectation for Classroom 3 was to see some change in the student's environmental perception. As mentioned before, part of the reasoning behind this could be due to an inadequate length of EE and an overall lack of exposure to the environment. An unexpected limitation of this study was that, due to district policy, students were not allowed to go outside while school was in session. The initial plan for C3 was to hold the class outside in a field near the school. However, permission was not granted due to safety issues for the students and teacher outside and because the door open would put the students inside in danger. Instead, labs were done inside the classroom.

The Teton Science School, located in Wyoming and Idaho, is an educational organization that uses place based education to connect classrooms and communities to increase engagement, learning and community impact. In an attempt to align the labs with place based education, the labs were designed to connect students with the local community. Despite the attempt to make the connection, without going out into the environment and directly working and learning from nature the environmental attitudes of students do not change (Collado, Rosa, & Corraliza, 2020).

Behavioral Impact

The second part of the research question measured the behavioral impact of the students during the EE. Figure 1 represents the percent change in the student's recycling habits in each classroom. What stands out the most is the peak that occurred in Classroom 2 during the second week. Interestingly, week 2 is also the week that C2 engaged the most during the lesson. The lesson that week was on natural resources. The two topics the students appeared to be most interested in were the caves in our area where we get our drinking water and the discussion about plastics getting into the caves and potentially into our water. This was a conversation that only occurred in Classroom 2. Again, the literature states that connecting with the environment has a measurable positive impact on a student's environmental behaviors (Ernst & Theimer, 2011). Since the students were so engaged in the topic, this could have caused a short-lived, yet measurable connection with the environment. While the topic was discussed in the other classrooms, students were not as engaged to ask the questions that could lead to that conversation. C3 appeared to be more interested in our fast growing community, and C1 did not ask any questions. However, after week 2, all three classes converged around the mid-range of the data and stayed consistent for the rest of the study.

How does a high school student’s locus of control affect their relationship with the environment?

Two statistical analyses were done in an attempt to answer RQ2. An unpaired t-test was calculated of the two test scores indicating no significant effect between the means of the two surveys ($t(22)=.90, p<.05$) . A Pearson's Correlation test was computed and found a positive very weak correlation ($r(20)= .11$, $p = .63$). However, this is not in line with past research. Engqvist and Nilsson (2014) found there was a positive correlation between pro-environmental behaviors and an internal locus of control. However, they found that this correlation occurred when the person prioritized their self-transcendence values. Additionally, Yang & Weber (2019), also found that individuals with an internal Environmental Locus of Control (ELOC) generally had positive environmental behaviors. Interestingly, none of the students with internal LOC had scores in either the low or high extremes of environmental perception. This suggests that students with internal LOC tend to perceive their environment moderately.

Overall, this data provides a deeper understanding of the student's personalities and perceptions of the world. The findings could be helpful to educators and counselors in developing strategies to enhance students' academic and personal growth.

An intriguing observation is that students with an internal locus of control did not exhibit low or high extremes in their environmental perception scores. This indicates that these students have a balanced view of their surroundings. The insights gained from this data offer valuable insights into the students' personalities and their perception of the world. These findings prove advantageous to educators and counselors alike as they seek to develop strategies to promote the academic and personal growth of their students.

Does the student's locus of control correlate with the ecocentric or anthropocentric environmental worldview?

The study found there is a moderate correlation between a person's locus of control and their anthropocentric and ecocentric worldview. This is consistent with other studies like that

of Thompson and Barton (1994), who found that when people are more egocentric, they have a deeper desire to do more for the environment because they feel a sense of responsibility. They also mentioned that a more anthropocentric person will want to care for the environment but will only do so if the reasoning is related to their self-interest. Other than the surveys, locus of control and worldviews were not discussed in the classrooms. Looking back at the notes taken from classroom 2 two students discussed recycling; one had a question and recommended that it needed to be done, and the other was a skeptic who felt that everything would end up in the landfill or environment anyway. The first student supported this correlation, and according to her scores she had an internal locus of control and an ecocentric worldview. However, the skeptical student's scores were almost identical to the first student. It is uncertain if the skeptical students' scores had any merit. A limitation with surveys is sometimes they are not answered truthfully.

