GROWING THE ENVIRONMENTAL STEWARDS OF TOMORROW: AN ANALYSIS OF AN URBAN SCHOOL GARDEN

by

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DEDICATION

To the children of Dove Springs who made this research possible. May you continue to dream, explore, and discover.

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LIST OF ABBREVIATIONS

Abbreviation	Description
STEM	Science, Technology, Engineering, Math
SEL	Social and Emotional Learning
AISD	Austin Independent School District
TEA	Texas Education Agency
AYP	Adequate Yearly Progress
OEE	Outdoor Experiential Education
LatCrit	Latino Critical Race Theory
NPS	National Park Service
TEKS	Texas Knowledge and Skills
CRMs	Curriculum Road Maps
ELLs	English Language Learners
CALP	Cognitive Academic Language Proficiency
IR	Improvement Required
MOY	Middle of the Year
CCCN	Cities Connecting Children to Nature
GIS	Geographic Information Systems
PEAS	Partners for Education, Agriculture, and Sustainability

1. INTRODUCTION AND PROBLEM STATEMENT

As the national parks celebrated their 100th anniversary in 2016, one of the main issues emerging from Park Service personnel and other conservation agencies was centered on how to stay relevant to the changing demographics of America and how to diversify park visitors and employees. Despite African-Americans and Hispanics comprising 31.1 percent of the U.S. population, a recent national park survey measured only 16 percent of park visitors identifying as Latino or African-American (Rott 2016). This question of minority inclusion in terms of the great outdoors is certainly being explored by others within the environmental movement. Scholars and educators agree that while there are many benefits to outdoor education for American K-12 students, they also recognize that students of color have been traditionally excluded from these opportunities, and communities of color more broadly have different relationships to nature than their white counterparts (Finney 2014). This disconnect to nature has precluded communities of color from being involved in mainstream environmental organizations, attending state and national parks, and participating in environmental science programs (Ozer 2007, Finney 2014, Sister et al. 2009). Other advocates concerned with a lack of minority engagement with the outdoors note that elevated rates of childhood obesity and Type 2 diabetes are health consequences associated with limited exposure to nature (Louv 2014). Furthermore, minority youth will play a leading role as the environmental stewards of the future, positioned to combat environmental degradation, natural resource depletion, and climate change (Nelson 2015). Despite the recognition that minorities are deprived of many environmental benefits, there exists little research on how to design, implement, and evaluate outdoor programs geared toward

minority youth. The acknowledgment that environmentalism in the United States has historically upheld a narrow definition of nature as 'people-less' wilderness has led many proponents of outdoor education to advocate bringing nature to schools and creating programs that are relevant to the lives' of urban youth and their families (Cronon 1995, McCown et al. 2011). In particular, scholars like William Cronon have advocated for a "middle ground," which calls for sustainable land use practices in the natural places closest to our homes such as yards, gardens, and local parks, thereby enabling practical acts of environmentalism that can be performed by people regardless of income, gender, or race (Cronon 1995).

Utilizing this framework of a "middle ground" approach, I designed, conducted, and evaluated an outdoor education program in one of the nation's most segregated cities: Austin, Texas. Building upon my experiences working in South Austin's Widen Elementary, I implemented a school garden program and evaluated its pedagogical impacts at a majority Hispanic school. Specifically, by using interviews, focus groups, and participant observation I asked: What role can community garden programs play in facilitating elementary school Latino students' achievement of learning objectives in the fields of a.) social and emotional learning (SEL) b.) scientific inquiry and c.) nutrition and health? What additional benefits do school community gardens bring to students at Widen Elementary? Studying the ways in which K-12 Latino youth learn and develop through interaction with a school garden provides an understanding of how to make nature programs more relevant to urban minority youth and will contribute to an a.) increase in attention spans and decrease in disruptive behavior b.) greater understanding of organisms and their habitats and natural resources, and c.) knowledge about food

systems. Furthermore, the information acquired in this study could be used to inform Austin Independent School District (AISD) curriculum in the areas of science, health, and SEL and provide a road map for other schools to implement their own garden programs. Existing research supports that greater access to green space and spending time outdoors have been proven to improve children's quality of life by lowering levels of stress, increasing physical fitness levels, and building relationships to the living world around them (Louv, 2014). These benefits would not only enrich the lives of South Austin's Latino youth population, but by teaching better ecological stewardship practices to youth, we increase the potentiality of creating environmentally responsible citizens of the future who will be educated in matters relating to sustainable development, natural resource consumption, and conservation.

2. BACKGROUND

Figure 1. Map of Travis County, (red area indicating Dove Springs and site location, McCray 2010).

