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Barriers Teaching Environmental Justice Education

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DEDICATION

This research is dedicated to my mother, Glenda, who passed away just a few months ago. My mom was the toughest person I have ever met. Having to leave school at the age of 15 to have and raise me, she never finished school. My education was always a priority over her own wellbeing. She encouraged me to finish this dissertation up until her very last days with us. I miss her deeply and wish she could have been here to see me finish.

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To my friends and family: you put up with me missing many events. I am forever grateful for your patience and understanding. I hope to have time now to reconnect with each of you.

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ABSTRACT

The idea of freedom in education has its roots in the social justice movements of the 1950s and 60s. Civil rights groups coalesced independently of other marginalized groups and movements of its time. While similar in nature, environmentalism and civil rights issues rarely crossed paths. As environmentalism made its way into science education and curriculum, social justice issues were restricted to historical perspectives in education. This research initially sought to create an understanding of purpose driven, social justice conscious, Environmental Education as it is related to marginalized learners and identify the barriers of creating and implementing culturally relevant environmental education curriculum. The results of this researcher's experience is the most distinctive and telling example of barriers in teaching Environmental Justice education as told through an autoethnography. Initially this research was meant to identify and incorporate Environmental Justice education into Missouri science curriculum. It would identify the Environmental Justice deficiencies in the current Missouri curriculum, coupled with identifying current barriers in teaching Environmental Justice Education, for use as the basis for teacher education tools and educational programs. The findings of this research suggest science educators have limited access to environmental education teacher training, resources and support. This poses the dilemma, without adequate teacher education training, bridging the gap between environmental education and community-based action is difficult. The political and racial objections serve only to widen this gap. The barriers identified by this researcher’s personal experience include a lack of support from administration. In many ways the teaching of environmental justice issues related to environmental education was simply

impractical when coupled with the insurmountable challenges of teaching marginalized learners. Administrative turnover, curriculum changes, lack of adequate teacher resources and limited building staff serve as inhibitors. The systemic challenges which exist in marginalized schools can serve to discourage some educators to the point of exhaustion and abandonment.

CHAPTER 1: INTRODUCTION

In the book, *Teaching to Transgress: Education as the Practice of Freedom* bell hooks (1994) adopts the term, "education as a practice of freedom," which was first used in Paulo Freire's, 1973 essay *Education as a Practice of Freedom*, and found in his groundbreaking book, *Education for critical consciousness*. Now, nearly 50 years later, in a time when education has been reduced to test taking, while blanketed in accountability (Taubman, 2009); education as a practice of freedom, suggests that education can promote civic engagement and allow for the empowerment of learners.

Unequaled environmental burdens in marginalized communities is sometimes referred to as Environmental Racism (ER) (Bullard, 1994). The social justice fight against Environmental Racism is called Environmental Justice (EJ). According to the self-described father of the EJ movement, Robert Bullard, Environmental Racism theory suggests, controlling for all other factors including socioeconomic status, socially marginalized groups, such as African Americans and Latinos, are more likely to be exposed to toxins in their environment than their white counterparts (Bullard, 1994; Purnell et al. 2014). Theoretically, EJ could be the Social Justice arm of the Environmental movement, which is focusing less on the land and species preservation and more on human health and quality of life initiatives. Logic tells us that these two camps, Social Justice and Environmentalism, should work together toward a common goal of EJ, though historically this has not been the case (Buttel & Flinn, 1978, Méndez, 2020). In 2006, nearly 50 years after the birth of the Environmental movement, social justice advocate, Fabian Núñez, a former California State Assembly member, placed pressure on the affluent white environmental community to include

marginalized members in an effort to build a stronger base of support (Méndez, 2020). Fundamentally, Environmentalism is predominantly 'White' in its dominant discourses and membership, while Social Justice is 'Black or Brown', meaning it is advocating for minority and marginalized rights and encouraging historically depicted 'others' or marginalized voices. This disconnect is resulting in a heterogeneous example of a polarized community.

Environmental Burdens

Children in the city of St. Louis, Missouri, are disproportionately exposed to dangerous neurotoxins, which dramatically affects learning and behavior, compared to Missouri statewide (Bullard, 1994; Gaitens et al., 2009; Kozol, 1991; Nevin, 2009). Controlling for socioeconomic status, African American children experience higher rates of asthma than Whites and are nearly two times as likely to be hospitalized from asthma and are four times as likely to die from asthma as White children. (United States Environmental Protection Agency, 2016). The burden of pollution and its destructive physiological effects weigh heaviest on marginalized children in the United States (Johansen, 2020). Historically, African American children, regardless of family income, reported higher rates of asthma. Thirteen percent of all African American children have asthma. This compares to 8 percent of White, 8 percent of Hispanic, and 12 percent of American Indians and Alaskan Natives children (Akinbami et al, 2012). Not only do African American children have higher incidences of asthma, but they are much more likely to suffer from chronic disease and be hospitalized or die of preventable diseases (Purnell et al., 2014). National Service Center for Environmental Publications, a division of the EPA, found that African American children are twice as likely to be hospitalized for asthma complications and are four times as likely to die because of their asthma as

white children (United States Environmental Protection Agency, 2016), Over the last decade, asthma rates among African American children have increased by nearly 50 percent (Akinbami et al., 2012). In addition to affecting children's health, asthma is impacting their access to a quality education as absenteeism due to asthma is the number one reason why African American children miss school each year (Akinbami et al., 2012). Unequal burdens of toxins and pollution in African American neighborhoods are translating into an unjust burden on the learners who are negotiating an urban educational system.

Asthma is not the only environmentally related health issue the children in the city of St. Louis endure. Much of the housing stocks in these marginalized communities were built in a time when lead paint, now known as a neurotoxin, was applied. Initially, these neighborhoods were predominantly white. While new homes had applied lead paint, the toxic danger was minimal because the paint dust was not yet airborne. Lead dust is something that occurs as the paint ages and breaks down. After 1978, the use of lead paint was banned (Gaitens et al., 2009). As the housing stock degraded over time, and white flight took hold of the area, African Americans began living in the now older homes once occupied by whites (Cambria, Fehler, Purnell, & Schmidt, 2018). The dangerous health effects of age deteriorated lead paint and a spatial relationship to the demolition of the older housing stock has caused lead poisoning to become more prevalent in the now predominantly African American communities. Missouri produces more lead than any other state in the U.S. (Missouri Health and Senior Services, 2021). Lead paint, and its dust, poisons a greater portion of the African American community in St. Louis than the rest of the State of Missouri combined. This is alarming given that, while St. Louis is home to only 6 percent of Missouri's children, nearly 50 percent of all the children in the state who tested

positive for lead live in the city of St. Louis (Patridge et al., 2004). In 2018, over twenty five hundred children under the age six tested positive for dangerously high lead levels (Missouri Health and Senior Services, 2021). Lead poisoning unequally burdens the African American community with a host of physical, mental, and social deficiencies, including lowered IQ, aggression, apathy, irritability, reproductive defects, high dropout rates and increased likelihood for incarceration. While lead levels in many communities are considered legally acceptable, lead has been shown to have devastating effects well before the legal definition of lead poison is reached (Akinbami et al., 2012; Braun, 2006; Nevin, 2009). While these data demonstrate a crisis, which could be eliminated, local and national policy makers are resistant to investing in the needed infrastructure changes. In 2021, the Biden administration crafted the Build Back Better bill suggesting to "Eliminate the nation's lead service lines and pipes, delivering clean drinking water to up to ten million American families and more than 400,000 schools and child care facilities that currently don't have it, including in Tribal nations and disadvantaged communities" (The White House, 2021, p. #1).

Environmental Education & Social Justice

Environmental Education is mandated as part of the Missouri Learning Standards Grade Level Expectations in Middle School Science. These standards include 6-8.ESS3.C.2 "Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment", 6-8.LS2.A.1 "Analyze and interpret data to provide evidence for the effects of resource availability on individual organisms and populations of organisms in an ecosystem, " and 6-8.ESS3.C.1 "Analyze data to define the relationship for how increases in human population and per-capita consumption of natural resources impact Earth's systems" (Missouri

Department of Elementary and Secondary Education. (2020). While NGO's, such as NGSS (Next Generation Science Standards) address sustainable development, human impact and racial inclusion and inequality (NGSS Lead States, 2013), the Missouri state standards do not explicitly mandate sustainable development, human impact or racial inclusion and inequality in teaching science. In recent years the nature of science itself has been at odds with the political powerhouses of our time. For example, former U.S. President Trump openly expressed his distrust of peer review science and was the first to not name a science advisor to his cabinet since 1941. (Kyle, 2019). Despite efforts to realign the political climate with the scientific community, neither the environmental movement, nor the Department of Education, has yet to fully incorporate a social justice context into the Sustainability Education Summit initiative set forth by the US Department of Education **(**Duncan, 2010**).**

Historically, environmental education has been *place* based, while social justice has been *people* based. Traditional environmental education has focused on ecology, land management and the citizen action skills needed to understand and influence policy makers and the media. Non-Government Organizations (NGO's), such as the Environmental Education & Training Partnership (EETAP), have begun to express concerns regarding inclusion. They are developing internal direction toward the inclusion of marginalized groups by identifying an emerging awareness of human health and social problems in racial minority and low-income communities resulting from environmental degradation is expanding the role of environmental education. (Hungerford & Peyton, 1986; Pratt 2019). If science education is to be truly accessible to all learners and amenable to all children, an Environmental Education curriculum needs to incorporate Environmental Justice awareness and remediation into its curriculum, standards, training and implementation. Educators must be bold in

their assertion to incorporate Environmental Justice advocacy into science curriculum. After decades of inaction, globally, students are demanding change. As Kyle, (2020) asserted, in 2019, during the wake of a political backdraft, youth around the world engaged in an environmental protest by walking out of school, demanding "adults do more to address climate change" (p.156).

While the integration between Environmental Education and Environmental Racism sometimes coalesces in a natural assumption of interests that are implemented by educators with a person's desire to integrate social justice, Critical Race Theory, and community-based learning in the classroom, these ideas have not been thoroughly examined and researched in science education.

I, after all, identify as both an Environmentalist and a Social Justice advocate. In fact, I was exposed to both environmentalism and social justice early in life. Being the child of hippies, you could say I was 'born' an environmentalist in the state of Oregon, where the birth of the EE movement also took place within a predominantly white population. Although my father came from wealth and privilege, my parents chose to reject their financial privilege in lieu of living independently off the land. We were poor, by choice, which is very different from being poor by circumstance, but as a young child I couldn't have known the difference; from my perspective, we were simply poor.

I grew up with a mature understanding of our natural environment and how we each interact within it, for better or worse, but with my adult wisdom and experience, I never laid eyes on an African American as a child. In my community, the marginalized were Native Americans and Hispanic immigrant populations. In my formative years, we moved to St. Louis so that my father could accept a job at

McDonnell Douglas (now known as Boeing). It was during our drive across the country where I saw, for the first time, an African American.

As I grew, I built a strong coalition with other white environmentalists, never actively recognizing the exclusion that was taking place or self-identifying as a white environmentalist. It simply never occurred to me until much later in life. As I completed my compulsory education in Missouri. I did, however, notice a deficit in my own Environmental Educational (EE) learning experiences. This void in my own education and a lifelong love of science and the outdoors, compelled me to become an EE teacher. To my surprise, in Missouri, there is no formal EE degree program. So, I opted for the next best thing and received my degree in Middle School Science Education which only provided me with one (elective) Environmental Science class. It wasn't until I began my PhD program and accepted the guidance of one professor that I recognized the whiteness of the EE movement. It occurred to me then, that if I had managed my way through that level of science education and experience and still had not recognized that EE was excluding both the issues and the participatory inclusion of marginalized groups, then there was a significant void in EE at every level in Missouri science education.

Social Justice and Environmental Education always felt like they complimented each other's moral compass. For me, being part of a marginalized population, having come from such an impoverished life, I felt a connection to the social justice movement. I can recall on more than one occasion not being invited or allowed in a friend's house because of how I looked (dirty, shoeless and poor). There was plenty of charity, but no acceptance. For me, Social Justice and EE complimented each other like two sides to the same coin. I both believe and accept the idea that it is our responsibility, as humans, to ensure that we each have an equal

opportunity at life, health, and prosperity. My experience in the educational system and my participation in social justice activism, however, painted a very different picture. This new world view would evoke a dramatic paradigm shift in my beliefs, which provided the context for my research.

This perceived disconnect between Environmental Education and Social Justice was made strikingly clear to me one semester in 2009. I had noticed an omission of social justice issues, such as EJ, in science education. At the urging of my mentor, I researched and created a course to merge these two ideas. We named it "Urban Education & Environmental Justice"; in my mind it was going to be perspective changing. The title had it all, for the Social Justice folks, 'Urban and Justice' and for the Environmentalists, 'Environmental & Education'. So here we all were, likely for the first time in an elective course together, both my social justice and EE colleagues, Environmentalists and Social Justice Advocate's in the same elective class. The result, to my shock, was an explosion between two groups who had never directly addressed each other's belief system in the context of race and privilege. Looking back, I was naive to presume there would not be an explosive outcome. Should I ever get the opportunity to do it again, I would make many changes to the syllabus and discussion management. Nevertheless, that class has changed forever how I look at the intersection of race and environmental education. This, for me, was what Maxwell Gladwell called the *Tipping Point* (2015). The paradigm had shifted in my mind. It was at this moment that I, a white woman, came to understand, although social justice and environmental justice were both heading in the similar directions, they were on two separate roads with very different drivers. From this point forward, Environmental Justice in Education became my focus as the paradigm of sustainable science education.

Barriers in Environmental Education

The original title of this dissertation was “Teaching Environmental Justice Education as a Practice of Freedom.” I added the term “Barriers” after experiencing limiting factors in teaching Environmental Education in any capacity in Saint Louis Public Schools. Initially, I framed my purpose & questions around identifying the deficits in the Environmental Education curriculum as it related to marginalized groups. Understanding that youth empowerment starts at school, this seemed plausible. My intention was to make the argument that marginalized groups are disproportionately exposed to environmental toxins, therefore, as educators we need to look at how we are teaching EE as it relates to this group. The end goal was a study of empowering learners to advocate for themselves and their community. While my focus has changed to barriers in EE, my arguments as to why we need to explore ways to develop an effective, culturally relevant EE curriculum will remain.

I came across several barriers to this study which I will explore further in my research. The first is the erosion of the EE required curriculum in public Missouri schools. Modern policy has created a culture of teaching to fulfill standardized testing requirements. This testing environment leaves little room for experiential education in the classroom. Therefore, developing a culturally relevant curriculum, which will likely not be implemented, is futile.

Another barrier is related to school district support. While students are eager to learn EE and many teachers are willing to participate in a study, we have found it is becoming increasingly difficult to gain access to schools and classrooms in Saint Louis Public School District. It is my understanding one would have an unreasonable challenge being given access to the research participants using our IRB system. Additionally, the high administrative turnover in St. Louis area schools

prohibits relationship building needed to do long term studies. While working with the STC (Science, Technology and Culture) program, a science enrichment program which works with teachers in marginalized schools to teach place based, student centered science education, over the last decade, I have experienced this phenomenon firsthand. I have worked with over 7 public schools during this time. Each year the school's participation is at risk due to an administration change, often resulting in moving the program to an entirely different school and cooperating teacher.

Teacher EE learning experiences are also limited. While Environmental Education subject matter is required for K-12 learner competencies, teachers are not required to obtain any EE certifications, nor is EE a requirement in their certificate plan of study. All environmental themed courses are considered electives in Missouri. Teachers, therefore, are required to be intrinsically interested in EE and actively seek learning experiences to develop their scientific literacy to a level which satisfies the mandated grade level science requirements. Educators must recognize and actively engage in an education environment which is working toward global stability and student engagement. (Kyle, 2020). If a teacher has not been exposed to, or does not find enjoyment in environmental activities, he or she may opt to develop other aspects of scientific literacy which appeal to them directly. It could be argued, these teachers may then, as a result of limited understanding and interest, dismiss EE topics in the classroom. If they do not dismiss these programs, they may seek outside assistance for authentic EE experiences for the learners.

These roadblocks lead teachers and environmental educators to seek EE experiences for the learner outside of the traditional classroom. This off-site learning lends itself to a new set of barriers. Transportation, parent involvement, school participation and teacher support have all been inhibiting factors when facilitating off-

site EE experiences to marginalized learners. In fact, these inhibiting factors are what lead me to the precipice of my initial research, requiring me to transition toward identifying these roadblocks in EE.

Purpose of Study

The purpose of this study is to identify the barriers in teaching environmental education to marginalized and high poverty learners in the greater St. Louis Missouri area. My goal was to identify emerging themes and teacher reflections which might help inform further research and improve teacher practices.

Definitions

For the purpose of clarity in this research, I have provided brief definitions of key terms used throughout the text.

Environmental Racism is discrimination in

1. The enforcement of regulations and laws
2. The deliberate targeting of marginalized communities for toxic waste disposal, proximity of polluting industries and exclusion of toxic cleanup
3. The history of excluding marginalized communities from environmental groups, decision making boards, commissions and regulatory bodies

Environmental Justice, as defined by the U.S. Environmental Protection Agency (EPA), is "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"(2021).

Marginalized groups or people will be applied herein where the term 'minority' has been historically evoked. Marginalized, I believe, is a more descriptive

and inclusive term to describe the communities of urban citizens who have been dis-empowered or excluded based on discriminatory factors.

CHAPTER 2

LITERATURE REVIEW

Environmental Justice has been historically addressed as a social justice context issue. Very little research exists connecting Environmental Justice directly to Environmental Education. Likewise, little literature links EE to EJ. Much of the research is mutually exclusive.

To understand the application of Environmental Justice in Education, one must first understand what it is not. Many topics related to or influenced by EJ are similar in nature to EE, but are not the same. The contextual differences between EE, EJ, Ecojustice, Experiential Education, Place Based education and other approaches vary mainly by how the learner is expected to frame the interactions between humans and the environment (Martusewicz et al., 2011).

Environmental Racism's Burden on Learning

As the environmental justice movement has gained understanding and acceptance, much literature and research has been devoted to it as a social and racial construct; yet little attention has been paid to the correlation between the location of these toxins and their effects on learning in African American and other minority children. Research suggests African American children are more likely to be exposed to mentally debilitating toxins that affect learning (Gaitens et al., 2009). Further, research suggests African American children, as a group, score lower on standardized tests, suffer higher instances of asthma, are more likely to have ADHD, and are more likely to suffer from mental retardation (Nevin, 2009; Reyes, 2015). Neurotically debilitating toxins such as Lead, Mercury and Chlorine are prevalent in their communities (Rossignol, et al., 2014). Lead, in particular, has been shown to have a

direct effect on standardized test scores. When lead is reduced or removed from a learner's environment, test scores go up (Aizer et al., 2018). These standardized test scores are directly linked to the procurement of educational funds by both the student and the public institution, as well as access to higher education. Despite the acute social implications of this correlation, the educational community has done little to incorporate environmental justice education into our classrooms or our communities.

While the Every Student Succeeds Act (ESSA), implemented in 2015, worked to undo the damage of No Child Left Behind, which enacted school closings, calls for teacher accountability, and hostile school takeovers, one must consider the educational implications of the systemic poisoning of our children. Like other predominantly African American cities, African American children, living in St. Louis, Missouri, have a reputation of maintaining low standardized test scores, high teen pregnancy, enhanced aggression, high rates of learning disabilities, violence and high dropout and incarceration rates, all of which can be linked to the impact of toxic burdens they contain in their systems (Reyes, 2015). The physical effects of prolonged lead poisoning, for example, have neurological effects that mimic some of these same behaviors. (Gaitens et al., 2009; Nevin, 2009;, Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention. 2012). These statistics and perceptions have perpetuated harmful racial stereotypes. We need not enable these stereotypes by ignoring this important topic in our classrooms and our communities. Closing schools and holding teachers accountable, only serves as a distraction from the elephant in the room, the poisoning of our children. Not unlike the Jim Crow laws, allowing low-income, African American students to continue to be subjected to and negatively affected by toxic waste and poor housing is yet another form of racism.

Youth in Action

Culturally relevant Environmental Education can provide a catalyst for youth action education. Marginalized groups are well aware of the toxic conditions of their environment and how the "U.S. society views them. But I think that they do not know what to do about it" (Hill Collins, 2009, p. 90). Giving youth the tools to evoke change and promote a healthier community has value which transcends the classroom.

This transformation can only occur in a safe place. It is up to the EJ teacher to ask themselves, "Where in their physical space can kids freely express what is on their minds?" (Hill Collins, 2009, p 91). As Kyle (2020) asserted, "effective EE classrooms, which identify placed-based, culturally relevant problems, have a responsibility to create a safe place to explore ideas and feelings about those ideas. However, despite the history of EE, it is not embedded or woven into the typical school curricula. EE is often avoided in school-based settings due to negative emotions and the overwhelming sense of hopelessness students and educators often feel as a result of immersing into such issues" (p.4). The current political climate only serves to deepen those emotional barriers.