Conclusion

The primary objective of this research study is to explore the impact of various teaching styles on the environmental perspectives of high school students. The study employed a mixed-methods approach, including a quantitative survey and qualitative observations, to gather data from a sample of high school students. The study found that there was no significant difference in the environmental perceptions of students, despite the teaching style used in the classroom. The teaching styles employed in the study included traditional lecture-based instruction, inquiry-based learning, and project-based learning.

In addition to the impact of teaching styles, the study also examined the relationship between the locus of control and environmental perception among students. The results of the study show that students with an internal locus of control had higher scores in environmental perception than students with an external locus of control. The study further revealed that students with a higher level of environmental perception exhibited a greater sense of personal responsibility towards the environment.

Finally, the study established a positive correlation between the students' locus of control and worldview. The results suggest that students with an internal locus of control tend to have a more positive worldview and a greater sense of responsibility towards the environment.

Recommendations

The focus of this research was to examine the potential correlation between different pedagogies and high school students' environmental habits. In addition, the study aimed to identify any personality traits that might make students more amenable to adopting eco-friendly habits. The findings indicated that while different teaching styles did not have a significant influence on students' environmental habits it still opened up environmental conversations in the classroom. The study also suggested that certain personality traits may make students more receptive to environmental changes. This implies that students may have a natural inclination to help the environment, but may require guidance on how to do so. Research indicates that simply teaching students about the environment is not enough to change their habits. While environmental education can increase awareness about the negative impact of irresponsible environmental behaviors, it takes more than a brief exposure to promote consistent eco-friendly behavior as was seen in C2 week 2. Therefore, the study suggests that environmental education should extend beyond the classroom and recycling bins.

Environmental education should not be limited to a single lesson about climate change and natural resources. It should ask important questions like "How has climate change affected our local rivers?" and "Where do we get our drinking water from, and are there any threats to our water?" These questions can help students understand the impact of their actions on the environment and the importance of responsible behavior.

Teachers, regardless of their area of expertise, should integrate environmental education into their curriculum, incorporate place-based education, and use community

resources for classroom instruction. They should also encourage students to think critically about environmental issues and take action to address them.

The study emphasizes that the quality of environmental education is more important than the quantity of it. Therefore, teachers should focus on providing meaningful and long-lasting environmental education that can lead to consistent eco-friendly behavior. By doing so, they can help create a generation of environmentally conscious citizens who are committed to protecting our planet.

Limitations

The research was carried out within a non-traditional charter high school, which presented certain limitations for the study. The students acquire knowledge through a self-directed learning style without direct instruction or the exchange of ideas in a classroom setting. The majority of students opt to pursue their studies at an accelerated pace, with the aim of graduating early. Their motivation to graduate early means that they often prefer to focus on their school work and want to refrain from participating in any activities or lectures that would keep them from completing their school work. In a traditional school, lectures are a regular daily routine. However, in this school setting, lectures, mini-lessons, or projects take time away from students completing their work and often want to refrain from participating. For example, in a traditional school, if a student takes English III during the first semester, they will earn half a credit when the semester is over. However, if students work hard enough in one semester at this school, they can earn a full year of credit for English III and IV. Students primarily motivated to graduate will likely only be interested in activities that help them progress their school work. If their main focus is to graduate as soon as possible, a lecture about the environment may seem irrelevant, which could ultimately affect the survey results. One of the limitations associated with the school model is that prior approval from both parents and administration is required to engage in activities outside of the school. Additionally, the rate of enrollment and withdrawal in

such schools tends to be higher when compared to traditional schools. Recommendations for limitations are discussed in the next section.

Future Research Opportunities

While this research has its limitations, this also allows for future research opportunities. The lack of data found in non-traditional school settings is worth noting. While there is existing literature on environmental education, this type of non-traditional school setting has yet to be studied, indicating a gap in the current literature. Due to the lack of data of non-traditional high schools, this opens up an opportunity to further investigate how students in non-traditional schools are impacted by the introduction of environmental education. This could be accomplished if the research is conducted for a full school year in order to get a better understanding of the impact of introducing EE.

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Appendix A

University of Findlay.

Institutional Review Board

Date: **January 26, 2023**

To: Dr. Gwynne Rife

CC: Tanya Marroquin

RE: How Does Different Pedagogies Impact the Environmental Habits of High School Students?

Project Expiration date: January 26, 2024

The University of Findlay Institutional Review Board (IRB) has completed its review of your project utilizing human subjects and has granted authorization. This study has been approved for a period of one year only. The project has been assigned the number **1636** .