Historical segregation has had a profound impact on Austin, Texas's school demographics, student achievement, and race relations. An Austin American-Statesmen analysis of district demographics shows that the 'majority of schools with the highest percentage of low-income, black and Latino students are east of Interstate 35, with 50 of the district's 116 campuses having 90 percent or more students who qualify as low-income' (Maclean 2016). Austin Independent School District (AISD) ranks 80th out of 1,247 public school districts in the state of Texas, with at least 11 schools being classified as failing by the Texas Education Agency (TEA). Compared to the westward school district of Eanes, whose demographics consist of a 94.7 percent white and Asian student body and rank in the top 10 school districts, it is clear that a continued legacy of racialized urban planning, cultural segregation, and gentrification continue to affect not

only the demographics of local schools, but the likelihood of student success (Raney 2014).

East of Interstate 35, sits Dove Springs—or "the 44" as it's nicknamed—after the area's postal code. Characterized by a large minority population (64-76 percent Hispanic, 14-17 percent African American), below average levels of median family income, and high rates of crime and obesity, Dove Springs is known to have an unfavorable reputation among locals in Austin (McCray 2010). Embedded in the heart of this community is Widen Elementary. As a primarily Hispanic (91.9 percent Hispanic, 6.3 percent African American) Title I school with 95.2 percent of the student body coming from economically disadvantaged backgrounds, and 50.9 percent of students being English language learners, the school faces a multitude of challenges. Widen is a campus that has historically struggled in not only test scores, but with behavior issues, social/emotional learning objectives, and community involvement. Passing rates on 2015-2016 standardized test scores hover in the 55th percentile for reading, math, and science, resulting in the school failing to meet adequate yearly progress (AYP), necessitating intervention and monitoring by the Texas Education Agency (TEA).

Severe behavior incidents are evident in a confidential internal survey, which shows that in 2015-2016, out of the 160 discipline incidents that were filed, 37 percent required the student to be removed from the classroom setting due to physically assaulting another student or adult, insubordination, throwing objects, or being disruptive. Further evidence of behavioral issues can be seen in data from the 2016 student climate survey issued by the AISD's Department of Research and Evaluation, which shows that only 58 percent of students responded affirmatively to the statement 'My classmates

behave the way my teachers want them to,' as compared to the 74 percent average across the district. In terms of SEL, Widen shows a lag behind other schools in the district as well. When answering statements centered on peer to peer and peer to adult communication and stress management, Widen consistently scores 10 percentage points lower than district averages. Lastly, with regards to community engagement, results from the 2016 Teaching and Learning Conditions staff survey show that only 62 percent of staff members believe that Widen does a good job of encouraging parent/guardian involvement as compared to the 92 percent district average.

All of these factors combined make student success in the classroom challenging, especially for children who do not respond well to traditional in-seat lessons. Some research suggests that learning through hands-on, experiential opportunities in an outdoor location where students are tasked with interacting with peers, and the natural environment would be helpful to the academic success of students in this community (McCray 2010). Moreover, research supports the fact that students who spend more time outdoors are less likely to have behavior issues or problems with attention and hyper-activity, which would also benefit the academic performance of students at Widen (Louv 2014).

Regarding the physical environment of the research site, I selected school grounds located on the northeast side of the school where a previous grant from Whole Foods enabled the construction of eight raised wooden garden beds, thus establishing an infrastructure for a garden program. Moreover, the site was optimal for gardening when considering ecological needs such as nutrient rich soil, sunlight, and proximity to water. The soil in the raised beds was previously tilled and spread with compost prior to

programming to promote healthy plant growth, and the plots receive both full and partial sunlight, which is beneficial in growing a variety of crops that require different amounts of sun. In terms of access to water, the garden beds are located close to a water spigot, which enables staff and students to water crops daily without having to transport water far distances.

In addition to considering natural needs, research indicates that some important factors resulting in green space/park use among minorities are associated with accessibility (walkability), available facilities, and safety (Sister et al. 2009). Therefore, the location of this site is advantageous to garden programming because it's easily accessible to over 550 students and their families by walking on foot or through public transit. Also, available facilities like bathrooms, playground equipment, and shaded areas are also easy to reach and open to the public. Consequently, the garden beds also reside within a well-lit fenced area to protect garden structures and visitors from vandalism and reducing criminal activity.

3. LITERATURE REVIEW

In a 2015 article in the New York Times entitled, "Why Are Our Parks So White?" Glenn Nelson explores the question that many in the National Park Service (NPS), environmental movement, and community outreach programs ask – Why don't communities of color seem to be engaged in the great outdoors? Indeed, research shows that minority attendance at national parks lags behind their Caucasian counterparts (Nelson 2015). In addition to being less inclined to visit parks, many critical scholars also indicate that minorities are less likely to participate in outdoor recreation activities, be involved in environmental activism, and enjoy benefits of outdoor green spaces in general (Finney 2014, Taylor 2016, Gibson-Wood and Wakefield 2013).