In 1969 Sherry Arnstien developed the "eight rungs on the ladder of citizen participation" (p. 216). The range of participation starts low at manipulation and therapy, where the community begins to be informed of the topics, but are given little to no opportunities for feedback. Then moving into informing, consultation, and placation phase where a selected few are provided participation opportunities but hold little control. It is not until the final stages, partnership, delegation, and citizen control, do we see transformative, cooperation and self-governing.

This cross disciplinary hierarchy of citizen participation can be used to illustrate how we can use EJ education to approach marginalized citizen control in environmental education and ultimately develop healthier local environments (Arnstein 1969). In our current approach to EJ in environmental education, we are, arguably, in the manipulation rung, as marginalized citizens are rarely given more than passive information regarding toxins in their communities. This information serves only to influence the marginalized citizen to be a non-participant. Further, it fails to acknowledge the important, arguably necessary, role youth play in action plans and facilitating change. This distinction is further exemplified by Botchwey, et al. (2019). The authors demonstrate an updated version of Arnstein's model, which embraces youth participation. Historically, youth have been excluded from the planning process of citizen participation related to actions that directly impact them. Case studies involving youth focused planning initiatives, such as engaging schools in urban revitalization: The Y-PLAN (Youth-Plan, Learn, Act, Now!) demonstrate a means by which youth may be better represented in the citizen ladder of participation. (McKoy & Vincent, 2007).

Recent events, such as the global student led school walkouts protesting climate change and the use of social media, such as Tik Tok, to disrupt political rally attendance, suggest youth may have become impatient waiting for adults to negotiate toward their collective will or in their best interest (Pezzullo & Cox ,2021). Often these activities are recorded and shared on social media platforms, which serve to amplify the message (Méndez, 2020). Educators have an opportunity to engage learners for self- advocacy while identifying "ways in which this placed based notion of contributing to climate change can become school-community based initiatives" (Kyle, 2020, p 153).

Environmental Education: The Birth of a Movement

Most historians credit Rachel Carson's 1962 book, "Silent Spring" for igniting the modern-day environmental movement. But wilderness preservation, or what would later develop into the modern-day environmental movement, was first influenced by white, male explorers, authors and artists such as William Cullen Bryant, George Catlin, John Muir, James Audubon and Henry David Thoreau. These men published works and advocated for the preservation of wild places (Taylor, 2002).

This conservation and preservation initiative became an environmental movement around the same time the civil rights movement developed and gained mainstream support. Some suggest those who identified as environmental activists splintered from the civil rights movement as they developed their social perspective (Bullard, 1990). While this idea likely applies only to some environmentalists, we must recognize that environmentalism was and still is highly segregated, which is counter intuitive to a group who would embrace civil rights as the genesis of its organization. Environmentalism, at its core, is not a people issue, it is a place issue. It places value on preservation for aesthetics and future generations of, presumably, privileged populations.

EJ & Urban Environmental Education

Some progress is being made in terms of inclusion. Recognizing a linguistic deficiency in Environmental Education, EETAP (Environmental Education and Training Partnership), contracted with the consultants, Intercambios, a bicultural consulting group, "to create and deliver workshops designed to support environmental education professionals in developing the awareness, knowledge, intention and behaviors needed to make their organizations, programs, and activities

more culturally sensitive and thereby more inclusive” **(**Galváán & LaRocque, 2010, p 29).

EJ Movement

The EJ movement is the Social Justice arm of the EE movement. In many ways, its roots run parallel to the EE movement, but those roots rarely intersect.

The phenomenon of environmental justice is described as an area of study and social activism that examines whether certain ethnic, socioeconomic, or other groups suffer a disproportionate burden of harmful environmental stresses in a particular society or region (Bullard, 1994; Cole, 2001; Executive Order 12898). The construct of environmental justice is a phenomenon which describes social injustices that are framed in an environmental context.

This phenomenon has gone by several names as it has developed in the collective social context. The term we use today, environmental justice, was coined by Benjamin Chavez (Cole, 2001), after the publication of the results of a study by the U.S. General Accounting Office, which formally identified environmental racism as authentic (1983). The study was motivated by citizen protests and arrests related to the placement of a landfill in the North Carolina community of Warren County. The report’s findings stated that out of the four hazardous waste landfills in Warren County, three were located in predominantly African-American1 communities, although African-Americans made up only twenty percent of the county’s population (Bullard, 1994; U.S. General Accounting Office, 1983). This report validated what others thought to be true; minority groups were being exposed to toxins and waste at a greater rate than their white counterparts. In 1987, The United Church of Christ Commission for Racial Justice conducted a landmark study, which identified St.

Louis among a handful of urban populations found to contain the greatest concentrations of hazardous waste sites (Lee, 1987).

By the early 1990's, the environmental justice movement was establishing roots in the social racism dialect and public policy (Executive Order 12898, 1994). However, almost no attention was given to the effects exposure to these toxins have on children's physical and mental development, or their ability to learn. There was almost no mention of the significant educational disparities, which exist in many minority communities, nor had any effort been made to direct the public's attention to the mainframe of the crisis. None, that is, until the book Savage Inequality by Jonathon Kozol (1991) uncovered environmental inequalities and described the disproportionate burden of toxic and hazardous waste exposure as it relates to children and educational racism (Kozol, 1991, p.11). Equally as important, he unveiled these inequalities in a public forum, a widely published book. Unlike those before him, Kozol's book made the connection between environmental justice and its effects on children's learning. His observations and investigation of the urban ghost town of East St. Louis, Illinois was a fitting location to represent the educational, environmental and racial disparities, which plague the US and damage our children's ability to learn (Kozol, 1991).

Toxins and Education

The preliminary research I conducted found that toxins, which are known to cause neurological and physical disabilities, are found predominantly in minority communities. Knowledge of EE is the foundation of understanding, correcting, and preventing these neurotoxins in communities. Very little research addresses this in science education or more specifically, Environmental Education. Likewise, a small pilot study of pre-service teachers suggested that pre-service education does little to

prepare teachers for sustainable science education in a marginalized community. Further, environmental organizations such as the Sierra Club and Future Farmers of America (FFA) are made up of predominantly White member's, 84 percent and 88 percent respectively. While groups like the National Resources Defense Council maintain a commitment to inclusion by stating in 2009 that "our groups are not as diverse as we'd like, but every one of the major groups has identified diversity as a top priority" (Navarro, 2009, p. 1), EJ supporters were seeing little difference in the makeup or access to environmental issues and groups. In 1993, EJ supporters, who had been advocating for environmental inclusion for years, wrote an open letter to the (self-described) top ten environmental organizations. At the time of the letter, there were no minorities in top leadership roles in any of the 'Group of Ten' organizations. While "minority staff representation ranged from a high of 12.5 percent (including administrative staff) at Friends of the Earth, to a low of 0.4 percent minority staff of any rank at the Sierra Club" (Rivers, 2009, p.475)

Learning and learners are not one-dimensional. Effective educators of minority and marginalized youth must consider the physical, social, and environmental dynamics that exist within these communities. In EE, the byproduct of toxic poisoning is addressed generally, but not the root cause. Nor is the group(s) which carries the greatest amount of the toxic environmental burden identified and the racial and social inequalities which facilitate the physical and mental impairments imposed on minority children. Given that many of the neurotoxins, for which marginalized groups are disproportionately exposed, effect learning and quality of life, incorporation of EJ education into EE, teacher education and ultimately classroom environmental education could provide an entry point, into Education for

Sustainable Development (ESD), affording a transformative empowerment to a historically disempowered population.

Since EE is not a required course in pre-service teacher education in Missouri, teachers interested in teaching EE must attend supplementary or elective EE coursework. Therefore, I will also look to the popular supplementary elective EE teachers' literature and programs, such as Project WET and Project WILD, developed by The Council for Environmental Education, for evidence of EJ in Environmental Science education.

Some groups, such as the Environmental Education and Training Partnership (EETAP) and the Missouri Environmental Education Association (MEEA) are looking to, or have developed programs to create and deliver workshops designed to support EE professionals in emergent awareness, knowledge, intentions, and behaviors needed to make their organizations, programs, and activities more culturally sensitive and thereby more inclusive. These important programs exist in few preservice teacher educator programs, including those in Missouri (Hungerford & Peyton, 1986, (Álvarez-García, et al. 2015, McKeown-Ice, 2000). The depth of deficiency in pre-service EE training and competencies was further analyzed in a 2015 study, where Álvarez-García, et al. concluded, "the overall scarcity of research in this area, jointly with certain gaps and methodological limitations, affirms the need for strengthening the evidence base" (2015, p. 72). In other words, not only have we identified gaps in pre-service EE preparation requirements, but pre-service teacher knowledge deficiencies are demonstrated in the limited number of studies which exist on the topic.

Nationwide, little has changed in terms of Environmental Justice, in fact, the April, 2007 *Toxic Waste and Race at Twenty* anniversary report found that racial

disparities in the distribution of hazardous wastes are greater than previously reported." "…people of color make up the majority of those living in host neighborhoods within 3 kilometers (1.8 miles) of the nation's hazardous waste facilities. Racial and ethnic disparities are prevalent throughout the country" (Bullard et al., 2007, p. 60). In 1994, executive order 12898, directed "federal actions to address environmental justice in minority populations and low-income populations" (2001). One result of this direction was the development of the "EJ 2020 Action Agenda: EPA's Environmental Justice Strategy." This document served as a framework of actionable items to address Environmental Justice issues in our nation. The framework provided a timeline from 2016- 2020, with the culmination of efforts concluding in 2020. The document asserted it would present the progress regularly over the four year period. As of this day in 2021, there is no evidence of progress or milestones reached or updates provided on the program website. Further, the framework of policy and planning identifies training needs within government agencies, but does not address or identify curriculum, learners or schools. Meaning, the framework proposes to effectively site violations, as stated in its objective to "address pollution and public health burdens caused by violations of environmental laws in the nation's most overburdened communities, strengthen the role of environmental justice in EPA's compliance and enforcement work, and enhance work with our regulatory partners in overburdened communities" (EPA, 2016), without educating the community or the stakeholders. Further research could revisit this policy framework and identify areas where educator training could be a pillar of the benchmark goals of the *EJ 2020 Action Agenda* (EPA 2016).

While these disparities have been identified, marginalized communities are rarely empowered to take reconstructive action. In Arnstein's Eight Rungs of the

Ladder of Citizen Participation, citizen participation is characterized as a tool to incite social reform, which enables the 'have-nots' to be empowered and "to share in the benefits of the society as a whole" (Arnstein, S.R., 1969; Hermans, 2004, p. 17). Further, "residents are unlikely to become involved in neighborhood-level organizing and planning in the absence of a strong citywide coalition of neighborhood groups that protect them from official retaliation" (Reardon, 1998, p. 330). This redistributing of power enables minority citizens, presently limited in the political process, to take control of the process, which is set up to protect them, but has not (Hermans, 2004, p. 37). Although a handful of these community organizations exist, educators have neglected to incorporate them into a community-based education or into the curriculum at any level. Community-based learning provides a sense of empowerment; this empowerment, which openly exists in the white community, is regularly discouraged in the African American and other minority communities by a number of factors (Johansen, 2020). As educators, it is our responsibility to create a learning environment that empowers students and communities to organize and pursue community defenses from those who are disabling African American and other minorities in urban poor communities. This empowerment approach can lead to greater community ownership of the project and significantly increase the participation of residents and stakeholders (Kyle 2019; Reardon 1998,). Using place or community-based education as a model; educators should enable learners to create awareness and understanding on these important issues in the community. They should provide the tools needed to support police, which induce a healthier learning environment, at the schools and in the community.

Which came first the toxins or the marginalized (does it matter?)

Years of living in these dilapidated housing units and the tendency of high polluting corporations to capitalize on the powerless minorities helped to perpetuate the exposure of toxins to a disproportionately African American demographic. In 1987, the United Church of Christ's Commission on Racial Justice presented the ground breaking study *Toxic Waste and Race* (Pezzullo, 2007). "The report was significant because it found race to be the most potent variable in predicting where commercial hazardous waste facilities were located in the U.S., more powerful than household income, the value of homes and the estimated amount of hazardous waste generated by industry" (Bullard et al., 2007, p. 60). Just four years later, Jonathan Kozol published *Savage Inequalities*; the findings in these reports and others were troubling. East St. Louis, Illinois was among one of the most toxic cities in the United States. "Of 66 cities in Illinois, East St. Louis ranks first in fetal death, first in premature birth, and third in infant death" (Kozol, 1991, p.14). "Soil samples tested at residential sites turn up disturbing quantities of arsenic, mercury and lead," "lead levels were found to be as high as an astronomical 10,000 parts per million" (Kozol, 1991, p. 14). Minority children presented with disturbingly high levels of lead and some were even to the toxic level of lead poisoning (Kozol, 1991). While these books revealed the inequalities in toxic exposures, government responses to environmental disaster continued to favor non marginalized groups. The media coverage of the tainted water in Flint Michigan, as well as the responses to hurricane Katrina, Harvey, Maria and more unveiled a dismissive response to the exposure of toxins in marginalized communities (Johansen, 2020).

These toxins are silent and debilitating. By the time the poisoning becomes apparent, "it is too late to undo the permanent brain damage" (Kozol, 1991, p. 15).

The poison, he says, "is chipping away at the learning potential of kids whose potential has already been chipped away by their environment" (Kozol, 1991, p. 15).

Together, these studies sounded alarms in the environmental movement and gave cause for legislative change during the Clinton administration. The movement now had a term, "environmental justice." In 1998, the EPA validated this new form of racism by giving it a legislative definition and goal, "…to ensure that all people, regardless of race, national origin, or income, are protected from disproportionate impacts of environmental hazards recommendations for addressing the problem" (EPA, 1998, p.1).

In a time when most (white) Americans were feeling defending racism as a historical challenge, these allegations were harsh. The naysayers of environmental racism suggest the inequalities were merely coincidences or unfortunate side effects to white flight. "Blacks are most likely to live in areas that have been left behind by the profound restructuring of the national and international economy: major metropolitan areas, particularly in the northeast and Midwest" (Racial Disparities, 1999, p. 299). Some reports suggested that black residents actually moved to the toxic areas, therefore relieving any guilt of the chemical plants. "Close to 80% of active facilities in St. Louis were originally sited in census tracts that were either uninhabited or contained higher than average percentages of nonminority (white) residents" (Lamber, 1997, p. 204). They suggested that it wasn't race, it was poverty subjecting a disproportionately black demographic to be exposed to higher levels of environmental toxins than whites. Some suggested that it was "housing values", not race, that "are closely related to existing environmental inequities" (Yang, 2001, p. 9). Noting shortcomings in environmental inequalities research, it "fails to account for the dynamic nature of the housing market. …economic factors--not sitting

discrimination--are behind many claims of environmental racism" (Lambert 1997, p. 204). However, many studies show when other factors such as income level are controlled, it is race, not poverty which is an indicator for toxic waste location and elevated lead level (Gaitens et al., 2009; Pezzullo, 2007, Pezzullo & Cox, 2021). One study found that African American children "had 2.2 times higher lead levels in the second and third trimesters and 1.9 times higher lead levels postnatally in the first year of life compared to white children" (Cassidy et al, 2017, p.3). Regardless of which came first, the toxins or the minorities, both sides agree, marginalized communities are more likely than white communities to be subjected to debilitating environmental toxins.

The highest in the SES ladder, which Arnstein called the "Executive Elite School," (Arnstein, 1969, p.10) was made up primarily of students with parents who are generally categorized as executives in the work force. These learners defined work as "developing one's analytical intellectual powers" (Arnstein, 1969, p.10). These students were being educated to think independently and were being prepared to be in positions of power.

Sadly, despite early legislation and grassroots movements, little has changed. Over the years, mainstream media has glossed over and even ignored this important topic. The racial divide has continued to isolate the rich from the poor and the black from the white. Residents of these areas are living in nothing short of an "apartheid" and in some areas short of "a third world county" (Kozol, 1991, p. 15). Richmond California, home to Chevron oil, for example, is located in a neighborhood of 25,000 people. 85% of those residents live at or below the poverty line within one mile of the facility (Mendez 2020). Many of the biggest U.S polluters When big corporations began to gain control of the judicial and political backbone, "people became

powerless and corporations became powerful" (Pezzullo, 2007, p. 15). Little was done to protect these corporations from abusing the local communities; "our government protects the right to pollute more than it protects our heath" (Pezzullo, 2007, p. 15). These companies are not being held accountable. They have created loopholes to avoid taxes and inspections (Pezzullo & Cox, 2021). To avoid government regulation, "they have created small incorporated towns which are self-governed and exempt therefore from supervision by health agencies." These so-called towns are nothing more than imaginary ghost towns, which exist only on paper. Towns like Sauget, Illinois "claims a population of about 200 people. Its major industries, other than Monsanto and the other plants, are topless joints and an outlet for the lottery" (Kozol, 1991, p. 43). These made-up towns "provide tax shelters and immunity from jurisdiction of authorities" (Kozol, 1991, p. 45).

EJ Literacy

The Environmental Education citizen

Creating culturally relevant, placed based, Environmental Education citizenship requires a commitment to the student as an intricate part of a living, breathing community. This community focus can be a powerful tool for change. For this change to be authentic, Environmental Education teachers and students may find it constructive to climb *Arnstien's eight rungs on the ladder of citizen participation* achieve citizen control (Arnstein, 1969). If we are to expect the student to value his/her community, we should expect the community to reciprocate the value to the student. About 30 percent of the Missouri population resides in urban areas, yet much of the Missouri EE curriculum is devoted to rural issues.

Barriers in teaching Environmental Education and Environmental Justice

To facilitate teaching Environmental Justice (EJ), one must be willing and able to also teach Environmental Education, as it is at the foundation of Environmental Justice Education. An emerging body of evidence-based research in Environmental Education (EE) suggests significant benefits. As this research has developed, the identified barriers of teaching EJ were confounded by the barriers of teaching Environmental Education. As we explore those barriers, the historical research on this topic has laid the foundation for us to explore further challenges. To unpack these barriers, we must identify trends and root causes of obstacles for educators. In *Barriers to Environmental Education* the authors selected four categories as a framework to use for these data; Conceptual, Logistical, Educational and Attitudinal (Ham & Sewing, 1988). These categories were essential to determining the internal and external challenges educators encounter when tasked with teaching Environmental Education. Internal perceptions and belief systems can be as obstacle forming as external barriers. For example, an educator who does not recognize the educational advantage to teaching Environmental Education in the classroom is not likely to attempt to breach any real or perceived barriers to teaching EE. Using this framework Ham and Sewing (1988) were able to make recommendations to teaching EE which included cross curriculum teaching, cross curriculum teacher education, in-service education program and resource sharing (Ham & Sewing, 1988).

One characteristic of EE that differentiates itself from other curriculum is the use of outdoor and off-site educational locations. This experiential education is not well suited for traditional classroom set-up and resources. Accessing and utilizing natural spaces as an extension of the classroom can give rise to many barriers for

educators. Perceived hazards, student accessibility and teacher training are among some of the reasons teachers find outdoor educational experiences to be barriers in teaching EE (Simmons, 2010).

In addition to off-site natural spaces, incorporating informal learning with green spaces on the school campus has shown to have unique benefits, especially in urban areas (Dyment, 2005). Given the proximity of the green spaces, researchers still identified barriers for implementing programs which utilize these spaces. One barrier to teaching EE on campus green spaces "was that many teachers lacked the confidence or skills about how to use the green school ground as an outdoor classroom" (Dyment, 2005 p.38).

Thinking Big: Changing the face of Environmental Education

Environmental Racism is historically a complex, discursive, and systemic reality, which is serving to erode our basic human freedoms and devalue our cultural conscience. As educators, it is not enough to simply recognize these inequalities exist, it is not enough to deal with them, and it is not enough to protest these atrocities. We, as educators, must take responsibility for the transformative education we seek to demonstrate. Educators committed to Social Justice and Environmental Education are "often constrained by dominant educational discourses" however we must not find ourselves "reinforcing rather than transform(ing) school institutions" (Hwang, 2009, p. 698). This type of transformative change may seem like an insurmountable task to pursue given the already challenging environments many teacher navigate during a typical classroom day. Sometimes systemic changes can be realized by first expressing the intention of change. I am reminded of an example of this in the book *Tipping Point* which was related to how the Declaration of Independence was first drafted. After meeting with the 1st continental congress, on his

travels back home, John Adams made a to-do list, of sorts. On this list of things to accomplish, he wrote, “form an alliance with France and Spain,” and “a Declaration of Independency” (McCullough, 2002). So often we forget that before great things happen, before nations are built, before revolutions are declared, there are a few people who believe in a change so dramatic, it seems impossible, then, they accomplish a seemingly impossible task. Educators must commit to educating youth on land stewardship and empower them to “engage in the inquiry of environmental justice” (Peloso, J., 2007, p# 2).

CHAPTER 3

METHODS

As the Environmental Justice (EJ) movement has coalesced, increased literature and research has been devoted to this concept as a social and racial construct, yet little attention has been given to the correlation between environmental toxins and their effects on the learning and development of marginalized groups, such as African Americans and other minority children. This relationship between environmental toxins, learning, and behavior is further amplified by systemic racism and the rhetoric of white-washed environmentalism (Aronson & Lateasha, 2022).