In order to comply with UF policy and federal regulations, human subject research must be reviewed by the IRB on at least a yearly basis. If you have not completed your research within the year, it is the investigator's responsibility to ensure that the **Progress Report** is completed and sent to the IRB in a timely fashion. The IRB needs to process the re-approval before the expiration date, which is printed above.

Please note that if any changes are made to the present study, you must notify the IRB immediately. Understand that any proposed changes may not be implemented before IRB approval, in which case you must complete an **Amendment/Modification Report**.

Following the completion of the use of human subjects, the primary investigator must complete a **Certificate of Compliance form** indicating when and how many subjects were recruited for the study.

Please refer to the IRB policy and procedures manual for additional information. Please include the project number on any other documentation or correspondence regarding the study.

Thank you very much for your cooperation. If you have any questions, please feel free to contact IRB at (419) 434-4640 or email irb@findlay.edu.

Sincerely,

Jaymelee Kim, Ph.D.

Co-Chair, Institutional Review Board

Cc: IRB Office

Appendix B

FINDLAY
THE UNIVERSITY OF FINDLAY

Institutional Review Board

Implied Consent Form

Date

Dear subject,

You are invited to participate in a study to identify any effects of introducing an environmental education program in a high school. I hope to learn without prejudice what impact the introduction of a recycling and environmental education program has on high school students. You were selected as a possible participant in this study because *you are a current Premier High School of New Braunfels student***.** If you decide to participate, please complete the enclosed survey. Your return of this survey is implied consent. The survey measures any changes in the students' environmental habits. It will take about ten minutes to complete the survey. No benefits accrue to you for answering the survey, but your responses will be used to identify the impact of introducing a recycling and environmental education program. Any discomfort or inconvenience to you derives only from the amount of time taken to complete the survey.

Any information obtained in connection with this study and that can be identified with you will remain confidential and will not be disclosed. Your decision whether or not to participate will not prejudice any future relationships with The University of Findlay. If you decide to participate, you are free to discontinue participation at any time without prejudice. You will be informed of any information that varies from what has been provided to you and might affect your willingness to continue participating in the project.

This survey and consent waiver have been approved by Institutional Review board at The University of Findlay which guarantees that research involving human subjects follows federal regulations. If you have any questions about your rights as a human subject please contact the IRB chair, at irb@findlay.edu.

We will submit the results of this study for publication in its entirety. The unprocessed data will be destroyed 3 years after publication. If you are interested in the project results, please email us information on how to retrieve the data. Please keep a copy of this email for your records. If you have any questions regarding this project, feel free to contact Dr. Gwynne Rife rife@findlay.edu or 419-434-4724

This project is being completed as part of graduation requirements at the University of Findlay to receive a Doctorate of Education. If you have any questions about our project, contact Tanya Marroquin at marroquint@findlay.edu or Dr. Gwynne Rife.

Thank you for your time.

Primary investigator: Tanya Marroquin

Appendix C

Initial/Final Environmental Perception Survey

EP1/EP2

This is a voluntary survey and you are not required to fill it out. You may simply choose to not be a part of the study. By filling out the survey, you will help the researcher find out if high school students benefit from environmental education programs.

1. How concerned are you about air pollution?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

2. How concerned are you about the extinction of endangered animals?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

3. How concerned are you about the loose regulations of the United States government's environmental laws?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

4. How concerned are you that people are not doing enough to clean up the environment?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

5. How concerned are you about the environment not being able to recover on its own from problems caused by humans?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

6. How concerned are you with our (Americans in general) dependence on oil to heat homes and fuel vehicles?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

7. How concerned are you that we (citizens in New Braunfels) do not have renewable energy options?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

8. How concerned are you that recycle bins are not in more public areas?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

9. How concerned are you that people are not doing enough to help clean the environment?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

10. How concerned are you that environmentally friendly products are more expensive than products that could harm the environment?

a. Extremely concerned

b. Very concerned

c. Slightly concerned

d. Not at all concerned

e. Not sure

EP2 Open-ended question

1. Do you feel you recycle more and/or make choices that are more environmentally friendly after receiving environmental education? Please explain.

_____

_____

_____

2. Did your feelings about the environment change after environmental education? Please explain.

3. What would be your biggest factor in why environmental change did/did not occur?

EP1 and questions 1-10 of EP2 Key

a=4

b=3

c=2

d=1

e=0

Score

0-10 Low EP

11-20 Medium low EP

21-30 Medium high EP

31-40 High EP

EP2 Key

These are only to be scored during the post-test distribution.