However, in order to understand the relationship between communities of color with the great outdoors, it's necessary to first comprehend the structural practices that gave birth to the US Park system, the exclusion of minority communities, and the greater implications that have resulted from such segregation with regard to minorities interacting with 'natural spaces.' This thesis investigates these issues as I draw on and contribute to three bodies of literature: 1.) the whiteness of wilderness, 2.) barriers to minority participation in nature, and 3.) a critical review of OEE and benefits and challenges to alternative outdoor programming. It is through exploring these themes that potential answers emerge as to why not only our national parks, but environmental movement is indeed 'so white,' as I illuminate the relationship between place, race, and ideology.

The Whiteness of Wilderness, Past Through Present

Drawing on political ecology literature, this section demonstrates how 'wilderness' as a concept was largely informed by Eurocentric and American post-frontier ideologies of the 1800s. This idea of wilderness promoted the experiences and ideals of white, upper-class men discovering pristine, natural landscapes devoid of human contact, thus constructing the framework for what I call the "whiteness of wilderness." In this piece, I will first examine how Romantic and Transcendental philosophy contributed to the idea of a white wilderness, and then I'll further explore how the social construction of white peoples' wilderness is evident in visual images from the past to the present. Lastly, I'll discuss how this whitewashing of the natural landscape has led to minority exclusion in the great outdoors and has far reaching consequences for how minorities interact with nature.

Romanticism and Transcendentalism took root in the American imagination throughout the 19th century and forever transformed the way society would view natural places. Romanticism brought an enthusiasm for open, isolated, and uncultivated spaces to American society, as proponents of this ideology celebrated a perceived 'divine beauty' found in large tracts of remote wilderness throughout North America (Nash 1982, Taylor 2016). Romantics even began to argue that wilderness was an American asset whose landscapes, mountains, and bodies of water rivaled the grandeur of Europe's cathedrals and castles (Nash, 1982). Transcendentalists like Henry David Thoreau and Ralph Waldo Emerson believed that in addition to beauty, there was also a spiritual connection between God, nature, and humans. For Transcendentalists, nature was a place where

divinity could be felt most strongly, where one could find a higher spiritual truth (Bode 1947, Harding 1992, Nash 1982)

Both of these philosophies grew in popularity amongst white, wealthy, educated Europeans and Americans in the mid 1800s who were surrounded by cities, conveniences, and material resources (Nash 1982). The attitudes, beliefs, and values of blacks, native people, and poor whites are conspicuously absent from these ideologies and as a result, historical representations about what the wilderness is (God's new Eden on Earth) are decidedly one sided, from a privileged perspective (Taylor 2016).

Discourse demonstrating the whiteness of wilderness has been characterized by visual representations, which can be seen in the work of conservation photographers throughout the 19th century. Martin A. Berger's work opens with questions surrounding the interplay between whiteness and wilderness in photographs taken by the esteemed conservation photographer, Carleton Watkins in the Yosemite Valley throughout the late 1800s. Analyzing Watkins' technical composition and selection of natural features in these photos, Berger asserts that images were created for consumption by wealthy European-Americans due to the fact that they were primarily composed of physical land formations deemed to be the 'biggest' or 'best' mountains and waterfalls that were reminiscent of European architecture (e.g. *The Yosemite Valley from the Best General View*, *Cathedral Rock*, etc.).

Moreover, the sale of these photos in gift shops around Yosemite to an exclusively elite, urbanite patronage further reinforces the notion that nature is something that can be commoditized and purchased by a white, wealthy consumer. Missing from Watkins's visual depictions of Yosemite National Park is any evidence that indigenous

people once inhabited the landscape, or that the park could be viewed through a gaze that didn't define the region through its large rock formations or cascading waterfalls, which benefitted European-American economic, political, and cultural interests (Berger, 2003). White representations of wilderness erase Native Americans from the landscape by not only disregarding their salient landmarks and features, but also by omitting the people themselves who originally inhabited these regions. Moreover, the practice of changing Native place-names in parks to European names further contributed to the erasure of American Indians as all evidence of their inhabitation was eliminated. The deletion of the U.S.'s Native population from photos continued to reinforce white hegemony in the sphere of the great outdoors (Taylor 2016).

Strengthening Berger's argument that photographic images of wilderness in the mid to late 1800s were racialized is Kevin DeLuca and Anne Demo's article detailing the construction of wilderness, which echoes many of the same themes. Here, the authors also examine the photography of Watkins to determine how historical wilderness photography has promulgated the idea of a raced and classed version of nature. DeLuca and Demo explore how Watkins's usage of perspective, composition, and subject material in his photographs of the Yosemite Valley demonstrated how Eurocentric ideology placed humans separate from their environment, essentially constructing a false idea of wilderness. In Watkins photographing only landscape features such as mountains, rivers, streams, and forests, he neglected to incorporate any other signs of wildlife or human activity that would show human's involvement or relationship to nature. Watkins's photographic composition reinforces the Romantic rhetoric of the time period that nature is a sublime space where no human habitation has or ever will occur, thus

establishing the concept of a 'pristine wilderness,' a place where a privileged White populace travels to experience the wonders and fruits of a natural setting (DeLuca & Demo, 2001).