My research question is in direct response to my experience teaching EE in the educational system. Identifying the barriers which helped direct marginalized students away from Social Justice and EE will help us facilitate a new direction in education. As a middle school science teacher whose own Environmental Justice (EJ) knowledge derived from science education, my assumption was that there was a need to incorporate social justice issues into the Middle School Environmental Science classes. Environmental Education is only relevant if it addresses the local needs of the community, therefore, it is necessary to build curriculum which addresses these specific issues. At present time, pre-service teachers in Missouri are not afforded the opportunity for training of how to teach in these unequal environments while building a community of well-informed students to gain social power and advocate against the injustice of EJ. However, before one can suggest changing an entire program or curriculum, I felt it was important to identify the barriers, both formal and informal, that educators have identified in their personal teaching experiences. This was the rationale for my research questions.

Research Question

1. What are the barriers to teaching Environmental Education identified by informal educators, teachers and non-profit organizations?

Research design

This researcher along with Great Rivers Greenway, Missouri Naturalist, Saint Charles parks department and other informal and formal educators initially intended to identify barriers in EE using a youth program geared toward giving youth informal EE experiences. This program was a newly developed tangent of the Race for the Rivers event in Saint Charles, Missouri. The participants in this research were responsible for the program development and implementation of this one-day program. This study would document the day-of activities and reflections of the informal educators and this researcher's personal reflections within this program and other barriers experiences in the past eight years of teaching informal environmental education in several unique settings. Unfortunately, the program was not successfully implemented due to unavoidable challenges and barriers in facilitating the program. These very barriers in implementing the program of study served to develop this researcher's autoethnography study and reflections (Poulos, 2021). The story of my professional and personal experience over the last 15 years of teaching and coordinating a science program as told using the qualitative autoethnography method serves the purpose of expanding upon the sociological understanding of the barriers inherent to teaching students in marginalized, underserved and/or extreme poverty communities (Stahlke, Wall. 2016).

Purpose of the Study

The purpose of this research is to identify barriers and complexities in implementing & facilitating EE programs for marginalized youth in Missouri.

Initially, based on my personal experience as an educator, and then as a researcher, I found implementing an effective EJ or EE curriculum in Missouri to be rife with challenges and roadblocks. Informal conversations with educators corroborated my personal experiences related to the barriers in teaching Environmental Education.

Selection and rationale of Curricula

Although MO Learning Standards identify EE concepts in their science curriculum, namely, ESS3 Earth and Human Activity, Concepts A, B and C, explore the impact of human disruptions effect on the environment, there is no standard to explore the effects of environmental toxins on humans. No meaningful standard of pre-service teacher curricula exists for Missouri Environmental Education, nor are there any required classes/courses to prepare teachers for Environmental Education in the classroom. Teachers who choose to educate themselves on the EE curriculum must seek outside training and professional development.

To fill the void, NGO's (*non-government organizations*) like MEEA (*Missouri Environmental Education Association)* created a resource center for educators interested in expanding their EE knowledge and developing support systems in EE science education. Other NGO's, such as Greater Greenway Network, Missouri Naturalists, STC (Science Technology & Culture), Saint Charles Parks & Big Muddy River Excursions will develop, implement and fund the outdoor EE experience. The informal Curricula was to be experience based, focusing on exposing youth to the environment as a hook for later Environmental Education. This experience was to take place at the Race for the Rivers event coordinated by the aforementioned NGO, city and park participants.

Throughout the development, implementation and reflection process, each NGO and volunteer participated in a survey. While the EE experience was with

Middle School students, reflections and questions related to the adult facilitators current and historical experiences. The facilitators' survey answers were analyzed based on three rationales; 1. This researcher's expertise is in Science Education 2. Missouri Science Standard includes EE concepts which could align or include EJ concepts in Middle School Science Education. 3. Identifying what barriers in teaching EE or EJ education emerge.

I developed a critical analysis of the participant and educator survey responses using open, then selective coding according to grounded theory (Glaser & Strauss, 1967), looking for emerging categories of barriers of implementation concepts and emerging themes related to curriculum content. Open coding was used to develop cooperating outdoor educator conceptions, identify emerging themes and identifying barriers in teaching EE using educator responses to the survey.

Source	Time-frame	Analysis type
Informal Educator (IE) Survey	Beginning/End	Open coding looking for emerging themes
Personal reflections	Throughout	Autoethnography

Participant outdoor educator identification

Participants were selected if they met the following criteria:

1. Currently participating in outdoor education programs accessible to Missouri Urban schools with a marginalized population.

2. Willing to participate in program observations, curriculum development, and survey.

Data collection procedures

After identifying formal and non-formal educator participants using list serves, referrals and open calls, this researcher requested participation in completing the

Barriers in Teaching Environmental Education Survey. I enhanced the sample diversity by engaging in a snowball method of participant procurement.

Based on the results of this research, I identified barriers and make suggestions for program changes which will facilitate EJ education.

Autoethnography

Reflecting on over 15 years of teaching science education with an emphasis on Environmental Education to high poverty youth, this researcher has developed an autoethnography with the purpose of identifying barriers in teaching environmental education to marginalized youth and reflecting on the practice of teaching in predominantly African America classrooms in the greater St. Louis Missouri area as a participant observer.

Ethics

The participants in this study were all over the age of 18 and taught science education either formally or informally. They were procure using the snowball sampling method starting with educators and organization which I am familiar. The participant were asked to network and refer other potentially eligible educators in our area. The names and professional affiliation of the formal and informal educator's survey participants were not collected.

These survey data are stored in a password protected in Alchemer, a cloud survey service. Alchemer is a highly rated, GDPR (General Data Protection Regulation compliant company.

Data analysis

The notes and/or recordings of the survey sessions were coded for themes of EJ and other Social Justice context. Grounded theory was used to develop overarching themes and emergent themes.

I created a coding system that identified key words, emerging themes and phrases that are sensitive to EE, EJ and social justice concepts and barriers in teaching EE. In addition, I looked for specific references to barriers in teaching EE and or EJ education.

Tables and graphs were created using the tools provided in the survey software use to collect survey responses. These figures were analyzed for emerging themes and duplicate responses which helped identify the most common answers and beliefs.

Limitations

Although middle school Environmental Education is a required Missouri State standard, it frequently is ignored or delayed in the classroom and in pre-service teacher education curriculum. In many districts the very essence of EE is diluted by standardized testing, limited resources and teachers who have minimal EE skills or practice. As a result, the "institutionalization of environmental education has muted its potential as a transformative educational discourse practice" (Furman & Gruenewald, 2004 p. 72).

It is this researchers' experience that social justice issues, such as poverty and racism, are rarely addressed in the classroom and in pre-service teacher education. For this reason, the survey was at risk of producing limited amounts of participant and data.

These limitations are the foundation of this research. I expected to find further emerging limitations related to the development and execution of environmental

education in Missouri. While these emerging barriers serve as limitations, they simultaneously serve are data.

Summary

As the survey results were analyzed through triangulation, I developed a comprehensive perspective of the scope and depth of how EJ and social justice barriers are addressed in Missouri EE curriculum and practice, while acknowledging my personal experiences and shortcomings as an educator. I identified barriers, reflected on teaching STC, and offer recommendations for improvements, which have the potential to facilitate inclusiveness in action education that is purposeful in its goal of educating the student as a productive citizen in their community, thereby able to serve as a leader and mentor for community involvement and action.

CHAPTER 4

A JOURNEY IN REFLECTIVE PRACTICE

In the fall of 2004, I was navigating a crossroads. Thirteen years after becoming a teen mom, I was entering the last semester of pre-service teacher training and nearing completion of a BA degree in Science Education. While it was not without its challenges, I loved college. I was eager to begin teaching, but the internal appeal to do something 'bigger' was welling inside of me. I had already been teaching in the local Community College's continuing education department, as well as substitute teaching. My obligation to student teaching would require me to cease my extracurricular teaching activities to prepare for the full-time experience of middle school science education. Soon I would be teaching in the classroom in a local suburban school, just as I had planned. Only, it didn't quite feel like I was doing enough. I felt I had more to offer as an educator.

Through a colleague at the local community college where I taught continuing education programs, I learned about a program that sent teachers to China for a year or two. It covered room and board while providing a stipend. This teaching experience fell more in line with the sort of educator impact I wanted to practice. By then, I had three children and an alcoholic husband. As an added benefit to teaching abroad, I was told my kids could attend school in China while I was teaching. This, I thought, was a perfect solution. I would be doing something important; my kids would get a unique and, arguably, broadened experience of the world; and I would get us away from my drunk husband. Perfect. But another opportunity to consider began to develop. A colleague at the Community College, who was getting her Ph.D. in Science Education, suggested I reach out to her advisor. She knew I was searching for

something more meaningful and challenging than my current path. The advisor was in charge of an endowment program which teaches science, technology and culture to high poverty learners in predominantly African American schools. After researching the realities of living in China in 2005, I decided this was a better opportunity for me and my kids. I sent an email to Dr. Kyle, requesting a meeting regarding the assistantship and starting a Ph.D. a few weeks after completing my Bachelor's degree in education. At the conclusion of the meeting, I had decided to enroll in the Ph.D. program, which began with Master's level classes. It would be a longer, non-traditional approach to the Ph.D. program, but that suited me just fine. I was in love with learning, and I was excited to take on the challenge of teaching in a community I knew almost nothing about. Here, in this place, I could do something I felt was important, transformative, and self-satisfying. Looking back, my teaching choice was, at its roots, based on a desire to reach kids like me: kids who were born into a world with limited resources, uncertain housing, unreliable adult support and family trauma. However, it shouldn't go unnoticed, that in my search for a more challenging, authentic and purposeful teaching experience, I was, at some level, exhibiting the stereotypical white savior complex approach to education.

Armed with an abundance of naivety, confidence, and energy, I was ready to embark on the Ph.D. journey, save for one obstacle, finishing my B.A in Middle School Science Education. Before my student teaching semester, I had already begun to immerse myself into the Science, Technology and Culture (STC) program. We held the program at a youth center as an after-school program once a week, but there was a conflict of time. My student teaching required me to stay until after 3:30 pm and the STC program began at 3pm. My advisor spoke to the cooperating school and my student teaching coordinator to help me negotiate the conflict. He made the argument

that the STC program would serve as a supplemental teaching experience. Much to the frustration and disapproval of the cooperating teacher, this highly unusual arrangement was allowed.

That semester, I taught at one of the most affluent schools in the area, while also teaching an after-school program to some of the area's poorest students, residing just thirty minutes away. It was an incredibly enlightening experience. Few educators can experience the educational divide in real time, the way I did that year. It was transformative. I took a front row seat to the daily experiences of inequality in education. Growing up in extreme poverty myself, I related to and empathized with the high poverty learners in a way I could not with the students from the more affluent school. Yet the affluent school had an abundance of resources and experienced teachers who helped guide my teaching practice for the better. And I was becoming a good, no, a great teacher. I was a natural. I had found my place, my purpose, in education.

After graduation, I was offered a science teaching job at two different middle schools in the affluent school district. Simultaneously, I had another offer to teach in China and I was about to begin my Ph.D. in Teaching and Learning. To add to the complexities of my dilemmas, I was contemplating an exit strategy for my marriage. What to do? Accept Job A at a middle school where some of the students had personal drivers take them to school, accept job B at the slightly less affluent school in the very affluent district, change course and take my children and run away to China, or begin an adventure in a job/education hybrid where advancing my education was supported and I would be teaching learners who, I felt, really needed me. With some hesitation, I turned down both of the full-time teaching jobs where I would have somewhat unlimited resources, extra planning time, a world class support system and a serious

pension, as well the opportunity for a temporary life escape to China, to begin my journey teaching the STC program while pursuing my Ph.D.

I found the STC program to be the challenging and rewarding experience I had expected. The first years of the program, I worked with a cohort of teachers who had participated in the implementation and development of the STC program. We were hosted by the Herbert Hoover Boys and Girls Club and the Youth and Family Center - two not for profit organizations serving youth in North St. Louis - as an afterschool program. Most of the students were brought to the program facility from a local catholic school. They were provided transportation from school to the HHBGC building. The nature of the program, being University funded under the umbrella of a nonprofit, gave us a lot of education freedoms which I fully embraced. We were able to fully explore topics such as vermicomposting, DNA, polymers, videography, web design, soil quality, wetlands, lead exposure, PowerPoints, public speaking, African Music, Language, email, time zones, climate, weather, cycling and spreadsheets. As a teacher, being afforded flexibility to modify lessons to the relevance of the moment and modify as needed felt like authentic learning. If there was a current event, or the opportunity to explore a relevant topic arose, we had the ability to pivot and take advantage of such teachable moments in ways classroom teachers may not be able to adjust their curriculum. While there were alternative programs available to students, many selected our program because it was engaging, and it promised a refurbished home computer after program completion and graduation. At this time, before smartphones and laptops, very few students in high poverty neighborhoods had computers or the internet at home. Schools were beginning to require homework, which relied on the assumption that computer access was universal. As an added benefit, the promise of a home computer was a useful motivator for sustained

attendance and program completion. Initially the computers were procured and refurbished by the YFC. Over the years, corporate donated computers became scarce, as did the YFC's ability to maintain the promised refurbished computers. Fearing we would not be able to fulfill our promise to provide every graduate with a refurbished computer, I began collection campaigns and solicited my younger brother, a computer tech, to volunteer his time to refurbish the donated computers for the students. Sometimes this had me driving all over town to collect computers and staying up late with my brother in his garage to piece together the donations like Frankenstein machines. Upon student completion of the program, STC hosted a graduation ceremony in the College of Education's Des Lee Technology and Learning Center. Students invited families to celebrate their accomplishments, receive their diplomas, view the class created school year slideshow, demonstrate their projects, and pick up their computers. It was a day of pride and accomplishment for the student, parents and the STC staff.

The Youth and Family Center was run by a few dedicated employees in a historic building in serious need of updates and renovations. The room where I taught, on the main floor, was small, dark, dated, and smelled as you might expect a 150-year-old building to smell; but it had an adequate number of seats, a projector and computers for every student. The floor above us was a large open area with a basketball court and storage. Most days our classroom instruction was punctuated by the sounds of a basketball pounding on the ceiling. Some days I could tune it out, but most days it left me with a fatigued mind and a headache. The aging building was the last one standing on the block. Yet, in its present state, it served as an after-school haven for youth in one of the poorest communities in the area. Without it, it seemed unlikely the community would have access to the services. The dedication to the

community and the families they served is like nothing I'd ever seen. It was humbling.

There is a lot of rhetoric around why the poor, specifically the African American poor, stay poor. It is sometimes suggested that the very poor don't work hard enough or try hard enough to lift themselves out of poverty (Feagin & Porter 1995). I've heard people suggest they don't care about their communities. This is not what I observed, Parents were moving mountains to make sure their kids received these opportunities. The program executive and employees were overworked and underpaid yet they dedicated every single day to facilitate a positive environment for these youth. In the face of insurmountable obstacles, the community rallied together to serve the youth. Their example made me a better teacher, maybe even a better human.

Being a better teacher meant being better prepared. I usually arrived about an hour before the students to be sure our technology was cohesive and functioning for that day. The technology in the lab was dated and unpredictable at best. We didn't have the cloud back then, so I needed to bring the files by jump drive or email. I usually did both because inevitably one or both would not be accessible. We only met once a week, so every moment needed to be spent on the lesson not struggling with outdated, donated computers and equipment. In the event of a full-blown technology disruption, I regularly had a backup lesson planned. The intention of the program was to integrate Technology and Culture into the Science curriculum; thus, it was important I facilitated a lesson that allowed students to practice a new technology skill while learning science as it related to their culture. To do this, I needed working computers and the internet. Some days, this felt like an impossible challenge. The

program, not just STC, but the entire Youth and Family Center program, was held together by the sheer will and dedication of the YFC staff. Each day, we worked together to achieve the sometimes overwhelming goal of teaching the students a simple skill or exposing them to a new idea. This collaborative effort was inspiring on a professional level and therapeutic on a personal level. Two years after I started teaching the STC program, I filed for divorce. Around the same time, my program cohorts began to graduate. I was on my own both in my professional and personal life. It was simultaneously empowering and terrifying.

One of the attributes that made STC special was our collaboration with students from schools in South Africa. Through his work in South Africa, Dr. Kyle had built relationships with educators and schools in South Africa. Many of our lessons were collaborative in nature. The cooperating African teachers and I would facilitate duplicate lessons, then share our outcomes as a class. In the first years of STC, we worked with Ainsworth Primary in Kenya, Kwamgaga High, Zwelethu & Vukuzakhe high school. All three schools South African schools were located in Township areas in the outskirts of Durban, South Africa. Naturally, coordinating lessons across the globe and seven hours ahead of us was a challenge. STC met as a class at about 3pm, which was 10pm in South Africa, so hosting live meetings was not an option. I would spend the week prior to the next class, making attempts to communicate our lesson and facilitate their participation. Due to limited internet access, sometimes a few weeks would pass before I would get a response from the participating classroom. And sometimes, I would be the one who didn't respond in a timely manner, further disrupting our regular communications. Our lessons needed to move forward, so without a consistent exchange, my frustrations would prevent me from trying harder to make the classroom connections happen more frequently. I felt

like each week I would try harder, but in my mind, I would fall short. In time, the sense of diminished accomplishments wore on my psyche. I began to feel completely defeated after class. There were victories, to be sure, such as our classroom garden, the numerous experiential field trips, and the insightful, yet surprisingly relatable, South African student biographies (see Figure 26, 27), but I struggled with the reality of the challenges related to teaching science to middle school students in poor communities.

Where our program and the students triumphed, was in our collaboration in preparation for the STC graduation. Each year, we had a t-shirt logo design contest. The opportunity to win, and have their design become the class t-shirt, was offered to the South African students as well as the US students. This provided an opportunity for the students to demonstrate their creative abilities while communicating and creating an artifact for the STC program. It was a great honor for the students to have their design selected to represent their class year at STC. One of our most memorable t-shirt designs was submitted by a student at the Kwamgaga school in South Africa. His logo design is, to date, my favorite art submitted by a student *(Figure VI, VII & VII*). While his artistic skills were impressive, that is not what made this design so memorable. Like every year, after our team selected a winner, we digitized the logo, then had it printed on a t-shirt to give out at the STC graduation. But this year Dr. Kyle scheduled a visit to Kwamgaga school in Durban, South Africa where he was able to present the students artwork on t-shirts to the entire class. This was such a special honor that the winner of the contest included his mother in the presentation ceremony (Figure IV). For the students in S Africa, the annual STC t-shirt was often the first article of new clothing they had ever owned.

Experiential, Place Based Learning

Growing up poor with chronic homelessness and frequent school disruptions afforded me one thing I am grateful for, experiential education. While it was likely not intentional, many of my childhood science lessons were facilitated by my own curiosity coupled with access to an abundance of informal outdoor science labs in the woods or farmland where we took up residence. This organic learning experience informed my teaching style. Within a short time, it became clear to me that the confines of the tiny, windowless technology lab needed to expand for us to pursue the exploratory, place-based science learning style I believed best served the students I was responsible for educating. We needed to incorporate field trips into our program, and I was able to procure funds through our program for the use of the YFC vans to set this objective into action.

Once or twice a month, I would plan an experiential based field trip related to what we were learning on a Saturday, or Sunday. Promoting lessons which were immersed deeply in experience, was not without its challenges. One of the first field trips I coordinated was to take the students indoor rock climbing. Rock climbing, I believed, would be a good way to build trust, self -confidence, and community while learning, firsthand, about force, friction, pulleys, and, of course, gravity. We would take what we learned back to the classroom to explore these ideas on the computer and make presentations to share with our pen pals (more on that later).

There were several barriers to facilitating an off-site field trip to a rock gym; thankfully, proximity was not one of them. The rock gym I selected was relatively close to their neighborhoods. The first barrier to overcome was to develop a trust in me. I had the task of convincing these youth, who hardly knew me, a white woman

that they should meet up with me, and a group of volunteers on the weekend, at a rock gym, a predominantly white space, then climb a three-story wall, often for the first time. My next charge was to use my connections to the outdoor community, which I had the good fortune to have in abundance, to recruit several individuals from an outdoor adventure group who have memberships to the rock gym and experience belaying, to volunteer as, what we called, buddies to the students. These buddies would provide student admission with their monthly free guest card. We chose to schedule on Friday night because it was youth night, allowing for more kids in the gym and taking advantage of lower equipment rental rate, which the buddy would donate to cover the cost. Permission slips became an additional challenge. The gym required several forms to be printed, filled out and returned before the excursion. We met once a week, so getting these documents returned could be strenuous and sometimes felt insurmountable. An alternative to the paper signature would be for the parents to come into the climbing gym at drop off; this solved some of the challenges, but not all. Transportation coordination became the next barrier to overcome. The YFC van and driver was not available on the weekend evenings, requiring the students to find their own transportation to the gym. In time, when I crafted the permission slips, I included a checkbox which asked the parents if they would be willing to provide a ride for another student, likewise, a checkbox for students who needed a ride. I would then coordinate with the parents to navigate student transportation to the facility. Transportation, check. Once we arrived at the facility, checked in, paid for services, and gave a short safety training, the students matched up their buddy to begin the task at hand, climbing an intimidatingly tall wall. While I would sometimes climb the wall with the students, typically, I took the opportunity to take several pictures of these experiences that were then woven back into the

classroom as lessons on physics, technology, and presentation skills. One of their favorite post field trip activities was to create a presentation of their experience to share with the other students and our cooperating schools in South Africa. Most experienced teachers will tell you, middle schoolers love to show off, and I enjoyed helping them transform these experiences into something to be proud of.