A negative connotation will receive zero points.

Neutral connotation will receive one point.

Positive connotations will receive two points.

Score

0-12 Low EP

13-24 Medium low EP

25-36 Medium high EP

37-46 High EP

Appendix D

SV1

Rotter's Locus of Control Scale

For each question, select the statement that you agree with the most

1. a. Children get into trouble because their parents punish them too much.

b. The trouble with most children nowadays is that their parents are too easy with them.

2. a . Many of the unhappy things in people's lives are partly due to bad luck.

b . People's misfortunes result from the mistakes they make.

3. a . One of the major reasons why we have wars is because people don't take enough interest in politics.

b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world

b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries

5. a. The idea that teachers are unfair to students is nonsense.

b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.

b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.

b. People who can't get others to like them don't understand how to get along with others.

8. a. Heredity plays a major role in determining one's personality

b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.

b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well-prepared student there is rarely if ever such a thing as an unfair test.

b. Many times exam questions tend to be so unrelated to course work that studying in really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.

b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.

b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.

b. It is not always wise to plan too far ahead because many things turn out to- be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.

b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.

b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

b. Getting people to do the right thing depends upon ability. Luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.

b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.

b. There really is no such thing as "luck."

19. a. One should always be willing to admit mistakes.

b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.

b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.

b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.

b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give. b. There is a direct connection between how hard 1 study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.

b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me. b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.

b. It's not much use trying too hard to please people; if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.

b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.

b. Sometimes, I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time, I can't understand why politicians behave the way they do.

b. In the long run the people are responsible for bad government on a national as well as on a local level.

Score one point for each of the following:

2. a, 3.b, 4.b, 5.b, 6.a, 7.a, 9.a, 10.b, 11.b, 12.b, 13.b, 15.b, 16.a, 17.a, 18.a, 20.a,

21. a, 22.b, 23.a, 25.a, 26.b, 28.b, 29.a.

A high score = External Locus of Control

A low score = Internal Locus of Control

Appendix E

Ecocentric/Anthropocentric Survey questions

SV2

One of the worst things about overpopulation is that many natural areas are getting destroyed for development.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2. I can enjoy spending time in natural settings just for the sake of being out in nature.

Strongly Agree Agree Neutral Disagree Strongly Disagree

3. Environmental threats such as deforestation and ozone depletion have been exaggerated.

Strongly Agree Agree Neutral Disagree Strongly Disagree

4. The worst thing about the loss of the rainforest is that it will restrict the development of new medicines.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5. Sometimes it makes me sad to see forests cleared for agriculture.

Strongly Agree Agree Neutral Disagree Strongly Disagree

6. It seems to me that most conservationists are pessimistic and somewhat paranoid.

Strongly Agree Agree Neutral Disagree Strongly Disagree

7. I prefer wildlife reserves to zoos.

Strongly Agree Agree Neutral Disagree Strongly Disagree

8. The best thing about camping is that it is a cheap vacation.

Strongly Agree Agree Neutral Disagree Strongly Disagree

9. I do not think the problem of depletion of natural resources is as bad as many people make it out to be.

Strongly Agree Agree Neutral Disagree Strongly Disagree

10. I find it hard to get too concerned about environmental issues.

Strongly Agree Agree Neutral Disagree Strongly Disagree

11. It bothers me that humans are running out of their supply of oil.

Strongly Agree Agree Neutral Disagree Strongly Disagree

12. I need time in nature to be happy.

Strongly Agree Agree Neutral Disagree Strongly Disagree

13. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources.

Strongly Agree Agree Neutral Disagree Strongly Disagree

14. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations.

Strongly Agree Agree Neutral Disagree Strongly Disagree

15. I do not feel that humans are dependent on nature to survive.

Strongly Agree Agree Neutral Disagree Strongly Disagree

16. Sometimes when I am unhappy I find comfort in nature.

Strongly Agree Agree Neutral Disagree Strongly Disagree

17. Most environmental problems will solve themselves given enough time.

Strongly Agree Agree Neutral Disagree Strongly Disagree

18. I don't care about environmental problems.

Strongly Agree Agree Neutral Disagree Strongly Disagree

19. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports.