This idea of a white wilderness is problematic for a multitude of reasons, the first being that White people were of course, not the first inhabitants in the Americas. Indigenous populations were forcibly removed from places like Yosemite National Park, El Capitan included, and banished to reservations (Finney 2014, Cronon, 1995, Berger, 2003). Furthermore, Cronon argues that,

> The myth of the wilderness as 'virgin,' uninhabited land had always been especially cruel when seen from the perspective of the Indians who had once called that land home. Now they were forced to move elsewhere, with the result that tourists could safely enjoy the illusion that they were seeing their nation in its pristine, original state, in the new morning of God's own creation (Cronon, 1995, p.15).

Certainly, from their onset, national parks have had a history rooted in racism, exclusion, and invention where White interests were placed over a racialized "other," thus leaving a legacy that can't be ignored. The United States national parks were originally created as White places, and therefore it's no small wonder that the public perception remains that they continue to be so (Floyd, 1999).

Visual images depicting pristine wilderness are also explored by Rod Giblett and Julia Tolonen through visual analysis of prolific conservation photographers. In their work, the authors examine the historic wilderness photography of not only Watkins, but also Ansel Adams and Timothy O'Sullivan, to examine how they reproduced ideas of unadulterated natural spaces. The authors further expound upon the role of Adams and his influence in shaping the current environmental movement. By Adams exclusively photographing classic landscapes steeped in Romantic ideals of nature, he overlooked more familiar representations of people and place, defining environmentalism and

conservation as being concerned only with sublime sites of wilderness rather than encompassing a broader definition of protecting everyday natural places closely linked to people's homes (Giblett & Tolonen, 2012).

Adam's and Watkins's historic visual influence in environmentalism is relevant to how minorities currently interact with nature because most communities of color reside in urban areas and have restricted access to national public parks in terms of financial resources, transportation, and time (Finney 2012). If the pervasive ideology surrounding environmental/conservation movements is that the only forms of 'nature' that matter are the large, dramatic landscapes of Wilderness that Adams and others made popular years ago, communities of color are unlikely to see themselves as being welcome or able to play a part in the environmental conservation of today. This perception leads to the exclusion of minorities from parks because nature is conceived of as something found outside of cities in faraway, inaccessible locations, rather than something you might regularly encounter in a backyard, school, or local area. Environmental historian William Cronon, explains that in creating an idyllic distant wilderness that is separate from our human activities, we do not promote responsible stewardship, nor a 'balanced relationship' with nature. He advocates instead for a 'middle ground,' which calls for sustainable land use practices in the natural places closest to our homes, thus enabling practical, small acts of environmentalism that can be performed by people regardless of income, gender, or race. It is only in dismantling categories like 'nature' vs. 'culture' that a more complete understanding of the environment, one that encompasses human imagination, livelihood, and interaction can be conceived (Cronon, 1995, p. 21).

Other visual representations of white wilderness persist to this day in environmental imagery in national magazines in the United States. In her book *Black Faces White Spaces: Reimagining the Relationship of African Americans to the Great Outdoors,* Carolyn Finney analyzed images in the publication *Outside* magazine, an outdoor leisure and recreation magazine 'dedicated to covering the people, sports, and activities, politics, art, literature, and hardware of the outdoors' (Finney 2014). Finney found that the idea of a 'White outdoor leisure/recreation identity was pervasive, as results of the image analysis revealed that out of 4,602 photos depicting people, only 103 showed African Americans, most of whom were male sports figures in advertisements (Finney 2014). Moreover, Finney also found that the National Park Service was complicit in constructing the idea of a racialized outdoor leisure identity through their brochures of three national parks in Florida. From 1991-2001 all the photos featured in informational brochures showed white people partaking in outdoor recreation activities, without any people of color represented (2014).

The idea that a racialized, white outdoor/leisure identity is perpetuated by one of the most prominent outdoor recreation magazines and the National Park Service further situates the outdoors as a domain for white people, thus implicitly propagating the notion that communities of color are excluded from not only participating in outdoor recreation activities, but prohibited from doing so in the same spaces as white folks, which reinforces the idea of racial segregation in environmental activities.

Other scholars have analyzed the visual representations of whiteness in the outdoors through magazine advertisements. In other scholarly articles exploring the environment and matters of race, author D.C. Martin performs a content analysis of over

4000 advertisements from three magazines, *Time, Outside, and Ebony* which were published between 1984-2000. The results concluded that black models and other models of color were rarely represented and when they were, it was in an urban or suburban setting, leaving their white counterparts to hold "ownership" of wilderness spaces.