As the years went on, I hosted less intimidating trips with students first, then rock climbing later in the year so that more kids felt comfortable enough to attend. And word of mouth helped to sell the idea to the first-year students. Each year, the students from the previous class years would tell their peers about their experience, stoking the excitement. Seeing a child who was unsure about showing up and hesitant to climb the three-story wall, make it to the top to ring the bell, is still one of my proudest teaching moments. After the students overcame their fear and made it to the top, it changed them. You could see it in the way they looked at you and the way they stood a little bit taller. Their confidence improved. This is transformative education.

Mali: A cultural awakening

The original piece of Bogolan fabric art from Bamako, Mali hanging in my living room is one of my most treasured artifacts. It was gifted to me from a teacher colleague who was invited as a guest: Kowery from Mali. He was invited to join our Science, Technology and Culture program in the spring of 2007, and to attend the annual NSTA conference in St. Louis, Missouri. My students had been corresponding with his class for nearly two years. We remotely cooperated in a number of science projects and cultural exchanges. At one point we facilitated a video conference with our classrooms, which, given our resources, early web calling technology, and the six-hour time difference was an epic endeavor. While I am confident his first visit to the

United States was transformative for him as an educator and as a Muslim, I am forever grateful for the perspective and insight I gleaned as we navigated his visit and our cultural differences.

Prior to his visit, our students were participating in a roots and shoots projects as well as learning about the genesis of the traditional Bogolan, or mud cloth used in the villages in Mali. Roots and shoots was developed loosely from the Jane Goodall lesson I discovered while attending an NSTA conference. The purpose of the lesson was to help the student connect with themselves by relating to the scientific parts of a tree. They would research trees from all over the world, selecting a tree they identify with personally based on its stature, function, location, and aesthetic qualities. Using the reflective nature of a tree's roots juxtaposed with its "shoots", meaning its branches, the students would identify people and institutions that served to represent their "roots and shoots." Using this exercise in self-reflection we were able to interweave the three pillars of our program: science, technology and culture. This lesson cooperative was more easily navigated with students in Mali Africa. The Mali classroom was our 4th or 5th consistent pen pal attempt. While the South African schools were rather successful, with the annual t-shirt contests and with teaching computers and technology tools, the Mali classroom was somewhat more successful as pen pals. Our Mali pen pals, however, while not without their connectivity challenges, were able to regularly communicate and participate in dual remote projects more consistently. Our first major collaborative project was the roots and shoots unit.

I found the roots and shoots collaborative project, including student tree artifacts, quite interesting when compared to the Missouri students. Overall, Missouri students identified parents, friends, and people close to them as their roots and shoots.

The trees they selected to represent themselves were often related to a geography they understood and an attribute they identified with such as strength. By contrast, the Mali students selected trees that represented fertility, rebirth, life, and food abundance. As a class we talked about these Mali tree attributes, in particular the Baobab tree, and why some Mali students selected these particular trees to represent themselves. We studied the trees and their uses in the community. The Baobab tree, for example, is known as the "tree of life" and is regarded by the Mali people as representing life and abundance as it bears fruit during the dry season and is nutritionally dense (Buchwald-Werner & Beckett, 2010). We also studied practical uses of trees in the western world; for example, trees are used to make many common goods students, or their families may have used. Some common uses of trees/plants in the United States are for rubber, aspirin, gum, baseball bats, hospital gowns, and more. The emphasis on a tree's usefulness was a more commonly identifiable theme in the Mali students' trees than the American students' trees. (STC Tree Examples: Figure 18, Figure 19, Figure 20, Figure 21, Mali Tree Examples: Figure 21, Figure 22). These differences in the trees and how students related to them helped our students identify some of the cultural differences between themselves and their African pen pals.

Major Taylor

Much in the same way I used trees to help students see themselves and contrast that with other cultures, when developing lessons, I made sure the subject matter was relatable and identifiable to the student. Meaning, the students need to see themselves in the curriculum. That is, they need to be able to imagine themselves within the context of the lesson. By 2010, I was searching for other ways to incorporate experiential, place-based learning of Science, Technology and Culture into my curriculum through the lens of the African American students in our program.

The result was the Major Taylor Curriculum unit. Bicycles, historically, have facilitated freedom and empowerment (Macy, 2010). This curriculum sought to do just that. We studied Major Taylor, an African American, who became one of the world's fastest bicycle riders in 1896, more than 50 years before anyone had heard of Jackie Robinson (Kranish, 2019). Taylor achieved his incredible one mile, standing start, speed record of 43 seconds, roughly 83 mile per hour, on a Velodrome.

Over the past 120 years, velodrome racing has waned in popularity. Velodromes, which are banked oval tracks, afford an exciting method to teach a number of physics lessons, including cadence, center of mass, and centripetal force. There are only 27 velodromes remaining in the United States, which includes the Penrose Park Velodrome in St. Louis, just a few minutes from our student population. In the classroom, I would demonstrate several cycling models, including a variety of bicycle wheels, tire treads and gears to show how friction and cadence are resolved. After exploring the models and collaborating with students in Mali, learning about how and where they used bicycles in their communities, we planned a field trip to experience these theories firsthand. Many of our students did not own bicycles and when they did, transporting them was a challenge. We worked with our local bike shop to deliver bikes to the riding site. Non-Profits and NGO's chipped in as well. For example, the organization Helmets First! donated helmets for the student riders for several years of our program. Riding on track with about a 45 degree bank can be intimidating, but inevitably after a few practice laps, the students would be excitedly asking to go another lap. The fast pace and excitement of the students both thrilled and terrified me.

One of my fondest biking field trips was on a mountain bike trail. Mountain biking is a very different type of biking than velodrome. A velodrome is a predictable

paved path, while mountain biking is on a dirt trail with undulations and sharp turns. A small group of students and some of their parents joined us on such a ride. We provided them with bikes and helmets. Prior to the outing we watched videos and lessons related to the skills needed and the physics of biking on a dirt trail. We loaded into the van and headed to a local trail suitable for beginners. It was a perfect day for mountain biking, partly cloudy with a nice breeze. After fitting the bikes and having a final safety talk, we departed down a long gravel trail to connect with the mountain biking trail. Once we hit the trail we tried to stay together. We provided a sweeper, a person who rides in the rear to avoid dropping a rider, and a leader who sets the pace and direction. The students enjoyed the trail riding so much that most students excitedly wanted to do a second loop. I was invigorated by their enthusiasm, so I agreed to take a smaller group again while a parent took a few of them back to the facility to wait for us to regroup. About five minutes after the smaller group separated from us, a torrential rainstorm came out of nowhere. The rain was coming down so hard I could see only a few feet in front of us and the students couldn't hear the adults give instructions. Suddenly, I was not able to see the entire group as we all scrambled to exit the trail. A rush of terror overwhelmed me as I prepared for the worse as we frantically departed the trail heading for shelter. It was nearly a mile back to the facility, and the students were bogged down by the heavy rain, mud, and fatigue. About halfway back we found shelter under a tunnel where the group who left earlier were waiting. We all congregated under the tunnel until the rain was light enough that we could see and hear each other again, then we made our way back to the van. Soaked, cold, covered in mud and tired, we returned to the facility to dry off. As I loaded the students into the van the dreadful thought of returning these students to their parents covered in mud and wet was concerning. Upon our return in the van, the

students were quiet, which I inferred to mean they had a terrible time. I had blown it. These kids were never going to trust me to take them out again. The sound of silence was telling as we headed back to the parent pick up location over 40 minutes away. After a few minutes in the van a student quietly said, “Ms. Jodi, I think they should make a movie out of our adventure.” And with that the van erupted with the excitement of the adventure they had just experienced. I blasted the heat, passed out snacks and listened as they retold their heroic personal tales of survival on the dirt path, in the woods, during a storm.

End of an era

Sometimes being naive is empowering. My first few years of teaching, I was self-assured that I had the capability to make lasting and significant changes to the students’ lives. Perhaps I did, perhaps I did not; but I believed I could. If I had to pinpoint a moment when that belief began to erode, it was when the director of the Youth and Family Center, Herman, retired. He had experienced a heart attack and decided it was time to leave the high stress position. With his departure, a cloud of uncertainty began to develop over the entire facility. The board identified a new director, and with him, as one would expect, came a new direction and accountabilities. It was clear there was a new sheriff in town. He pulled me in the office one day before my class to question me about the program, I found myself selling it to him, and I got the sense he was not interested in continuing the program. I suggested we request a meeting with the STC program director in an effort to convince him our program was a valuable resource for the community as my salary and classroom supplies were paid for by the University. During our meeting, the new director took issue with our using the YFC van to transport the students from school to the program as well as for some field trips. It no longer felt like a partnership, it felt

like a facility rental. Our Director, Dr. Kyle, agreed to supplement the funding of the transportation going forward, and I began to feel a sense of disconnect with the program and the host facility.

About a year later, in the middle of a particularly cold winter, the pipes of that old building froze, then burst, flooding the facility beyond redemption. Class was canceled for weeks as they navigated the search for a new facility. The new director was quite pleased with the newer building he had procured. It was quite a bit further from the school we serviced, so fewer students were able to attend classes, and shortly after the move, the Catholic school where the students went to school, closed. After the move, much of the original staff had taken other jobs, and the director seemed pleased they were gone. Our program was one of the only relics left from the old guard, and the writing was on the wall that our days were numbered.

By now I had been doing this program long enough that I felt it could be modified for a traditional classroom, thus reaching a larger number of students. After a number of conversations and searches, we were able to recruit a principal from a St. Louis public school to allow us to be paired with a cooperating teacher to implement the program as a model with the intention of training the teachers to incorporate the lessons into the curriculum. Running the program within a public school incurred a whole new set of challenges. I no longer had the freedoms afforded an after-school program, and the red tape for experiential learning was discouraging. Simply taking the students to the green space on the school ground required several levels of advanced approvals and negotiations. Experimental, place-based field trips continued on a smaller scale with the support of several teachers and transportation funding through the STC program.

The turn-over rate of the administration became the most challenging barrier to overcome. I was surprised by the frequency of administration changes every school year. It didn't seem to matter what cooperating school I attended, there would be a new principal nearly every year. And with each administration change I found myself in front of a new person just days before school was in session, convincing them that the STC program was a worthwhile and free resource for their school.

These rotating administrators seemed to serve the individuals more than the districts they served. It seemed each administrator wanted to wipe clean the previous person's agendas in favor of their new, better programs, only to depart by the next school year, leaving the teachers, students, and program coordinators to start over under a new set of rules and expectations. This coupled with teachers calling off work on the day of the week I would be scheduled to visit the classroom, was discouraging. I often felt as though I spent more time out of the classroom than in it. It was incredibly depleting, and my faith in the St. Louis Public School (SLPS) system we served was eroding.

When searching for a school willing to commit to this fully funded enrichment science program, we tried selecting the potential schools based on the presence of computers and other technology. One of the deficiencies of the public schools in high poverty neighborhoods was the limiting nature of the computer lab. There were often lessons which required technology, but we were not allowed access to the computer lab on the day I would be visiting the school for a number of often unnecessary reasons. I would have to quickly modify the lesson to exclude the technology feature. The most common reason given for a lack of computer lab availability was that state testing was taking place. This seemed to take place all year long. Here we

had access to several computers in the school, but the most common use for them was for standardized test taking. Simply appalling.

We eventually found a potential school that had a well-supplied and maintained computer lab. After a number of meetings with the principal of the Wellston School District (which later merged with the Normandy School District), and after a tour of the technology lab, we were ready to begin the program. This time we asked to facilitate an after-school program. While this required a lot more time in the school year to procure students and transportation, we hoped going back to the after-school model would eliminate some of our historical challenges with working with public schools during the traditional classroom hours.

When it came time for the first day of the program, I met the students in the school lobby, proceeded with introductions and eagerly escorted them to the computer lab for our first lesson. The computer lab, however, was locked. It was supposed to have been unlocked in anticipation of our arrival. Further, it being after hours, no one could get ahold of the one person in the entire school who had a key to the computer lab. No secondary key was left on the premises, and we were told that the computer lab tech was the only person in the school given a key. We were unable to proceed with any lesson and were now simply entertaining a dozen middle school students, who were excited to get to use a computer for something other than standardized testing. We made a few more attempts at gaining access to the room after hours, but we were unsuccessful.

We attempted the next couple of weeks to gain access to the lab. On more than one occasion, the principal assured us the problem had been resolved from the previous week, only to find ourselves locked out of the classroom or the computer lab.

These repeated experiences of members of a school staff in these high poverty areas having little concern or value of the education of these students, or our time was taking its toll. I began to develop a negative perspective of schools in this area. At this point in my teaching, I began to see signs of discontent and teacher fatigue. I was beginning to wonder if I could make a difference or if I had become part of the problem. I was wondering why I gave up a job in an affluent school with virtually unlimited resources and support in favor of the equivalent of beating my head against the wall and hoping I would not bruise.

Sometimes, we didn't make it to the new school year before the viability of the program came into question. One particular year, at a local public school, when I arrived to teach, I was told I could not enter because there was no principal on staff. Confused, I returned home. I reached out to the cooperating teacher, but her responses were cryptic and unclear. The next week, I asked to return, she said she was stressed and overwhelmed. They still did not have a principal, which they felt made it illegal to continue classes, but did not want to push that narrative for the sake of the kids who needed to be at school. Further, the rumors as to why the principal simply stopped coming to work was unsettling to the teachers and, of course, they were trying to keep the information from the students. However, the truth ultimately made it to the media. I read in the paper the principal was arrested for conspiring to have his pregnant girlfriend, a fellow teacher, with whom he'd had an affair, murdered. She was seven months pregnant. To make the situation even more upsetting, he used school fundraising money to pay the gun for hire. The trauma these students experienced that year was incomprehensible.

In the interim, I had been searching for a new cooperation school and working with local NGO's, local park departments and non-profits to create an outdoor

learning experience tailored specifically for the high poverty youth we served. Naturally, I was relieved when I received a call from the cooperation teacher at the school that a new principal was hired. She gave me his contact information and I reached out to him straight away. He agreed to meet with me, but I could sense he might not be as receptive as I had hoped. At the conclusion of the meeting, he agreed to hear more about the program and its success. Given the circumstances of the termination of the last administrator, he seemed uninterested in pursuing any programs or interest the previous principal had facilitated. I got the sense that once again, the principal was there to make a name for himself, then move along to the next opportunity. I sent him additional information and artifacts from our program. I also drove home the idea that this was a fully funded program and incorporated a relationship with the local university. I presumed this would entice him, and I was right. He agreed to allow me to resume the program with the same cooperating teacher. We were both eagerly anticipating a sense of stability being brought back into this SLPS classroom for these students and ourselves.

There was a distinct difference in the students' behavior upon my return. The incumbent principal had implemented several new policies and procedures, the teachers were feeling undermined and devalued, and the students had experienced a trauma followed by a lockdown of activities and freedoms in their school. By now the program I had been developing was ready to commence. I offered the idea up to my cooperating teacher, which was received with excitement. This was exactly the type of experience the students needed.

The program could accommodate more than just our classroom, so she talked with a couple of other teachers. While many of the teachers, expressing an overwhelming strain, declined, she was able to advance the idea to a small group of

teachers. Now to get the support of the principal. Because we were using a summertime event as the foundation of our outdoor experience, the principal had to agree to allow this experience to happen outside of the school year, over the summer. The school had programs all year round, so while it added challenges to coordinating the teachers and students, it was not completely unreasonable. The principal agreed and it was time to get to work. Our outdoor experience had just jumped off the theoretical drawing board and onto the logistics. By this time in my life, I had assembled an impressive group of friends and colleagues with experience in teaching outdoor education, many of whom were experts in a specific field of outdoor experience. This group of individuals volunteered countless hours to planning and facilitating this grand outdoor experience. We had amassed individuals from Missouri Naturalist, Greenway Network, Missouri State Parks, local park rangers, Missouri Department of Conservation, Missouri River Relief, First Missouri State Capital and more who came together over the course of nearly two years to develop a full day of learning activities, outdoor experiences, transportation, meals & swag bags for this multi-level outdoor experience.

The school year was coming to a close. We still had some details to hammer out, but I believed we were ready to proceed with the summer adventure. We were set, the principal had agreed, three teachers had volunteered, the groups of informal educator volunteers had the activities planned and rehearsed, supplies were purchased, permits were obtained, permission slips were signed, transportation was secured, and students were excited to participate.

I knew a lot of people were counting on me to come through with the student participation, so I checked in with the cooperating teacher every 2-3 weeks. I reached out to the principal as well, but did not hear back from him right away. When I did

hear from him, he seemed to be back pedaling on his commitment to the event. He started citing concerns about the rules regarding students being near water and having enough teacher participants. One teacher backed out because she was pregnant, but the others were still happy to attend. Also, we had a number of adult volunteers on hand. The ratio of adults to students would be 1 to 3. The principal and I exchanged calls back and forth, but I was feeling he might back out.

I absolutely could not let this event fail. At this point, I'd pulled in favors from nearly everyone I knew. I asked them to spend an entire weekend working on this event and I needed the post event responses to serve as data in my dissertation. I could hardly sleep at night. The closer the event came the more anxious I felt. We had purchased the consumables, rented facilities, paid for the transportation, scheduled the volunteers and bagged the sack lunches. It was just 24 hours until the event, and I was waiting for the bottom to fall out and fall out it did.

I received a call from the principal the day before the scheduled event telling me the teachers who had volunteered could not attend because he needed them to help repaint the school before the new school year began just a few days later. Repaint the school! I thought, are you kidding me? Why? Why are teachers repairing the school? Why was he allowing these students, who made arrangements to attend, to be dismissed so easily? What did the teachers think? Did they have a choice? These were questions which I would never receive an answer to. I begged for him to reconsider. I offered a stipend for the teachers, expressed my concern about the students who planned to attend the field trip the next day and attempted to convey the gravity of his decision. It was of no consequence; he had made his decision.

Now I had the unfortunate task of telling the group of volunteers, who had spent weeks of their personal time developing this program, that it was all for nothing, and that the event would have to be canceled. The thought of that phone call and the email that proceeded it makes me sick to my stomach to this day. Just writing this is incredibly upsetting. I let so many people down.

The gravity of the future consequence of this settled deep inside of me. Many of these people and organizations would never work with me again, in part because they lost faith in me to follow through and in part because they lost faith that kids from high poverty schools would ever be given such opportunities or have the will to participate in authentic outdoor experiences. They had lost faith in me and the system, and so had I. With such short notice, we couldn't get our transportation funds back. I suspect the contents of the swag bags were distributed to other youth organizations. After this experience, I fell into a depressive state.

The next few years were shrouded in both personal and professional tragedies. My mom, who had been very ill with cancer, had moved into my house and needed my daily care for over a year. In time she recovered and moved back to independent living, but I was emotionally checked out after the roller coaster of chemo, doctor's visits and personal care.

The final few years of the STC program were at a middle school in the Jennings school district. During this time, we welcomed two new principles. The cooperating teacher was early in her career and eager to work with a seasoned educator. However, I did not feel I was emotionally invested enough in teaching to give her all that she deserved in a mentor. Although, in our short time, we were able to facilitate a couple of field trips participating in stream clean-ups, utilizing the now

more abundant and accessible classroom technology afforded all school districts; and to study African cultures in relation to our own. Unfortunately, we did not make any student-to- student connections with our friends in South Africa or Mali. By now, my mother's cancer was back, but this time it was not curable, and I once again became her caregiver.

Shortly after my mother's diagnosis, I learned of the existence of my real father. The next few months were a whirlwind of emotions related to discovery, identity, regret, and relationship building. Just a few months after the discovery of my biological father, our classroom time was cut short by the onset of Covid 19. Schools were closed down, and programs were suspended. My mother was declining quickly, and had moved back in with me so that I could be her primary caretaker as she entered hospice. Then came the unexpected and traumatic death of my father by suicide. My mother passed away just a few months later, ending her long battle with lung cancer. I spent the final year of the STC program enveloped in guilt and crippled with sadness and grief while contemplating the impact remote learning would have on the students we served. Nothing would ever be the same.

It is tempting to reflect upon one's experience and contemplate alternative outcomes. As an educator in challenging teaching environments, such as the ones I experienced at STC, I often felt like I had fallen short of the full potential of the lesson or myself. But I don't want that to be the takeaway. It is not about what I didn't accomplish, it is about what I did. I was afforded a unique opportunity to expose students to experiences they would have never experienced in a traditional classroom. Those moments in time are not quantifiable. The experiences won't help a student fill in the correct bubble on a standardized test, but they will last with them and help them grow in ways we simply cannot assess.