Strongly Agree Agree Neutral Disagree Strongly Disagree

20. I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources.

Strongly Agree Agree Neutral Disagree Strongly Disagree

21. It makes me sad to see natural environments destroyed.

Strongly Agree Agree Neutral Disagree Strongly Disagree

22. The most important reason for conservation is human survival.

Strongly Agree Agree Neutral Disagree Strongly Disagree

23. One of the best things about recycling is that it saves money.

Strongly Agree Agree Neutral Disagree Strongly Disagree

24. Nature is important because of what it can contribute to the pleasure and welfare of humans.

Strongly Agree Agree Neutral Disagree Strongly Disagree

25. Too much emphasis has been placed on conservation.

Strongly Agree Agree Neutral Disagree Strongly Disagree

26. Nature is valuable for its own sake.

Strongly Agree Agree Neutral Disagree Strongly Disagree

27. We need to preserve resources to maintain a high quality of life.

Strongly Agree Agree Neutral Disagree Strongly Disagree

28. Being out in nature is a great stress reducer for me.

Strongly Agree Agree Neutral Disagree Strongly Disagree

29. One of the most important reasons to conserve is to ensure a continued high standard of living.

Strongly Agree Agree Neutral Disagree Strongly Disagree

30. One of the most important reasons to conserve is to preserve wild areas.

Strongly Agree Agree Neutral Disagree Strongly Disagree

31. Continued land development is a good idea as long as high quality of life can be preserved.

Strongly Agree Agree Neutral Disagree Strongly Disagree

32. Sometimes, animals seem almost human to me.

Strongly Agree Agree Neutral Disagree Strongly Disagree

33. Humans are as much a part of the ecosystem as other animals.

Strongly Agree Agree Neutral Disagree Strongly Disagree

Appendix F

Day 1 Lesson Plan ▪ Ecosystem

TEKS/Established Goal(s)/Content Standard(s):
•The student knows the relationships between biotic and abiotic factors within habitats, ecosystems, and biomes.

Understanding (s)	**Wrapping up the lesson**
Students will understand that: • Explain the cycling of water, phosphorus, carbon, silicon, and nitrogen through ecosystems, including sinks, and the human interactions that alter these cycles • Evaluate the effects of fluctuations in abiotic factors on local ecosystems and local biomes.	• **Classroom #1** 2-3 minutes of questions from students for clarification and understanding. • **Classroom # 2** 2-3 minutes of questions from students for clarification and understanding. How do humans affect this? 3-5 minute open discussion. • **Classroom #3** 2-3 minutes of questions from students for clarification and understanding. 2-3 minute open discussion of how do humans affect this? 3-5 minute open discussion asking students what difference I can make to help our environment.

Student objectives (outcomes):
Students will be able to • At the end of this lesson, students will be able to identify different cycles in the ecosystem. • Students will be able to explain how each cycle works and what effect humans have on disrupting the cycle.

Stage 2 – Delivery

Method of Delivery

- Google Slides will not last longer than 30 minutes.

Stage 3 – Classroom

Differentiation per classroom

- **Classroom #1**- students will be shown the Google Sheets and asked if anyone has any questions.
- **Classroom #2**: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers.
- **Classroom #3-**Classroom #2: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers and how they can make a difference. *On the last day of the lesson, students will be divided into groups. Each group will create an ecosystem and discuss how the nutrients cycle.

Week 2 Lesson plan ・Natural Resources

TEKS/Established Goal(s)/Content Standard(s):

•The student knows the interrelationships among the resources within the local environmental system.

Understanding (s)	**Essential Question(s):**
Students will understand that: • (F) Evaluate the impact of waste management methods such as reduction, reuse, recycling, upcycling, and composting on resource availability in the local environment.	• 5-10 minutes of Q&A about what we learned? **Classroom #1** • How do humans affect this? 5-10 minute discussion.**Classroom # 2** • What difference can I make that could help our environment? 5-10 minute discussion. **Classroom #3**

Student objectives (outcomes):

Students will be able to:

- Students will know how to recycle according to New Braunfels Waste Management properly
- Students will understand the importance of conserving our natural resources.

Stage 2 – Delivery

Method of Delivery

- Google Sheets.
- The lesson will not last longer than 30 minutes.