The implications of minorities being relegated to urban spaces in the images of national publications and the endorsement of a white wilderness identity have far-reaching consequences as to how African Americans and Hispanics view their role in wilderness recreation, environmental involvement, and participating in nature. It's evident that the propagation of a white outdoorsman identity sends minorities the message that there is a racialized way to know and experience nature, and they do not qualify. The literature supports the idea that for one to enjoy the outdoors, you must be white, privileged, preferably male, and able bodied thus excluding those that do not fit this description. This makes people of color (as well as women and those with disabilities) far less inclined to visit national parks and less likely to engage in outdoor recreation activities such as climbing, hiking, rafting, and so on. Ultimately, white wilderness is so pernicious in nature because of its continued reinforcement of the segregation of space and unequal distribution of land, thus perpetuating racism and white colonial interests. Due to this ideology, I make the case for establishing an urban school garden for my thesis project rather than using a site located in a national park or wilderness preserve. In order to combat historic injustices of environmental exclusion, my research strives to use accessible land situated in the heart of human activity, where children of color have open easy access to a natural area.

Barriers to Minority Participation in Nature

In this next section I examine how historic practices of land dispossession and segregation in the U.S. continue to influence minority use and nonuse of parks, and also affect minority participation/exclusion in environmental activism. I'll conclude by exploring alternative approaches of knowing and interacting with the environment that communities of color have established to promote a conservation ethic. These alternative ways of connecting with the environment reflect informal knowledge passed on generationally, community storytelling, and inventing a broader definition of the environment.

Empirical research shows that there is a gaping disparity between communities of color and Anglo-Americans' usage, participation, and inclusion in outdoor areas (Finney, 2012). While studies conducted by Berger, Byrne, and Santucci et al. have shown that some factors such as income and education play a role in minorities lack of participation, other scholars such as Patrick West, Dorceta Taylor, and Carolyn Finney point to more 'subcultural values' like discrimination, slavery, and xenophobia which have been infused into institutional, systemic practices that precludes non-dominant cultural groups like African Americans and Hispanics from outdoor recreation opportunities and roles in the environmental movement (Taylor, 1989).

Carolyn Finney continues by elucidating the fact that a series of systemic exclusionary practices in U.S history has shaped how racial identity has influenced the making of places and defined human's interaction with space, place, and nature. Finney and Kosek state that government sanctioned minority disenfranchisement started with the institution of slavery where Africans were classified as mere pieces of property, forced to

work a White master's land for free. Moving along the historical timeline, oppression continued with the Indian Removal Act of 1830, which sanctioned the removal of thousands of Cherokee Indians from their homes and lands in Georgia to be relocated in reservations in Oklahoma (Finney 2014). Yet another historic injustice was Hispano's 'systemic dispossession' of land in the 1848 Treaty of Guadalupe Hidalgo, which further supports the claim that the U.S. has a long ugly history of prohibiting certain racial ethnic groups from occupying, owning, and enjoying land (Cervantes 2003, Kosek 2006).

Another piece of literature that analyzes park use and minority participation is Jason Byrne's work researching cultural politics and social exclusion in an urban national park. In his publication, Byrne explores how segregated urban parks in the age of Jim Crow continues to affect and influence minority perceptions of who space belongs to and who is permitted to use such space. After interviewing Latino focus groups in Los Angeles, Byrne reaches the conclusion that (non)use of parks by Hispanic populations is largely due to Hispanics spatial perceptions of the parks as being 'gringo' areas, essentially 'White, wealthy, and xenophobic' (Brynes 2012).

Brynes suggests that if we are to make access to parks and natural spaces more equitable, socio-spatial details like Spanish signage needs to be available, park staff should be more diverse, and after-school community outreach programs geared toward underprivileged minority communities should be implemented (2012). Byrnes highlights how the systemic racialization of places further emphasizes the belief that outdoor 'natural' spaces have been set aside for white people and multiple factors ranging from language, to representation, to fear of discrimination all contribute as barriers to Latino involvement in the "great outdoors."

Outdoor recreation and participation in activities in nature are so closely linked with environmentalism due to the cultivation of an appreciation for both physical landscapes and the wildlife that reside there (Nash 1982, Louv 2008). Indeed, research supports the idea that adult concern for the environment is directly connected to engaging in 'wild nature activities' like hiking, fishing, nature play, etc. as children (Louv 2008). Therefore, in order to foster a conservation ethic in an adult, one must develop it as a child through outdoor exploration and enjoyment of natural surroundings.