I did not have the opportunity to return to the classroom before the program ended. STC is where I had spent the bulk of my teaching years. I am incredibly grateful for the rich and diverse experiences the STC program has afforded me. Every now and then, I hear from some students I taught, especially from the original after school program at the Youth and Family Center. I can't say for certain the STC was transformative for these students, but I am certain it was transformative for me.

CHAPTER 5

RESULTS

Survey Results

In 2020, under the guidance of Dr. William Kyle, I conducted a survey of Missouri regional formal and non-formal educators on the use and barriers of teaching Environmental Education (EE) and Environmental Justice Education (EJ) in K-12 Schools and outreach programs.

The purpose of the survey was to identify barriers in teaching environmental education and environmental justice education programs in Greater Saint Louis Missouri. The survey asked about specific programs used, such as outdoor education, recycling programs, Environmental field trips and composting, implemented on school campuses or in outreach curriculum.

The online survey was sent via Alchemer.com to educators from a variety of list-serves, including, but not limited to, SLPS (Saint Louis Public Schools) MEEA (Missouri Environmental Educational Association), Missouri Botanical Gardens, Saint Louis Zoo, Missouri Department of Education, University of Missouri- School of Natural Resources, Greenway Network and Great Rivers Greenway using a referral method of procurement. Survey recipients were asked to provide contact information or forward the survey request to potential participants. The survey was open for just short of two months and reached approximately 300 potential participants representing both urban and rural areas of Missouri USA. 46 participants responded, with a 100% completion rate. Based on the identifiable organizations referred to during the popcorn sampling exercise, it can be assumed most of the survey participants were informal educators.

This survey was modified from a survey developed by the Washington State Office of Superintendent of Public Instruction.

The question of what barriers exist in teaching EE or EJ came first from my personal experience. My experience with barriers related to incorporating EE in the classroom was during my undergraduate work as a pre-service Middle School Science teacher. It was during this experience where I first learned EE topics, while this curriculum is required in the Show-Me Standards, now called the Missouri Learning Standards (MLS Science Standards Grades 6-12, 2019) are not taught to pre-service teachers as part of their required curriculum. In fact, unlike other science disciplines, such as physics, biology, and chemistry, science teachers cannot receive degrees or certifications in EE. MEEA (Missouri Environmental Education Association) does provide a certificate for EE Educators, but it is not recognized as coursework toward a degree in Science Education. In other words, for science teachers to receive the education required to adequately teach the subjects of EE, one must pursue a separate certification that will not apply toward graduation.

Beginning in 2020, the required curriculum for pre-service Science Teachers includes at least one 3 hour Environmental Science course to be certified in Missouri (*MLS Science Standards Grades 6-12*., 2019). The result of EE not being included in the teacher certification process until 2020 is why I selected informal teachers to survey regarding barriers in teaching EE. In -service teachers are rarely the ones facilitating EE programs and experiences, it is the informal educators and NGO's that are filling that void. Perhaps the next generation of science teachers posed to graduate in 2023-2024 will have the opportunity to implement EE in the classroom or contribute to further research on the barriers of teaching EE or EJ.

Survey Question analysis

1. Environmental Education (EE) is a learning process that increases knowledge and awareness about the environment and associated challenges; develops the necessary skills and expertise to address these challenges; and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action. It can include three dimensions: education about the environment, for the environment, and in the environment.

   Based on this definition do you teach anything related to the general topic of environmental education?

   - Yes
   - No
   - Not Sure

Analysis:

Environmental Education is more than teaching information about environment. This question inquiries a deeper understanding of the participants regarding the definition of Environment Education and if the non-formal educators teach in accordance with the definition provided. As per the data gathered, (see Figure 1), 96% of the teachers/instructors believe that they agree to the definition as indicated in the question and believe they teach about Environmental Education with a similar perspective. The target audience being Environmental Educators, this is an expected outcome.

2. Education for sustainability (EfS) is a learning process that develops a responsible citizenry capable of applying knowledge of interconnected ecological, economic, and socio-cultural systems to meet current and future needs; and how personal and collective actions affect the sustainability of local and global systems.

   Based on this definition do you teach anything related to the general topic of education for sustainability?

   - Yes
   - No
   - Not Sure

Analysis:

Quite often Environmental Education and Educational Sustainability are used interchangeably, thus one would expect an overwhelming majority of the respondents would select yes. The nature of these first two questions is to establish that we have reached our target audience of Environmental Education educators. These data support this assertion (see Figure 2). Education for Sustainability (EfS) is an educational approach that aims to develop students, schools and communities with the values and the motivation to take action for sustainability. Based on the definition provided for Environmental Justice Education, the majority of the respondents believe they are teaching content which addresses Environmental Justice in education. 89% of the educators indicate that they provide some kind of knowledge around sustainability and being prepared for the future challenges with regards to Environmental Challenges. This establishes that the sample is well aware of the similarities, differences, and focus of environmental education vis-à-vis education for sustainability.

3. Environmental Justice Education is the confluence of Environmental Education and Social Justice. Marginalized or Minority learners are more likely to be in close contact with environmental toxins than any other demographic. These toxins are often neurotoxins which can dramatically affect learning and behavior in students. Using Placed Based Environmental Education to teach students in the area of Environmental Justice can empower them to become active participants in developing the social capitol need to protect themselves and their families from toxic exposure.

   Based on this definition do you teach anything related to the general topic of environmental justice?

   - Yes
   - No
   - Not Sure

Analysis:

Teaching Environmental Justice requires a more customized approach to enable learners to understand their surroundings, the toxins that they are getting exposed to and how they could be active participants in changing the situations. 49% of teachers/instructors believe that the content they teach currently provides little to no Environmental Justice content to the students (see Figure 3). Based on the responses to previous questions, there are a lesser number of teachers including concepts of Environmental Justice in the curriculum that Environmental Education. This could be for of a variety of reasons such as limited availability of resources, lack of relevant time, student interest, management initiative or even a limited understanding of environmental justice by the teachers themselves.

4. In what subject area(s) do you teach environment education (EE) education for sustainability (EfS) or Environmental justice (EJ)?

Analysis:

Respondents to this item mostly teach subjects of relevance like science, biology, chemistry, water and related management studies and social studies (see Figure 4 & 4-1). 56% of teachers/instructors believe that Environmental Education concepts are part of their subjects in general while the remaining 44% believe that they do have specific subjects where they address these. This is a great indicator that the existing curriculum and subjects facilitate an approach to teaching environmental education. Several instructors indicate that they touch upon the concepts of environment while discussing water, conservation etc.

For example: *I teach 2nd grade children in an outdoor classroom on 30 acres in the forest. "Nature Studies" is one of our subjects and it is woven in to nearly all aspects of teaching. We read books about protecting clean water, we give thanks to the trees and discuss our reciprocal relationship of oxygen and carbon dioxide, we notice patterns of how spiders weave their webs. My role as their teacher is to help inspire a love of the environment, as well as help them see how to be good stewards of the environment*.

5. In what grade level(s) do you teach in class or as a non-formal educator EE, EfS or EJ? (Check all grades that apply)

Analysis:

These data indicate EE and EJ concepts are taught informally at most grade levels in Missouri (see Figure 5). There is a consensus that the subjects around Environment Education are being taught at all grades while an increased emphasis exists in grades 1-5 and 10-12. Overall, 60% of teachers/non-formal educators believe that they teach environment related concepts to Grade 10 to 12. This is

important because, as expressed in the previous question, the teachers integrate environmental education in subjects like science, social studies and outbound learning which are part of every grade. This establishes that the students would have some exposure to environmental education at any and every grade.

6. Within the subjects you teach, what specific EE or EfS topics/issues do you address? (check all that apply)

Analysis:

Ecology and Ecosystems rank the most taught topic while habitat restoration and Bio Diversity are the next most taught topics with more than 80% teachers indicating these subjects as the catalyst for teaching EE (see Figure 6). The reason for this could be that these topics are the easiest to discuss on field trips, outdoor learning and even with existing basic resources at many schools. Resource conservation, sustainable forestry and water resources, carrying capacity, ecological footprint along with environmental health are the next popular concepts taught as mentioned by 40% – 50% of the teachers. As it has been rightly indicated in Question 3, environmental justice is relatively rarely/sparsely taught concept as agreed by 23% of the educators.

7. Do you have comments on the above, or other, EE, EfS or EJ topics/issues that you teach? [Open response)

Analysis:

The responses to the open question indicate that the instructors are positive about the outcome of teaching these concepts as indicated in one of the responses: “Learners of all ages are interested in environmental issues. Most were under aware before presentations.” (see Figure 7)

Several instructors have indicated multiple other topics that have experience teaching and also touch upon the concepts of Environmental Education like nature connection through all the senses and different learning modalities, herbalism, crafts, indigenous culture and history (and its relationship to environmental stewardship), and activism. The responses also give an insight into the challenges the teachers face in terms of time and resources.

This has been well explained in one of the responses as shown below: "*Often times we are so rushed in our curriculum content that issues such as sustainable energy use are quick mentions rather than full lessons. My main courses are biomedical science classes and their HOSA club does include topics related to environmental health and justice for competitive events*".

8. In what context do you teach EE, EfS or EJ? (check all at apply)

Analysis:

54% of the participants indicate that the responsibility of Environmental Education is with external faculty/programs (see Figure 8). This could be due to a variety of reasons including the limited class time, subject matter expertise or the necessary resources to teach the students. 40% – 50% of teachers mention that the context of teaching Environmental Education is an after-school club/program, occasional lesson with a related subject or a special event. The subject is considered to be a part of the university program by a minimal of 19% of the participants in the survey. These data strongly indicate a dependence on external sources or events for the opportunity to impart Environmental Education. The more the dependency on external experiential learning, the more the impact of factors like funding, transportation, facilities and staff.

9. What are EE, EfS or EJ instructional materials/resources you find especially useful?

- Textbooks: Other print material (e.g.: supplemental texts, books, magazines): Videos/films
- Experience (e.g. field trips)
- Hands on (e.g. discovery trunks)
- Websites: Community resources (e.g.: speakers, public agencies, non-profit organizations, businesses, individuals)
- [Open response]

Analysis

The most prominent instructional material used is not standard classroom materials. Over 39% of respondents mention that they reference the Environmental Education while teaching another core subject matter (see Figure 9 and 9-1). 28% of respondents indicate that they do use video and content such as websites or articles of relevance. This suggests that there isn't any standard material that is provided to the students or specific sources of information that provide holistic references to students. Several instructors' couple this learning with external environment based hands-on learning, such as discovery trunks (a suitcase with lessons and manipulatives for classroom use developed by the Missouri Conservation Department) or trips because of which the impact of COVID has also been indicated.

10. How do you think your students benefit from EE, EfS & EJ? (check the top three benefits)
    - Helps students meet standards in core content areas (e.g.: applied math, science, reading/writing)
    - Improves academic achievement (e.g. grades, test scores)
    - Supports positive and productive social behaviors
    - Increases skill development (e.g.: collaboration, communication, project-based learning, problem-solving)
    - Enhance engagement and motivation (e.g.: participation, leadership, reduction of drop-out potential)

- Helps them prepare for their next steps into a higher grade or into the workforce Connects them to their community and empowers them to participate

Analysis:

Over 70% of teachers believe that EE/EfS/EJ enable students to enhance engagement and motivation, develop skills and support positive and productive social behavior (see Figure 10). A relatively low number of respondents, 36%, feel that the subject knowledge of Environmental Education helps students meet standards in core content areas. This indicates that comparatively, Environmental Education has a perceived limited relevance to the core subjects.

11. What are obstacles or barriers to your teaching EE, EfS or EJ? (check all that apply) Provide personal experiences. Please explain and give examples for any that apply.

- Lack of professional development
- Lack of time
- Lack of administrative support
- Lack of interest
- Lack of knowledge
- Lack of funding
- Lack of access to resources (e.g. people, materials, and/or tools)
- Lack of parent involvement
- Lack of transportation
- Lack of teacher support
- Other: Please specify

Analysis:

Here we have the most relevant question in the research. In this study, none of the instructors have indicated lack of knowledge as a barrier. This has already been established by the overwhelming majority of participants acknowledging an understanding of the definitions of EE, EfS and EJ and teaching them. Lack of knowledge is an indicator of educational barrier and data from the study rules out such possibility that educators feel personally unprepared to teach the subject matter. Only one respondent mentioned that lack of professional development could be a challenge in small schools.

Logistical barriers such as lack of time, resources, transportation and money seem to be the most significant concerns. 53% of the respondents have indicated that these are the major barriers and out of this percentage, 23% mention time to be the critical barrier. Eight participants mentioned that they have very limited time and it is a challenge to create a curriculum and plan field trips (see Figure 11). The following response highlights this concern:

"Teachers are short on time with all they have to accomplish which can lead to choosing what is the most important objective(s) they have been tasked with leaving EE on the side lines". This response implies that teaching EE is not prioritized by the district and/or the educator as other, more pressing topics occupy the allotted classroom time restraints.

15% of respondents have identified funding to be an impediment. The responses indicate that EE might not be a standard part of the budget plan. One of the participants mentions:

"As a governmental agency, we have a strictly defined budget. Most money in this agency goes to actual conservation work "in the field"

Finally factors like lack of teacher support, administrative support and interest constitute attitudinal barriers. 23.5% of the respondents believe that these are the obstacles for teaching EE. Lack of interest on the part of the other stakeholders who are in charge of providing these opportunities have been well indicated in the following response:

"It feels that we are always preaching to the choir, it is hard to teach others that don't understand the importance of environmental education either for lack of knowledge, interest or social problems".

Current pandemic situation has also been mentioned as an impediment by three different respondents. While this might change, it still is a point of concern for the near future.

12. Thinking about your top three answers from the previous question, what are some of the barriers that have prevented you from achieving these goals?

Analysis:

A majority, 27 out of 33 teachers indicate that time and/or funding are the biggest challenges (see Figure 12). While these are logistical barriers, it definitely would need a lot of time and effort to remove these obstacles. The data also drives attention to the attitudinal barriers that can be significantly overcome with comparatively less effort. These include the interest of students, management support and the involvement of parents. While it has been established in question 5, that Environmental Education is taught at each and every grade still, we see that at this stage the student interest changes significantly.

This has been indicated in several responses but the following one indicates the multi-dimensional barriers clearly: *"Since I primarily teach biomedical sciences, the environmental topics I am passionate about don't easily fit with the curriculum topics. Once we started these biomedical classes, my science club was replaced by HOSA. Those students are less naturally interested in ecology and the environment but could be inspired if a guest speaker taught them the connections. For Biology we are so focused on state test scores that we hesitate to incorporate meaningful projects unless we feel confident it will align with topics (vocabulary and specific concepts) needed to be successful on the state test".*

Varied interests of students, Lack of a structure to keep them connected and motivated about environmental education and greater focus on other subjects are some more attitudinal barriers that have been indicated here. Also the conceptual and educational barriers like the teachers' knowledge to connect the concepts and lack of content knowledge cannot be ignored. This has been well indicated in couple of responses as follows:

- *"I'd say a major barrier is the lack of teachers with a dynamic and multi-faceted education that involves actual life experience, self-awareness, and awareness of their limited perceptual frameworks."*
- *"Some teachers have not thought about how to connect students with EE, and will invite me to come share. But sometimes they come out wearing inappropriate clothing (high heels, etc.), and do not get involved in the service-learning activity with their students, so the leaning is not as likely to continue inside".*

While funding and facilities are barriers that are relatively difficult to overcome, attitudinal, conceptual and educational barriers can be overcome with less effort.

13. Describe a situation where you experienced barriers in teaching EE, EfS or EJ if applicable.
    [Open response]

Analysis:
Logistical factors seem to be the major barriers with 58% of teachers indicating such concerns. Also a very close 42% teachers have also indicated barriers like the stringent curriculum, parent involvement and conceptual knowledge of the instructors to be a barrier (see Figure 13). This has been clearly indicated in some of the responses as follows:

- *"It is difficult to add a program to a school calendar. In addition to curricular constraints, we have to find ways to provide transportation, substitute teachers, meals, and can have difficulty getting parental and administrative permissions".*
- *One possible barrier to getting into the schools to talk about soil and water conservation is that many teachers say they do not have time and/or permission to stray from the curriculum.*

It has been established in previous responses that Environmental Education is touched upon while teaching several core subjects like Science, Biology and Social studies. So the conceptual barriers, education and communication barriers about the importance of environmental education also need to be considered. The understanding of non-formal educators and the core subject teachers could have differences which contributes to these barriers. The same has been highlighted in the following remark: *"I was supporting a teacher who was doing a lesson on life cycles. They were observing some food waste as it decomposed. When the maggots emerged in the compost, she threw it out stating that the presence of maggots ruined the life cycle lesson. She failed to see the connection because her mind was so set on a singular outcome".*

There are some important social barriers that also need due consideration as explained in certain responses like the aspect of racism expressed in this response: *"it's a historically white, conservative program (although our club is diverse) and making the connections between land use and conservation is slow to happen"*

14. Does your school or program have in place any of the following sustainability/green activities for student participation? (check all that apply, Provide personal experiences next)
    - Recycling program
    - Vegetable garden
    - Native plant garden
    - Wind power system
    - Solar power system
    - Composting/food waste collection
    - Rainwater collection/cistern
    - Energy efficiency measures (e.g.: lights/computers off)
    - Water conservation measures
    - Access to natural areas (e.g. river, stream, woodlands, prairie)
    - Carbon emission reduction strategies (e.g.: biking or carpooling)
    - Other

Analysis:

A majority of the non-formal educators, 65%, indicate the schools have several basic amenities to develop student's understanding of Environmental Education, such as access to natural areas, native plant garden, and recycling program (see Figure 14). As established in previous questions, these data also confirm that these activities can be used for all the grades. The lesser available activities are alternative sources of energy activities like wind and solar power systems, which is understandable as these need significant funding and support.

15. Thinking about the selected program from the previous question. Provide personal experiences of the barriers in participating in programs featuring sustainability/green activities for student participation

Analysis:

81% of the non-formal educators acknowledge the barriers that exist for students (see Figure 15). Several responses indicate that environmental education needs financial support and hence there are several financial challenges involved in executing the same. A majority of responses from the teachers show that though the explicit barriers seem to be logistical, such as Finance and Resources, a substantial concern is the priority given to Environmental Education. If this were made a top priority, then many of the barriers wouldn't exist. This has been made clear in several responses like:

- *"It's definitely not really a priority. There is a county wide BBQ fundraiser every year with MOUNTAINS of trash. I know one club tried to initiate reusable dinnerware and wasn't supported"*
- *"I work with multiple schools, and time after time, I see the outdoor space de-valued especially when a new construction project occurs. There is little regard for the hard work and energy put into balancing the ecosystem of a school yard so native plantings, gardens, ponds, are often bulldozed over"*

16. Do you use outdoor/experiential education as part of your teaching and/or does your school/program offer these opportunities for students?

    - Use the outdoors as a setting/context for learning Outdoor/environmental field trips (e.g.: parks, EE centers, ropes courses, etc.) [Response option: Yes, No, Not Sure]
    - Overnights/camping/backpacking Other [Response option: Yes, No, Not Sure]

Analysis:

While a majority of educators expressed a limited access or support of outdoor experiences, 57% of them indicate they utilize the outdoor experiences afforded them (see Figure 16 & 16-1). An overwhelming majority of teachers (74%), mention they utilize an outdoor setting and/or overnight camping. This indicates that the schools do provide relevant opportunities to learn. So connecting the dots from previous questions, the teachers have a fair idea of the subject knowledge as they are all environmental education – non formal educators. The schools do have basic facilities, such as the native plant gardens and recycling facilities. So the major barriers apart from funding, and resources, are several educational and conceptual barriers, for example, the stringent curriculum, low priority to Environmental Education, and limited support of administration, teachers and parents.

This high percentage of outdoor/overnight camp-based learning also indicates a potential opportunity to stimulate a student's interest and educate them about the environmental issues. However, these experiences, being more fun than learning occasions may create an attitudinal barrier to pay attention to concepts of EE. This is suggested in a response to one of the previous questions as follows: "*Often a visit from me is a "fun day" and not considered a supplement to an actual lesson".*

17. Please provide any additional comments or suggestions regarding the questions in this survey. [Open response]

Analysis:

67% of the participants indicated a positive outlook and to look forward to more programs which would enhance the learning in environmental education (see Figure 17). The respondents who aren't positive are apprehensive because of the current socio-political conditions that are a result of the pandemic situation. A majority have welcomed the research and have also mentioned that awareness and inclination to impart environmental learning have been increasing over the last few years. Connecting the dots from all the previous questions it is to be noted that teachers are aware of the subject matter of EE/EfS/EJ. While there are primary facilities that are available and schools also have programs that include opportunities to teach environmental concepts. While the major barriers are logistical, such as finance, resources and time, the other significant attitudinal, conceptual and educational barriers like priority to environmental concepts, curriculum flexibility and core subject teachers and non-formal educators being on the same page can't be ignored.