Stage 3 – Classroom

Differentiation per classroom

- **Classroom #1**- students will be shown the Google Sheets and asked if anyone has any questions.
- **Classroom #2**: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers.
- **Classroom #3-**Classroom #2- students will be shown the Google Sheets and asked if anyone has any questions, then discuss how humans affect the local rivers. Students will then discuss how they can make a difference. *Last day of The Tragedy of the Commons lab on the last day of the week.

Week 3 Lesson Plan · Energy Flow

TEKS/Established Goal(s)/Content Standard(s):

•The student knows the sources and flow of energy through an environmental system

Understanding (s)	**Essential Question(s):**
Students will understand that: • (C) Explain the flow of heat energy in an ecosystem, including conduction, convection, and radiation. • (D) Identify and describe how energy is used, transformed, and conserved as it flows through the ecosystem.	• 5-10 minutes of Q&A about what we learned? **Classroom #1** • How do humans affect this? 5-10 minute discussion.**Classroom # 2** • What difference can I make that could help our environment? 5-10 minute discussion. **Classroom #3**

Student objectives (outcomes):

Students will be able to:

- Students will be able to describe how energy flows through our environment using conduction, convection, and radiation
- Students will be able to explain how humans can disrupt the energy flow.

Stage 2 – Delivery

Method of Delivery

- Google Sheets.
- A lesson will not last longer than 30 minutes.

Stage 3 – Classroom

Differentiation per classroom

- **Classroom #1**- students will be shown the Google Sheets and asked if anyone has any questions.
- **Classroom #2**: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers.
- **Classroom #3-**Classroom #2- students will be shown the Google Sheets and asked if anyone has any questions, then discuss how humans affect the local rivers. Students will then discuss how they can make a difference. ***Energy flow lab

Week 4 Lesson Plan · Population

Established Goal(s)/Content Standard(s):
•The student knows the relationship between carrying capacity and changes in populations and ecosystems.

Understanding (s)	**Essential Question(s):**
Students will understand that: • Compare exponential and logistic population growth using graphical representations. • Identify factors that may alter caring capacities such as disease, natural disaster; available food, water, and livable space.	• 5-10 minutes of Q&A about what we learned? **Classroom #1** • How do humans affect this? 5-10 minute discussion.**Classroom # 2** • What difference can I make that could help our environment? 5-10 minute discussion. **Classroom #3**

Student objectives (outcomes):
Students will be able to: • Students will be able to identify how surpassing the carrying capacity of the ecosystem will affect the environment. • Students will be able to identify how the human population can change the carrying capacity of the earth.

Stage 2 – Delivery

Method of Delivery
• Google Sheets. • The lesson will not last longer than 30 minutes.

Stage 3 – Classroom

Differentiation per classroom

- **Classroom #1**- students will be shown the Google Sheets and asked if anyone has any questions.
- **Classroom #2**: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers.
- **Classroom #3-**Classroom #2- students will be shown the Google Sheets and asked if anyone has any questions, then discuss how humans affect the local rivers. Students will then discuss how they can make a difference. **Carrying Capacity Lab

Week 5 Lesson Plan · Natural changes in the environment

Established Goal(s)/Content Standard(s):

•The student knows that environments naturally change

Understanding (s)	**Essential Question(s):**
Students will understand that: • Students will understand and explain how regional environmental changes may have global effects. • Students will understand and analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures.	• 5-10 minutes of Q&A about what we learned? **Classroom #1** • How do humans affect this? 5-10 minute discussion.**Classroom # 2** • What difference can I make that could help our environment? 5-10 minute discussion. **Classroom #3**

Student objectives (outcomes):

Students will be able to:

- Students will be able to explain how temperature inversions have short-term and long-term effects.
- Students will be able to analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures.

Stage 2 – Delivery

Method of Delivery

- Google Sheets.
- The lesson will not last longer than 30 minutes.

Stage 3 – Classroom

Differentiation per classroom

- **Classroom #1**- students will be shown the Google Sheets and asked if anyone has any questions.
- **Classroom #2**: Students will be shown the Google Sheets and asked if anyone has any questions. Then, they will discuss how humans affect the local rivers.
- **Classroom #3-**Classroom #2- students will be shown the Google Sheets and asked if anyone has any questions, then discuss how humans affect the local rivers. Students will then discuss how they can make a difference. **Climate and earth's energy balance. https://serc.carleton.edu/eslabs/weather/2c.html