However, as we discuss environmentalism and white privilege in Hilary Gibson-Wood and Sarah Wakefield's (2013) article, we find that there are multiple "mechanisms of exclusion" at play in limiting Hispanic participation in environmental activism in Toronto. The authors state that a number of variables contribute to this phenomenon: 1) Economic marginalization experienced by the Hispanic population, which requires them to be more concerned with urgent financial needs (e.g. supporting their families); 2) Raced and classed ideas of what environmental 'participation' should look like; 3) The separation of environmental issues from social issues in the prevailing environmental narrative; 4) A narrow definition of what environmentalism is as presented by primarily white, wealthy parties of interest.

Supported in the idea of Gibson-Woods and Wakefield (2013), is the concept that informal knowledge in the Hispanic community doesn't 'count' toward contributing within the environmental sphere. Correspondingly, environmental issues were often presented in a very Eurocentric, 'scientific,' 'technical,' or 'intellectual' way that made them unapproachable and difficult to understand by many minority or immigrant communities. As explained by one Hispanic interviewee,

> I don't see a lot of inclusion coming from you know, well-established environmental groups. I don't see a lot of diversity, I don't see how they celebrate the diversity that we have here in Canada by including other forms of caring for the planet that come from immigrants: an analogy would be the Eurocentric model of medicine, and then you have natural medicine… the same way environmental programs are designed in a very Eurocentric, technological [way]… (David).

The exclusion of alternate ways of knowing and caring for the environment also corresponded to participants' beliefs that there was a profound lack of diversity within the more mainstream organizations and further prohibited Latino involvement in environmental organizations (Gibson-Wood and Wakefield 2012). The systematic exclusion of minority experiences and ways of knowing nature within the white outdoor/conservation community also can be viewed from a feminist theory standpoint in order to illustrate the facets of subjugated knowledge. Hill Collin's piece, Black Feminist Epistemology, openly addresses the problematic nature of exclusionary Eurocentric scientific methods of knowledge production in relation to minority communities, specifically African-American women. Collins (2000) contends that those responsible for producing and authenticating scientific thought have traditionally been white, wealthy, elite men, seeking to protect their own interests. In essence, this kind of "knowledge validation," has ignored people of color by design. Collins shows that due to the exclusion of minorities in educational institutions, African-American women have developed alternative epistemologies built upon lived experiences, dialogue, and empathy to justify how they know what they know. These themes are echoed in other minority groups accounts of how they interact, interpret, and ultimately conserve the natural world around them (2000).

Collin's theory on subjected knowledge in the world of African-American women relates directly to Gibson-Woods article regarding Hispanic participation in

environmental movements because of the shared experience of exclusion in environmental conservation efforts by both minority communities through Eurocentric scientific thinking. While further scholarship will be examined in this review to explore the unique character of how Hispanic epistemologies of environmentalism/conservation take form, it is apparent that mainstream white, wealthy ideas about how people interact with the environment continue to overpower the narrative within the movement, thus hindering efforts to reach a more diverse audience.

Using Latino Critical Race Theory (LatCrit) C. Anguiano et al. (2012) sheds light on the racial divide between a conventional, white environmental movement and the role of Hispanics in New Mexico and the ways in which they negotiate their own distinctive relationship with nature and how it pertains to environmental justice agendas. The authors argue that Hispanics' engagement with nature draws heavily on the idea of "la resolana," a communication practice rooted in Hispanic New Mexican history and oral tradition that embraces community stories and lived experience as important forms of knowledge" (Anguiano and Milstein et al. 2012, p. 136). Essentially, it is through the role of language, storytelling, and lived experiences that Hispanics in New Mexico are finding ways to construct their own environmental narratives. Moreover, the authors endorse moving environmental advocacy away from the Romanticism of wilderness that has been transmitted in the past, rejecting the notion that the natural environment and human society are mutually exclusive. Instead, they advocate for placing human concerns of employment, livelihood, and land-use at the heart of environmental problems in order to garner support of Latino communities.

Reaffirming the idea that alternative ways of knowing and being concerned for the environment are needed to make the environmental movement more inclusive is Dorceta Taylor's comprehensive 2014 report uncovering the profound lack of people of color in environmental organizations. Here, Taylor interviews employees of environmental NGOs and governmental organizations who assert that the need to expand on the idea of the 'environment' is imperative to include more diverse communities. One interviewee describes the need to redefine the notion of the environment as being so critical "especially for [minority] groups that are doing this work, but they may not call it environmentalism, they may not call it conservation, they may not call it sustainability, but they are still taking care of nature, the outdoors, [and] what's around us in meaningful ways." These groups often combine health issues, community building and economic development with ways to care for the green spaces around them (Taylor 2014). Fundamentally, this article supports previous authors' (Anguiano et al. 2012, Collins 2000, Gibson Woods and Wakefield 2013) claim that the path for greater inclusion in the environmental movement is contingent on a reimagined idea of nature and cultivating space for the ways in which urban communities may sensibly interact with their local environment, such as in an urban school garden. This revamped imaginary of nature includes both human concerns as well as environmental protection to form a new narrative of green politics that blends social justice and conservation.