CHAPTER 6

CONCLUSIONS AND PERSONAL REFLECTIONS

I have been teaching science education in some capacity, both formally and informally for over 20 years. It is my experience that barriers to teaching Environmental Education and then later, Environmental Justice Education, have not improved much in those 20 years. In fact, I would argue, with the current political climate, teaching EE or EJ has more barriers than ever before. Historically, barriers fell into three categories, lack of compulsory teacher requirements, lack of resources such as transportation, or funding, and a lack of support from administration and parents.

Reflecting on the last 15 years of teaching, I would have to include myself as a barrier in teaching EE or EJ. Some factors which gave rise to me getting in my own way included the paradigm shift I experienced during my time exploring the intersection of EJ and Social Justice. After that experience I began to question my place as a white woman in the racial justice theater. While I recognized my privilege and purpose as a white ally, I also questioned my participation in the white savior phenomenon. These complex conflicts served to question my ability and place in the conversation of inequality and education.

Administrative turnovers in the schools, where I facilitated the STC program, were negatively impacted by the disruptive nature of the turnover and policy changes which followed. All the student program interactions in which I participated happened after school or as a supplement to the traditional school day. The public school and after school programs I serviced over the last fifteen years have had a remarkably high turn-over rate in administration and leadership. While teaching the STC program over the span 15+ years, I worked with seven program coordinators or principals. Five of the administration changes occurred in the public school sector over a seven year period. These disruptions presented

two key challenges, one, consistency for the students, and two, frustration and delays for me, the educator. In the public schools I serviced, nearly each year, the school would welcome a new principal. This transition would require me to reintroduce the program, meet with the new principal or program coordinator and set up a new curriculum scheduled based on the new administration's vision of the school year, only to have a new principal, or no principal in a few months or the next year.

One particularly disruptive year, the principal was suddenly removed from the school, mid-year, with no explanation. With no principal on campus, I was forced to abruptly discontinue my school visits without explanation to the students while we waited for a replacement to be hired, which never came. The students had been working on projects within our program over the course of the week, which we never finished. This type of disruption, which abruptly ended a class project prior to completion, sent a message to the students that what they were working on was not important and we do not value their time and work. To add to the student stress and disorder, we soon learned the principal had been arrested for allegedly murdering his girlfriend in a murder for hire plot using school fundraiser moneys. This information was widely spread in the media and reflected on these students and the community where they lived. It was traumatizing on many levels, yet, my perception was this trauma was not acknowledged or addressed by the district.

The next school year, I was able to convince the new principal to allow us to go on an experiential EE field trip with several volunteers providing outdoor learning expertise during a program developed for these students, only to have it canceled at the last moment, just days before the event had taken place because the principal wanted all available teachers to come in after hours to repaint the building before classes resumed. Students and parents had been prepared and were excited for the experience. Dozens of volunteer's educators and outdoor enthusiasts donated time and resources to make this outdoor experience. Transportation funds

were procured, and arrangements were made for pick up, and drop off at multiple sites for an outdoor EE experience. The principal called me a day or two before the experience to tell me he would not have any teacher chaperones available because he had asked them to come in on the weekend to paint the school before the new schoolyear officially began. I implored him to allow us to host the students as we had several volunteer adults on hand and the parents had already provided permission slips. He dismissed the compromise, saying we must have a schoolteacher present. The STC program did not participate with this school the next school year, however, the cooperating teacher I worked with the prior year informed me the new principal did not return the following year.

Experiences such as these were damaging to my morale and my belief that educators would or could have the opportunity to teach Environmental Education in a transformative manner, let alone Environmental Justice, which requires an EE foundation.

Discussion of Findings

The findings of this research lays the groundwork for future research into place based environmental education with an emphasis on EJ education. These data suggest that the traditional assumptions related to the engagement and practice of teaching EE or EJ in education are challenged by three main components that have experienced meaningful change in the past 40 years. This study set out to develop the EJ curriculum and facilitate said curriculum in local science education. This researcher determined the depth of disconnect between social justice and Environmental Education too prodigious to accomplish the planned program. Thus, the barriers of teaching EE and EJ educations, which this researcher and others identified became the focus of the research. Before one may build a house, they must first determine the barriers which exist on the land, which may inhibit a strong foundation. This research provides one of the first comprehensive assessments of some of

those barriers. It establishes a qualitative framework for identifying the challenges educators and policy makers must overcome or address when teaching in marginalized, high poverty communities. Thus far, government programs have used the top down, penalty, approach to effect change and serve a political agenda. Teacher education, however, and grassroots movements may likely be able to provide the only meaningful transformations in communities where these barriers exist. Marginalized students must see themselves as knowledgeable and capable of transformative actions.

These data identified informal educator frustration and a perceived lack of support by policy makers and administration for implementing EE curriculum and almost no reference to EJ in curriculum. Classroom teachers, within the cooperating schools and classrooms were somewhat dismissive or uninvolved in the implementation of EE programs. This could also be attributed to limited training and responses for pre-service and in-service teachers to help them understand the natural world connection and student impact in their standardized teaching as well as develop strategies to minimize barriers.

Further Research

Determining barriers in teaching EE and EJ education is fundamental to creating policy and curriculum that empowers youth to research, identify and advocate for sustainable environments. Three pillars of research are needed to fully understand the impact of EE and EJ in education. Teacher knowledge base, public education policy reform and empowerment in communities. As mentioned in the literature review, we have an abundance of research that identifies the impact of neurotoxins on youth development. Public policy is being established to identify and eradicate toxins in marginalized communities, however little research exists that demonstrates a connection between teacher training, curriculum development and the EJ issues. Future researchers should look for more ways to dig deeper into the questions of what barriers exist in teaching EJ and develop a road map for incorporating it into the curriculum. This

requires engagement at the pre-service teacher level and elevate into local, state and professional organization standards. Disconnect between EE/EJ advocacy efforts at the policy level verses the educational level are blatant. Presently, teaching Environmental content is relatively optional and dependent on teacher initiation and knowledge. Critics argue this type of curriculum application is inconsistent, non-data driven, and dependent upon each educator's personal EE experience and belief systems, which is potentially counterproductive to creating a culture of citizen participation.

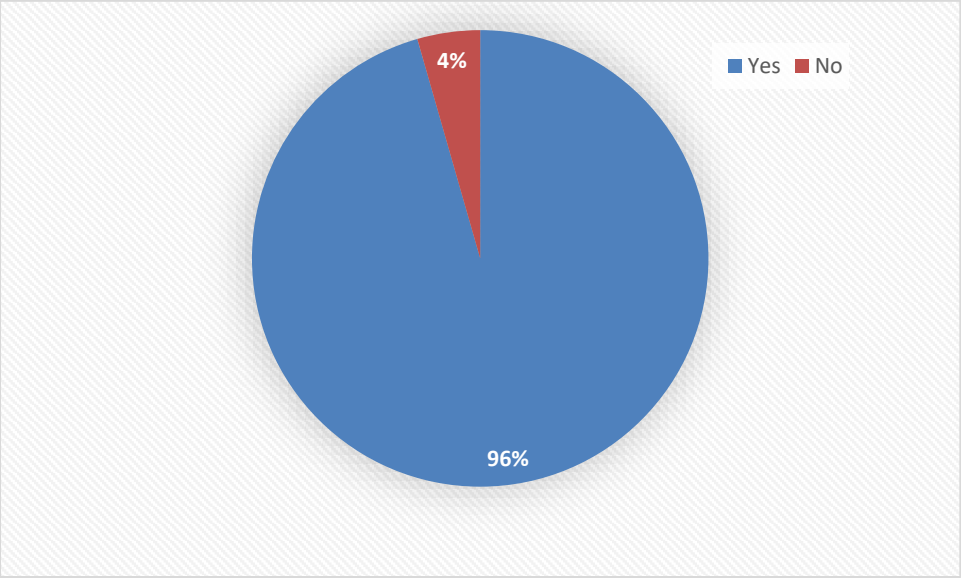
Ideally, this research would be replicated. By disseminating these survey questions to a larger audience of both informal and public school educators in a wide range of schools in varied districts across the U.S, we would broaden the scope of understanding of specific programs and tools for allowing students greater access to EE and EJ education.

As the pendulum of politics has swung to and from the topic of EJ, in November of 2021, the Biden administration passed a bipartisan infrastructure bill which promises to address Environmental Justice concerns in marginalized communities. Specifically, it suggests the funding will address legacy pollution which disproportionality affects marginalized communities (The White House, November 2021). While the remediation of toxins in marginalized communities is an essential step towards EJ, it fails to demonstrate a commitment toward EE and EJ in education and curriculum standards which could, arguably, prevent these inequalities from presenting themselves in the future.

FIGURES

Figure 1

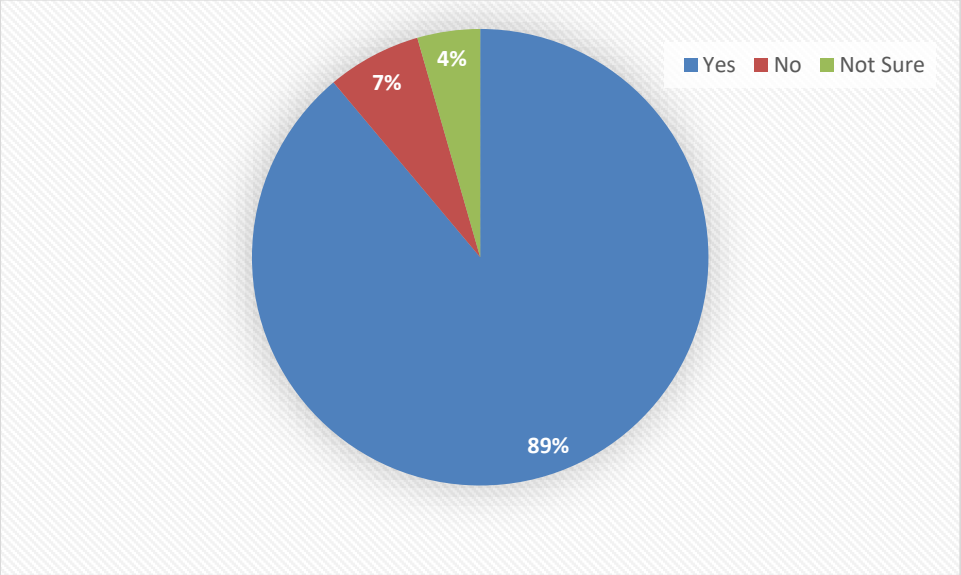
Teaching Environmental Education in line with the Definition



A yes response suggests the respondent understands the definition as it is written

Figure 2

Teaching Education for Sustainability in line with the Definition



A yes response indicates the respondent understands the definition as it is written

Figure 3

Teaching Environmental Justice in line with the Definition

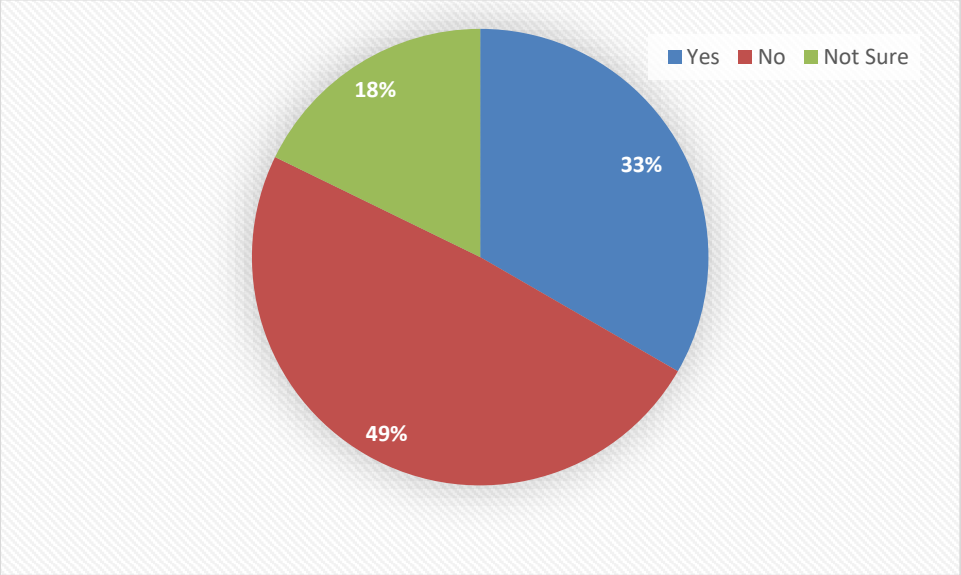
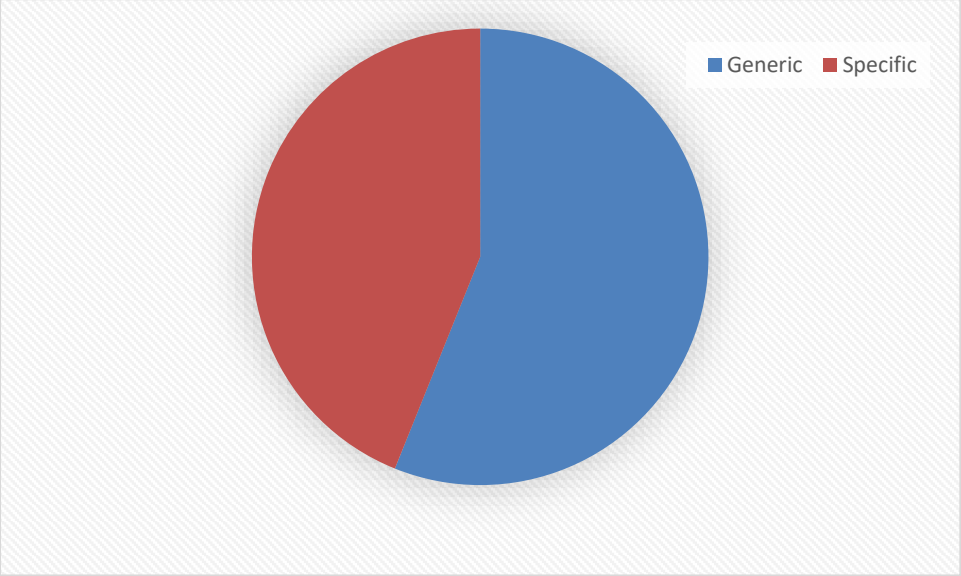


Figure: 4

Subjects that integrate EE/EfS/EJ concepts



Specific indicates the respondent teaches subjects specific to EE/EfS/EJ while generic is not directly related to these topic.

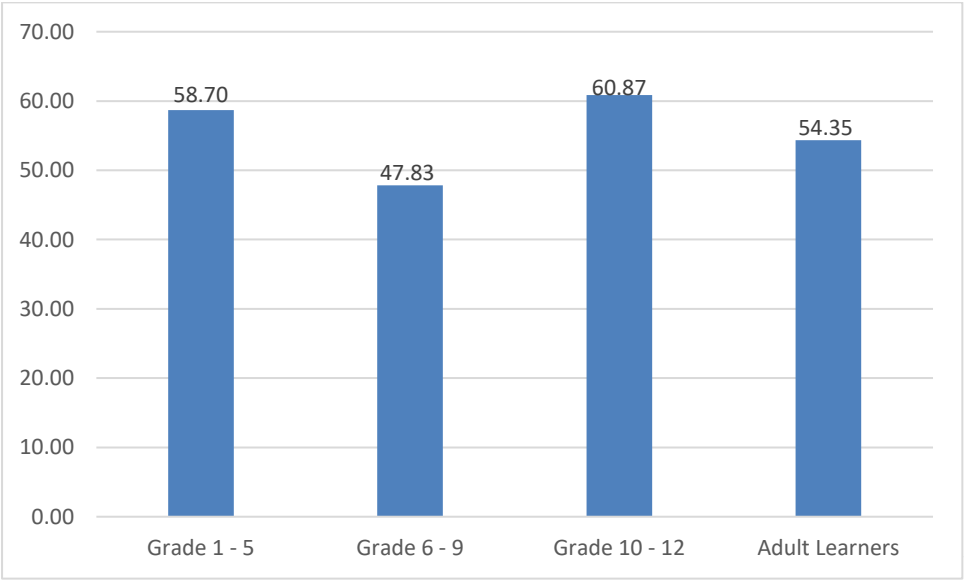
Figure: 4-1

Word map EE/EfS/EJ concept responses

Word map depicting common responses of respondents.

Figure: 5

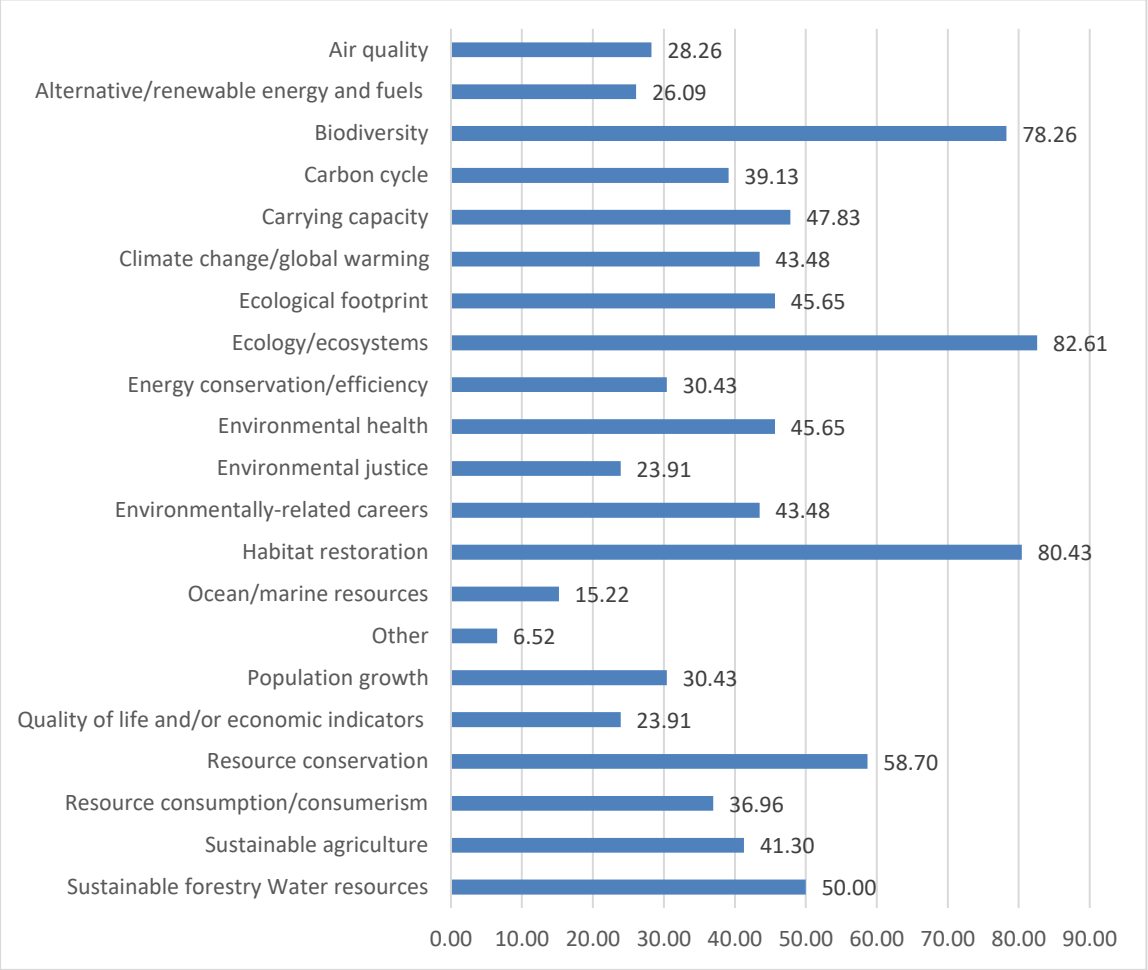
Teaching EE,EfS or EJ by Grade



Identifies the grade level each respondent teaches

Figure: 6

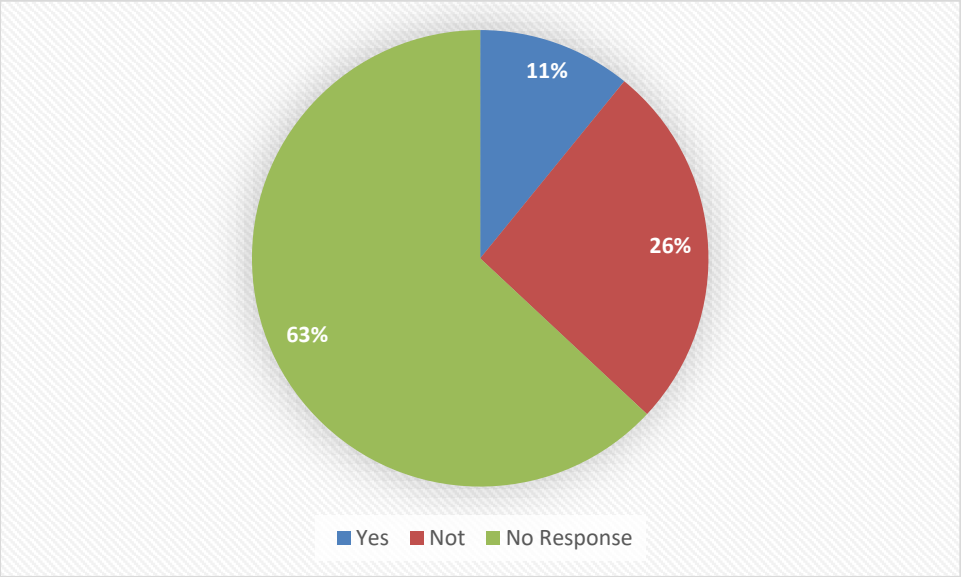
Topics of Prominence Covered



Indicate frequency of topic tough by respondents.

Figure: 7

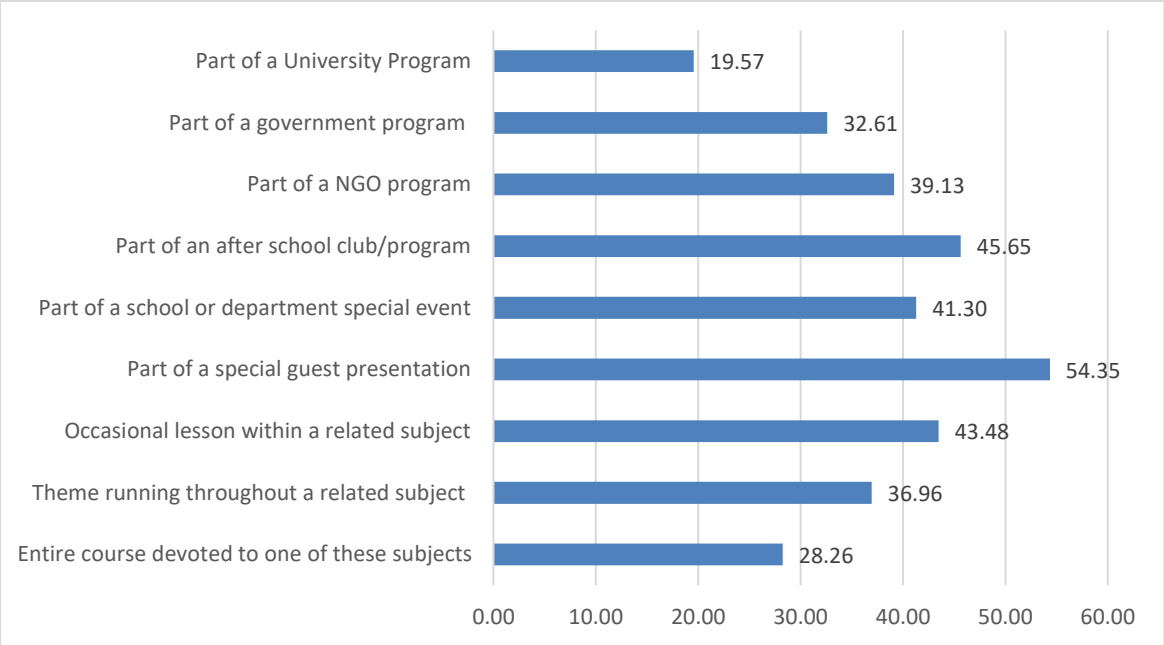
Awareness Quotient of Inclusion of Environmental Concerns in Education



Open question determining if EE/EJ or EfS topic are supplemented in the course.

Figure: 8

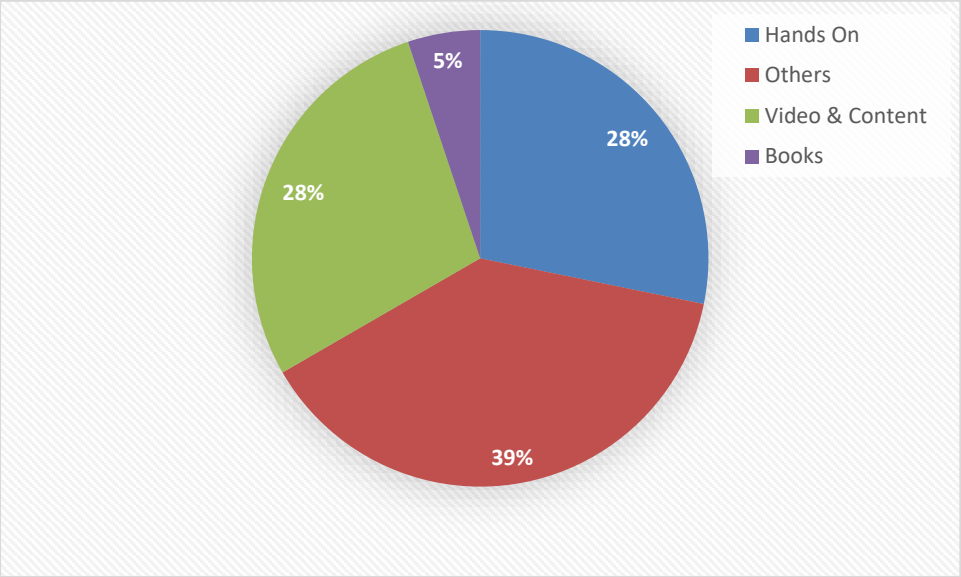
Context of Teaching EE, EfS or EJ?



Provides the class environment by which the respondents teach programs.

Figure: 9

Preferred type of instructional material



Indicates the most used instructional material.

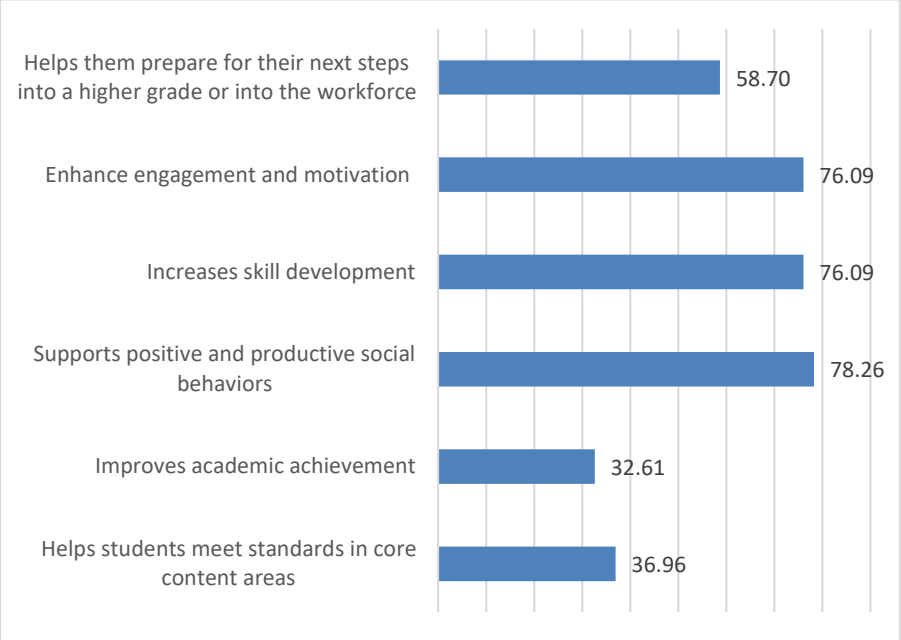
Figure: 9-1

Word Map of preferred instructional material

Word map of the most used descriptors of instructional material.

Figure: 10

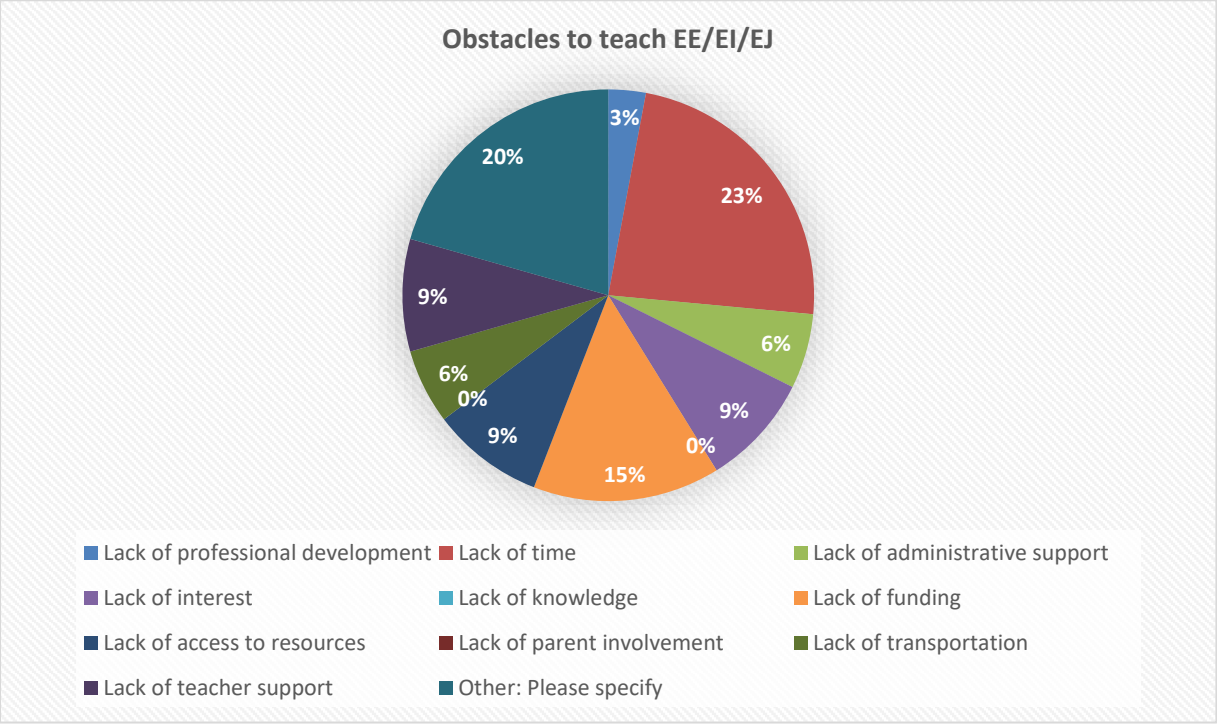
Perceived benefits of environmental education



Responses to perceived benefits of teaching EE.

Figure: 11

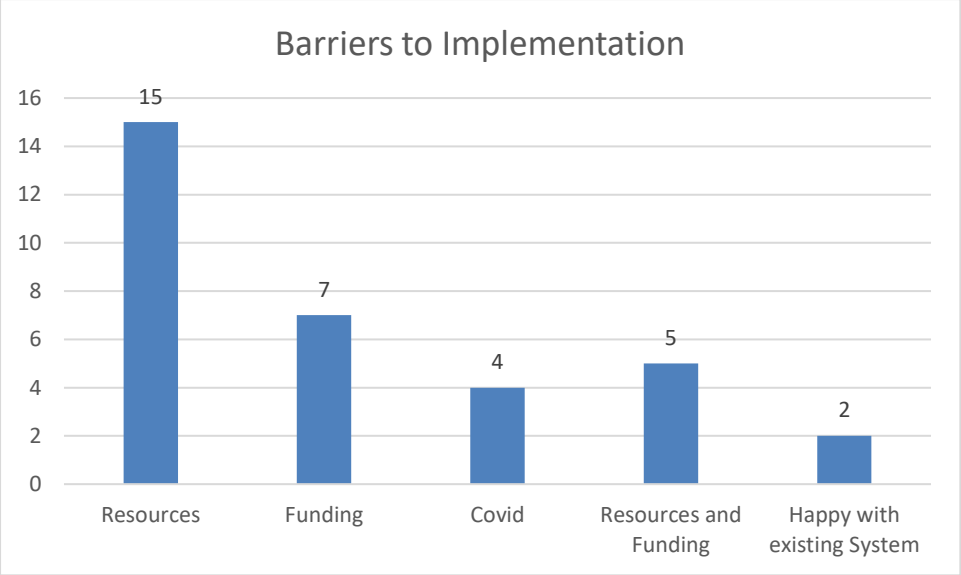
Obstacles or barriers to teaching EE, EfS or EJ



Percentages of responses to specific barriers in teaching EE, EfS or EJ.

Figure: 12

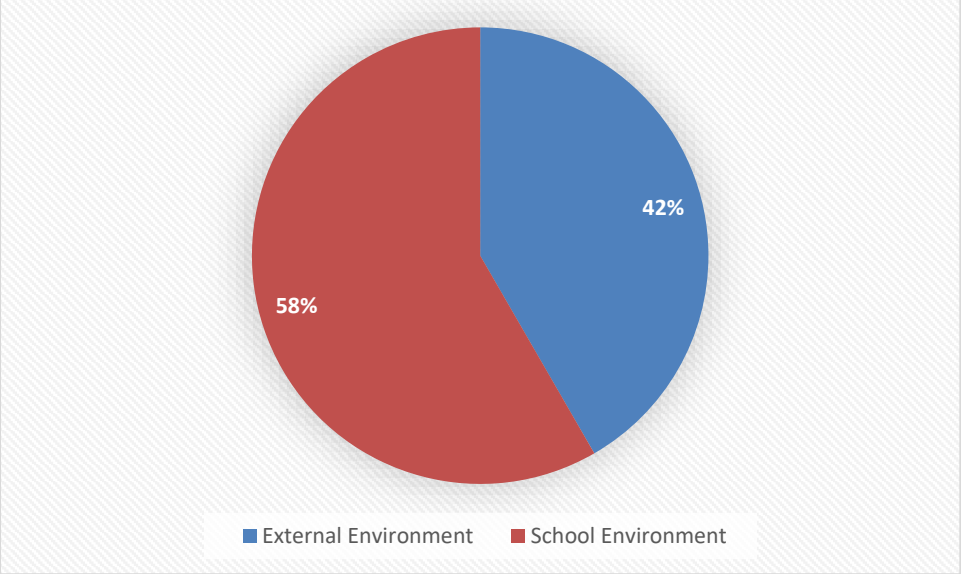
Barriers to Implementation



Frequency of respondent identifying barriers.

Figure: 13

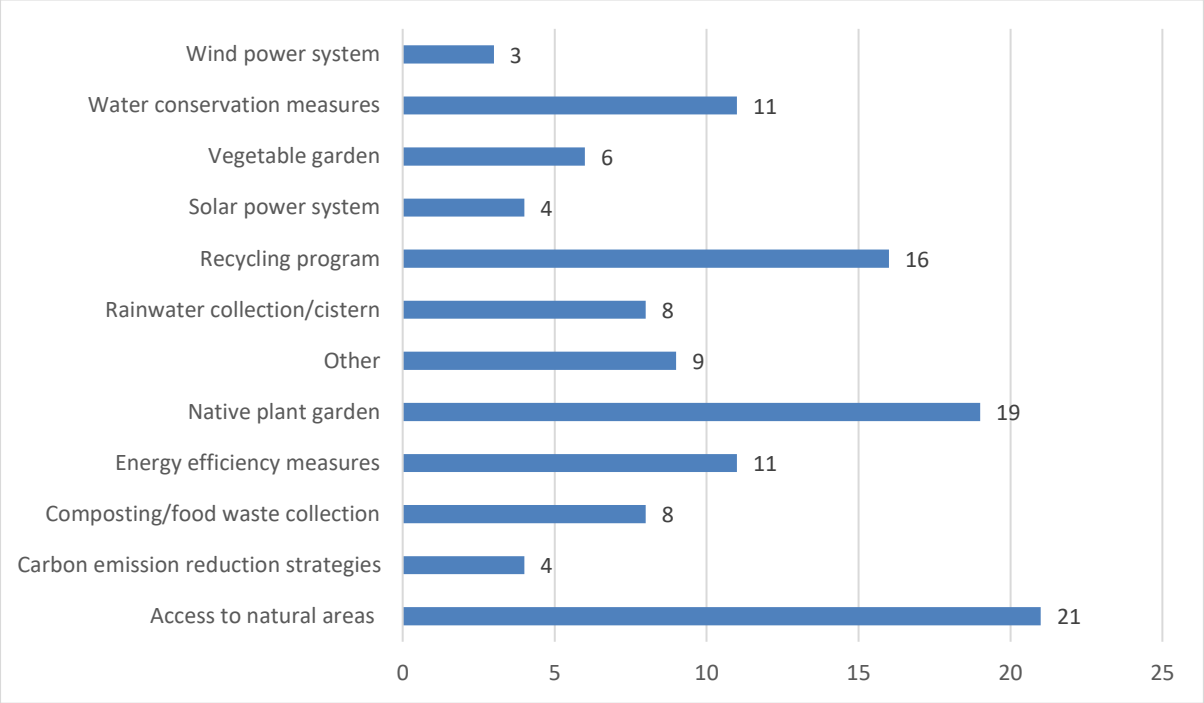
Internal Vs External Environmental barriers to teaching EE, EfS, EJ



Beliefs regarding locational origin of barriers.

Figure: 14

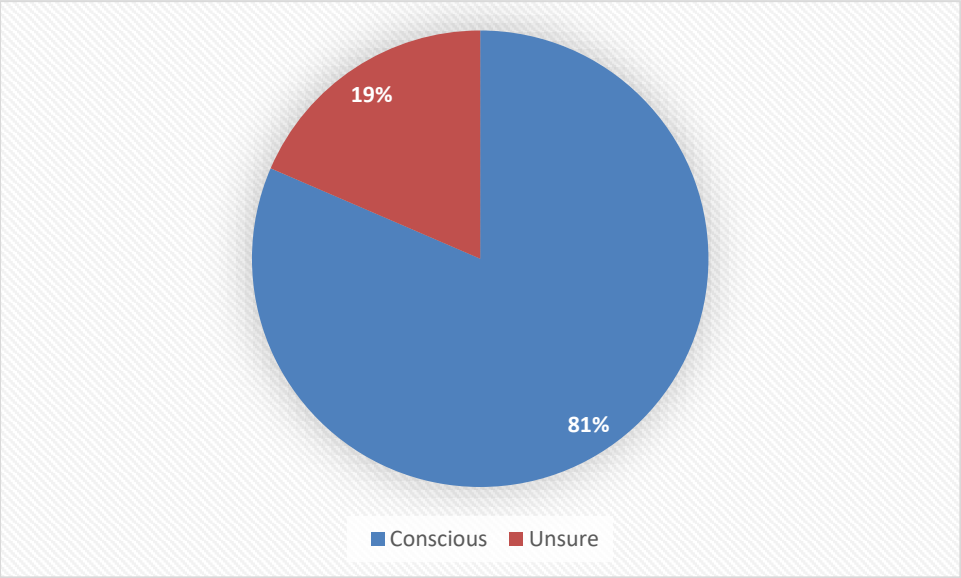
Prominent Sustainability Activities as part of School



Participant identification of resources available.

Figure: 15

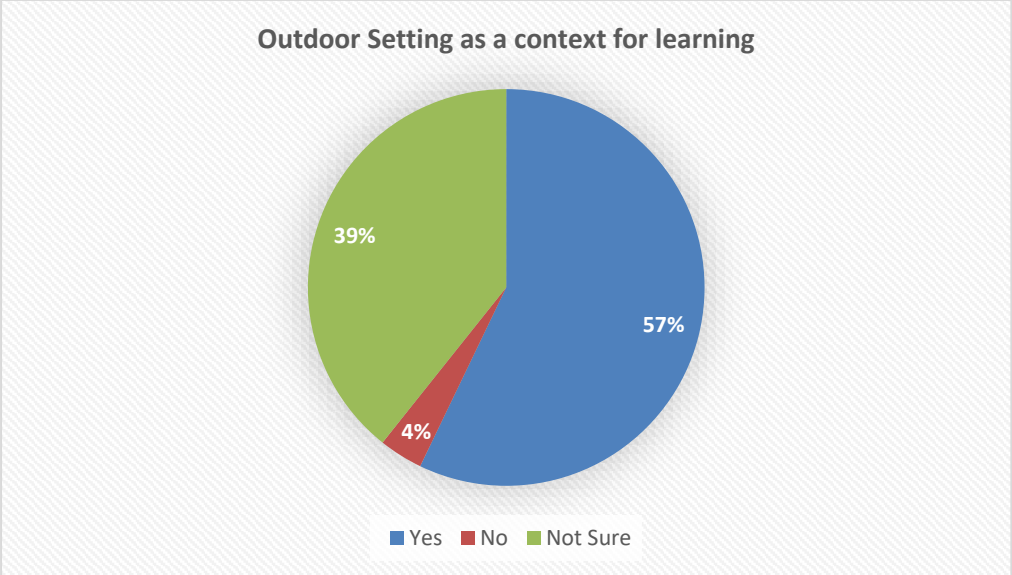
Barriers to Participation



Indicates respondents understanding of reasoning behind barriers.