Benefits and Challenges of Alternative Outdoor Programming

Before discussing the benefits and alternatives of alternative OEE, I will first engage with critiques of traditional OEE approaches that claim these traditional approaches reproduce racial inequalities. At the outset of this section I'll delve into the conventional pedagogy that has typified the field of outdoor education and the criticisms that many scholars have delivered in terms of OEE reproducing Anglo-normative values of environmental participation. I'll continue by exploring alternatives to conventional outdoor programming, ultimately leading to my thesis project of an urban school garden. As we arrive at this program, I'll investigate both the benefits and challenges inherent in school garden programming/outdoor activities that contribute to a re-imagined idea of nature.

Authors Rose and Paisley offer a critical analysis of the role of white privilege in outdoor and experiential learning programs geared toward exposing children of color to nature. Using their own personal experiences paired with critical race theory, they examine how traditional outdoor challenges such as climbing steep mountains or maneuvering wild terrain merely reproduce existing power structures of white hegemony, where a powerful actor (the instructor) requires participants (children of color) to perform. Moreover, most outdoor educational institutions neglect to address issues of adversity or trauma that underprivileged students may be facing at home, which implicitly sends the message to children that their hardships are deemed inconsequential. Above all else, Rose and Paisley seem to emphasize that increasing diversity in the great outdoors is not enough to reverse years of social injustice. They recommend that underprivileged participants have greater input towards programming and pedagogical

practices and those institutional leaders adapt or modify outdoor challenges to meet the needs of an increasingly diverse population.

These criticisms of traditional approaches to OEE have contributed to the ways in which I've developed curriculum for my thesis project of an urban school garden. Because of the recommendation that underprivileged participants should be actively involved in programming, my student participants will contribute to community norms, select their own tasks (such as watering, weeding, composting), and choose which area of the garden they'd like to complete their work. This shift of influence from instructor to participant helps empower students of color by offering choice, control and independence in their learning objectives and activities.

Further critiquing the idea of outdoor experiential education (OEE) are authors Warren, Roberts, Breunig, and Alvarez (2014) who explore the function of social justice in OEE. Here, the authors present a thorough exploration of outdoor education and social justice viewed from 'sociocultural, critical, and feminist theories.' The authors reaffirm previous sentiments (Rose and Paisley) that OEE was founded on the experiences of white, wealthy, able-bodied men, thus resulting in the marginalization of poor folks, women, and people of color in the outdoor arena. Additionally, the authors emphasize that communities of color have a particularly complicated relationship to the outdoors, due to a history of violence against them playing out over the landscape. To sum up, the authors state that although some outdoor institutions have made strides to incorporate greater ethnic diversity of participants and leaders, little thought has been devoted to changing structural practices of OEE, like implementing more relevant curriculum, changing group activities, and altering wilderness-based experiences.

Due to this key assessment of OEE, my school garden program seeks to shift the paradigm of traditional activities and wilderness experiences to more relevant programming for urban youth. Namely, through learning and laboring in their school garden, youth discover the ecosystem of their immediate environment, rather than a distant people-less wilderness. I argue that it is through planting, maintaining, and harvesting crops in a local environment that students are best able to foster a connection with nature. Studying and caring for local green spaces makes nature more relevant because students can directly observe organisms in their habitats, life cycles of wildlife, and the conservation of natural resources through hands on activities and daily tasks. Moreover, by placing the human concern of gardening at the base of educational programming, I shift the conversation away from preserving pristine plots of land--which urban youth have little contact with-- to sustainably interacting with neighborhood flora and fauna.

Touching on both the topic of structural changes in outdoor programming and greater diversity in environmental institutions is Santucci's et al. (2014) piece describing NPS strategies to encourage ethnic diversity at urban parks. In this article the authors interview National Park Service (NPS) employees to ascertain staff perceptions on NPS initiatives of racial and ethnic inclusion. Results found that three primary themes emerged, the first being a necessity for 'youth engagement beyond threshold experiences,' which described the need for the NPS to engage in deep outdoor experiential programs with minority youth, which features "in-depth, hands-on learning and a continuing pathway for deepening park-community relationships" (Stanfield et al. 2011). Secondly, a reworking of 'NPS traditional and organizational culture,' where

programming is made more relevant to communities of color, especially in reference to offering bilingual services to limited-English proficient populations. Lastly, the theme of 'talking the talk' materialized after interviewing participants identified the issue of lacking communication, funding, and operational tools to actually implement policies of greater inclusion within the national park system (Santucci et al. 2014).