Figure: 16

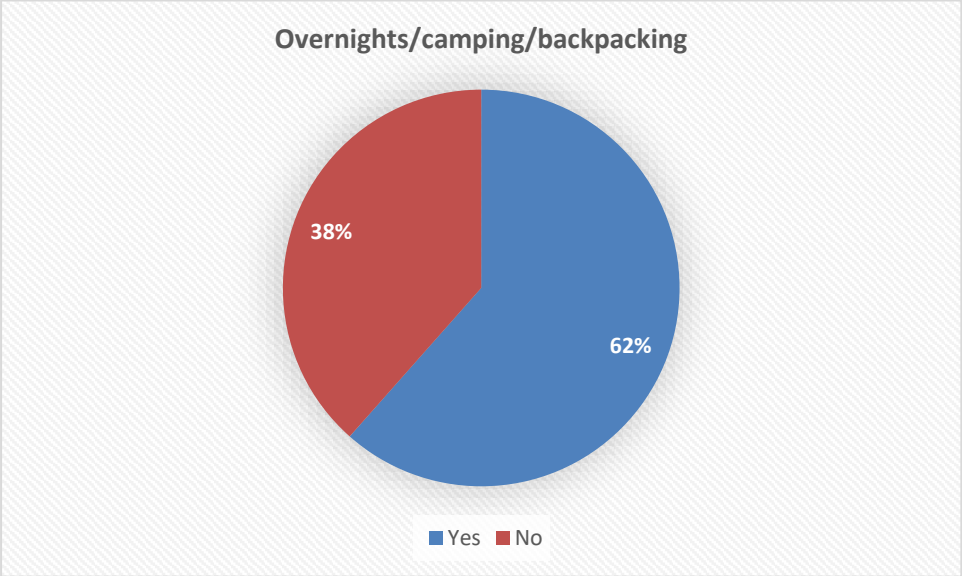
Usage outdoor/experiential education as part of teaching and offered by school



Participant uses an outdoor setting in program curriculum

Figure: 16-1

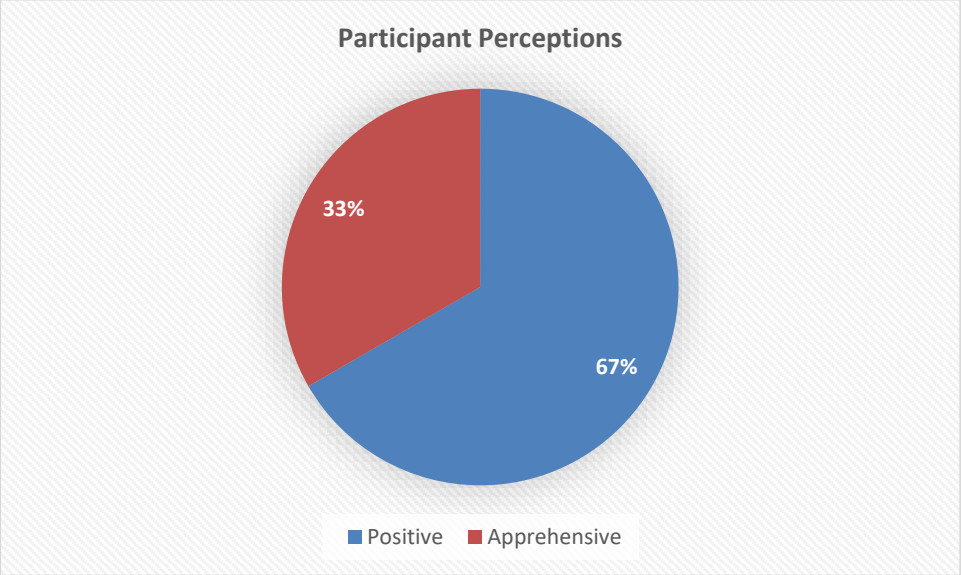
Usage of overnight camping/backpacking as part of teaching and offered by school



Respondent's percentage of uses overnight/camping/backpacking.

Figure: 17

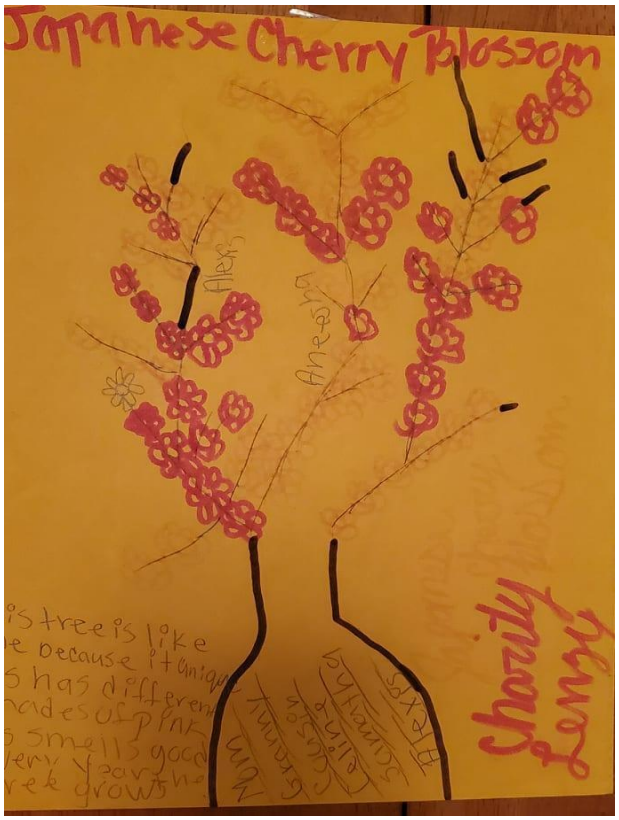
Participant Perceptions



Participants overall feeling toward teaching EE/EjS oe EJ content

Figure 18

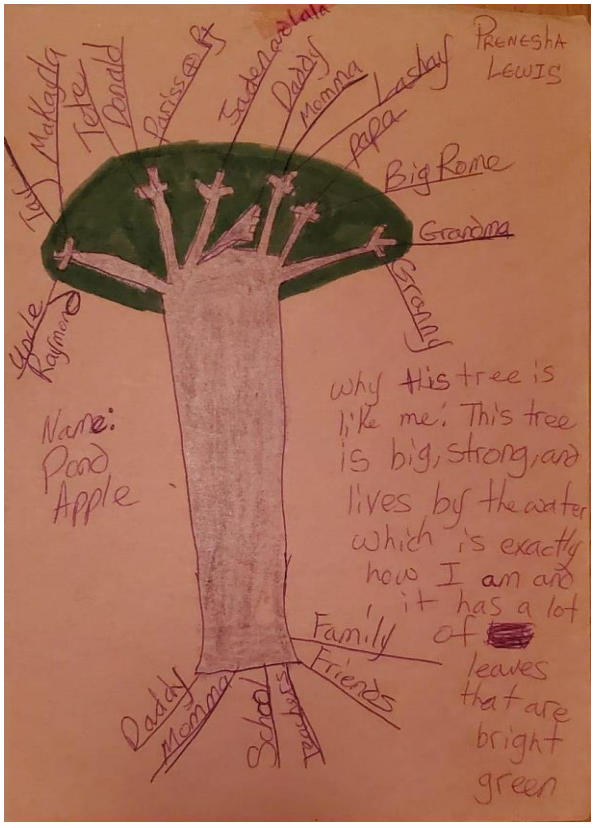
Japanese Cherry Blossom



This STC student has selected a Japanese Cherry tree. For the tree roots this student identifies close family and friends as her support system, specifically the family matriarch. The student associates these individuals as the people who help keep her stay stable and grounded, like the roots of a tree.

Figure 19

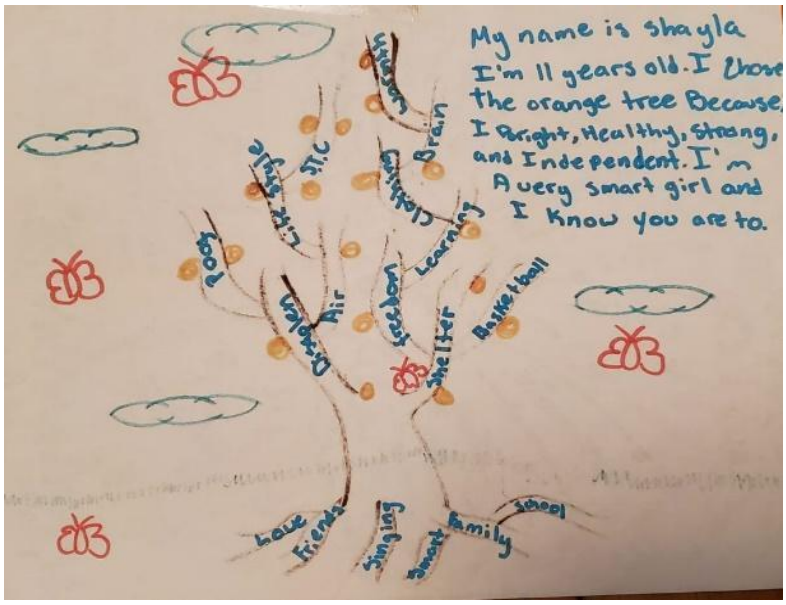
Pond Apple Tree



This STC student selected a Pond Apple tree to represent herself. This students' roots include both parents, school, teachers and friends. The shoots are identified as specific people who are the student's support system for science goals and developing a life plan. This student was quiet and determined. She wrote, "this tree is big and strong and lives by the water which is exactly like me."

Figure 20

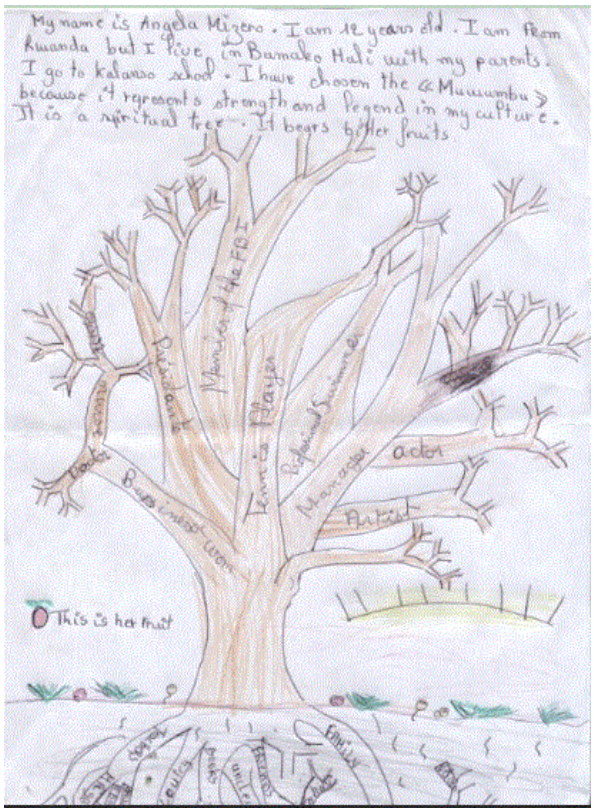
Orange Tree



This STC student chose an Orange Fruit Tree to represent herself. She believes it shows she is bright, strong and independent. Unlike many of the other US students, she saw her roots as concepts more than actual people. She cited love, friendship, family, school and being smart are her support system. While her shoots, or ways she achieves her goals include activities such as the STC program. This was one of those memorable students who touched my heart. I have no doubt she went on to do great things.

Figure 21

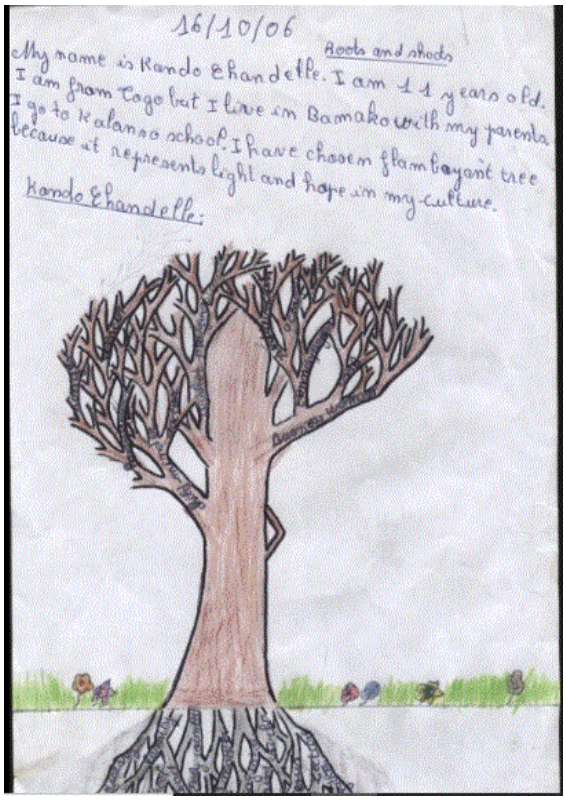
Bamanko Student tree



The trees from the Bamanko children have a different tone than the US trees. Here you find that the trees have a more spiritual and cultural context. Notice how she refers to the fruit of the tree as, “her fruit”. It was a common theme among the Mali students that the tree represented the feminine and fertility side of themselves. The roots identified are similar to those of the US students, but the shoots represent the dream and aspirations of this young lady.

Figure 22

Flamboyant Tree



Here the student selected a Flamboyant Tree, which they say represents light and hope. This student seemed to have an abundance of support and aspirations. Many of these West African students, especially girls do not get access to a full education (Mali n.d). As a result, we see those who are able to attend school beyond primary grades as eager and driven to be successful.

Figure 23

Dr. Kyle with art winner

Dr. Kyle, the KwaMgaga (Durban, SA) student artist (Marcellius), and his mother (L-R)

Figure 24

KwaMgaga Class

The KwaMgaga (Durban, SA) school the artist winner attends with his peers.

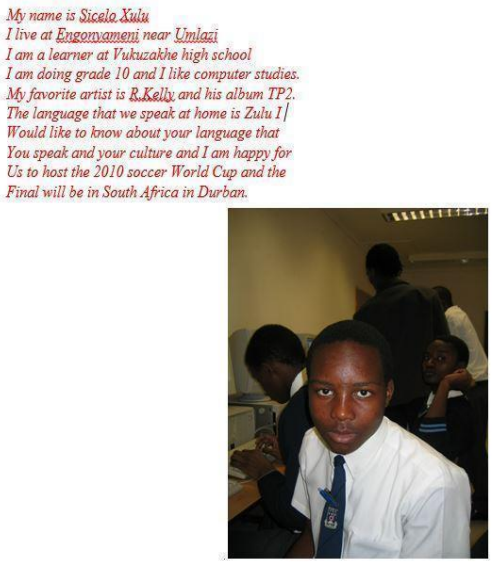
Figure 25

KwaMgaga Class with mother

The KwaMgaga (Durban, SA) the artist winner attends with his peers, mother and teacher.

Figure 26

Durban SA student



Sample Durban SA student autobiography

Figure 27

KwaMgaga stude

Hopefully this is the beginning of something good. I cannot wait to hear from you. I'm known by the name of Faith Kunene. I'm a girl of 17 years and I attend school at KwaMgaga is situated in a Township called Umlazi.I am currently doing Grade 11 and I am defenatly enjoying it.

I enjoy listening to music especially if it is from my favorite musician Musiq.I also enjoy watching movies and my favorite actor is Thapelo Mokoena locally & internationally I love every one. I love reading as well one of my favorite book is written in my home language.

Sample Durban, SA student autobiography.

APPENDIX

A. Informal Educator Survey Text

Informal Educator Interview Questions using Survey Monkey

Permission: By completing the questionnaire the participant give permission for his or her anonymous answers to be used for the purposes of research.

Statement: All questions are related to your experience as an informal educator in Missouri.

Jodi Devonshire from the University of Missouri St. Louis Graduate School is collecting data, via an online survey, on barriers in teaching environmental and sustainability education in informal and formal settings to middle school learners. The information provided by formal and informal educators will allow us to identify challenges in teaching environmental education and environmental justice education programs in the Greater Saint Louis Missouri area and provide opportunities for improvement.

Please answer any questions that are applicable to your situation.

1. Environment education (EE) is a learning process that increases knowledge and awareness about the environment and associated challenges; develops the necessary skills and expertise to address these challenges; and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action. It can include three dimensions: education about the environment, for the environment, and in the environment.

Based on this definition do you teach anything related to the general topic of environmental education? [Response option: Yes, No, Not Sure]

2. Education for sustainability (EfS) is a learning process that develops a responsible citizenry capable of applying knowledge of interconnected ecological, economic, and socio-

cultural systems to meet current and future needs; and how personal and collective actions affect the sustainability of local and global systems.

Based on this definition do you teach anything related to the general topic of education for sustainability? [Response option: Yes, No, Not Sure]

3. Environmental Justice Education is the confluence of Environmental Education and Social Justice. Marginalized or Minority learners are more likely to be in close contact with environmental toxins than any other demographic. These toxins are often neurotoxins which can dramatically affect learning and behavior in students. Using Placed based environmental education to teach students in these areas about Environmental Justice can empower them to become active participants in developing the social capital needed to protect themselves and their families from toxic exposure.

Based on this definition do you teach anything related to the general topic of environmental justice? [Response option: Yes, No, Not Sure]

If you answered no to 1, 2, and 3 skip to question 12.

If you answered yes or not sure to 1, 2, or 3 go to question 4.

4. In what subject area(s) do you teach environmental education (EE) education for sustainability (EfS) or Environmental justice (EJ)? [Open response]

5. In what grade level(s) do you teach EE, EfS or EJ? (check all that apply) K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

6. Within the subjects you teach, what specific EE or EfS topics/issues do you address? (check all that apply)

Air quality

Alternative/renewable energy and fuels (hydro power, solar, wind, biodiesel, hybrid vehicles, etc.)

Biodiversity (e.g. terrestrial/aquatic plants and animals)

Carbon cycle

Carrying capacity

Climate change/global warming

Ecological footprint

Ecology/ecosystems

Energy conservation/efficiency

Environmental health

Environmental justice

Environmentally-related careers (e.g.: natural resource management, green building, solar/wind installation)

Habitat restoration (e.g.: streams, lakes, wetlands, salmon)

Ocean/marine resources

Population growth

Quality of life and/or economic indicators (e.g.: genuine progress indicator)

Resource conservation (e.g.: energy, water, recycling, soil)

Resource consumption/consumerism

Sustainable agriculture (e.g.: organic farming, biological pest/weed control)

Sustainable forestry Water resources (e.g. quality, quantity, conservation)

Other

7. Do you have comments on the above, or other, EE, EfS or EJ topics/issues that you teach?

[Open response]

8. In what context do you teach EE, EfS or EJ? (check all that apply)

Entire course devoted to one of these subjects

Theme running throughout a related subject (e.g. biology, social studies, math, art) Particular unit set within a related subject

Occasional lesson within a related subject

Part of a special guest presentation

Part of a school or department special event (e.g. Earth Day)

Part of an after school club/program

Part of a NGO program (e.g Girl Scouts)

Part of a government program (e.g local parks or DNR)

Part of a University Program

9. What are EE, EfS or EJ instructional materials/resources you find especially useful?

Textbooks: Other print material (e.g.: supplemental texts, books, magazines): Videos/films

Experience (e.g. field trips)

Hands on (e.g. discovery trunks)

Websites: Community resources (e.g.: speakers, public agencies, non-profit organizations, businesses, individuals)

[Open response]

10. How do you think your students benefit from EE, EfS & EJ? (check the top three benefits)

Helps students meet standards in core content areas (e.g.: applied math, science, reading/writing)

Improves academic achievement (e.g. grades, test scores)

Supports positive and productive social behaviors

Increases skill development (e.g.: collaboration, communication, project-based learning, problem-solving)

Enhance engagement and motivation (e.g.: participation, leadership, reduction of drop-out potential)

Helps them prepare for their next steps into a higher grade or into the workforce Connects them to their community and empowers them to participate

11. What are obstacles or barriers to your teaching EE, EfS or EJ? (check all that apply, Provide personal experiences)

Lack of professional development

Lack of time

Lack of administrative support

Lack of interest

Lack of knowledge

Lack of funding

Lack of access to resources (e.g. people, materials, and/or tools)

Lack of parent involvement

Lack of transportation

Lack of teacher support

Other: Please specify

12. Describe a situation where you experienced barriers in teaching EE, EfS or EJ

[Open response]

13. Does your school or program have in place any of the following sustainability/green activities for student participation? (check all that apply, Provide personal experiences)

Recycling program

Vegetable garden

Native plant garden

Wind power system

Solar power system

Composting/food waste collection

Rainwater collection/cistern

Energy efficiency measures (e.g.: lights/computers off)

Water conservation measures

Access to natural areas (e.g. river, stream, woodlands, prairie)

Carbon emission reduction strategies (e.g.: biking or carpooling)

Other [Response option: Yes, No, Not Sure]

14. Do you use outdoor/experiential education as part of your teaching and/or does your school/program offer these opportunities for students?

Use the outdoors as a setting/context for learning Outdoor/environmental field trips (e.g.: parks, EE centers, ropes courses, etc.)

Overnights/camping/backpacking Other [Response option: Yes, No, Not Sure]

15. Please provide any additional comments or suggestions regarding the questions in this survey. [Open response]

Thank you very much for your participation in this survey!

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