These findings confirm the notion that minority inclusion in the NPS remains to be a struggle, however the recommendations of long-term projects and relevant programming have been critical in how I've chosen to structure my urban school garden project. For example, the importance of participants to engage in comprehensive in-depth programming lead me to set the curriculum for nine consecutive weeks of nature exposure instead of a one-time field trip or weekend program. Additionally, all my curriculum, recruitment materials, and instruction will be offered in both Spanish and English in order to make activities and learning accessible to Latino students and their families. I contend that through embracing participant involvement, implementing relevant programming, and adopting bilingual curriculum, my urban school garden program will be more inclusive to communities of color than traditional outdoor educational programming

In addition to making nature seem more approachable to minorities, recent studies reveal that much has been directly observed with regards to the advantages of school urban agricultural programs like 1.) increased community building initiatives, 2.) enhanced science education, and 3.) promotion of health outcomes (Bodel and Anda 1996; Kurtz 2001; Mundel and Chapman, 2010; Beilin and Hunter, 2011; Turner 2011). In terms of increased community, scholars have noted that school gardens provide

students with a kind of tactile urban ecology that fosters opportunities to develop trusting relationships with classmates, teachers, plants and animals (Moore et al. 2015). What's more is that school gardens may also offer opportunities for "thinking relationality," or the idea that by forming strong connections to those plants, animals, and people around us, we may cultivate a sense of ethics that don't merely reproduce neoliberal 'capitalist logics' (Haraway 2008).

Authors Wells and Evans (2003), explore the benefits of access to nature in relation to anti-anxiety measures, stress management, and positive self-image in their article exploring nature's impacts on stress levels in rural children. Here, their findings support the idea that children who have greater access to nature are less likely to suffer from behavioral conduct disorders, depression, and anxiety. They found that young people who had more nature close to their homes even rated themselves higher than peers in terms of assessments measuring self-worth. I find this area of research particularly relevant to my research study, as the population that I'm working with has high rates of trauma, abuse, and underlying issues surrounding anxiety and depression. Empirical research centered on interviews and participant observation will be essential in determining if the school garden has any impact on psychological issues or mental health.

More analysis in how urban gardens promote health outcomes in children reveal that researchers have found school gardens increase children's willingness to taste new fruits and vegetables and lower their preferences for unhealthy food (Turner et al. 2016). These findings are reinforced by a new Cornell study that reveals children were over four times more likely to consume produce if it was grown in school gardens on campus.

The pilot study measured vegetable selection and food waste when fresh greens grown by students were introduced into cafeteria salads. The data shows that salad consumption increased among students from 2 percent to 10 percent, however an increase in plate waste also increased (Wansink 2016)

Other positive outcomes linked to outdoor green spaces can be found in work emerging from the Human-Environment Research Laboratory at the University of Illinois. Authors Kuo and Taylor found that "outdoor green spaces foster creative play, improve children's access to positive adult interaction, and relieve the symptoms of attention-deficit disorders." Their findings conclude that greenery in a child's everyday environment specifically alleviates hyperactive behavior and ameliorates attention deficit symptoms. Additional studies documenting gains centered around outdoor programming for children with disabilities can be found in Ewert and McAvoy's article that explores the effects of wilderness immersion amongst children. These authors discovered that students who participated in outdoor summer camp programs with specialized curriculum for children with disabilities showed better initiative in performing tasks and a stronger sense of self direction that carried over into their lives at school and at home (1987).

Yet more authors exploring the growing movement of educating youth outdoors are Habib and Doherty with their Seeds of Solidarity research program (2007). In this study, third and fourth graders participated in outdoor garden programming as researchers measured their "affective experiences, food choice selection, and transfer of garden knowledge to other areas of their lives." Habib and Doherty's findings support the idea that students described the school gardens as both a happy, calm, safe place and fostered

an emotional connection to the natural world, thus reinforcing claims from other scholars (Wells and Evans) that school gardens promote overall well-being and can reduce stress in children. Other notable results were that the majority of students shared what they had learned in the school garden program with others, and that the garden served as a catalyst to student inquiry, reinforcing science concepts and providing opportunities for curriculum integration.

Further expanding on enhanced science education, other studies concluded that students who participated in hands-on-learning activities associated with school garden-based curriculum outperformed their peers on achievement tests in science. In Klemmer's et al. 2013 article, the authors focused on assessing academic achievement in the field of science for students in third, fourth, and fifth, grade in Temple, Texas. For this study, students were separated into an experimental group that received outdoor science instruction in a school garden and a control group that were taught science curriculum through traditional methods. As the study closed, results concluded that students in the experimental group performed statistically significantly better on state issued standardized tests in science (STAAR), thus reaffirming the notion that active outdoor learning in gardens bolsters student academic achievement in science.

Moreover, in addition to improving student test scores, time spent outdoors during childhood may have even farther-reaching implications, as multiple studies have shown that positive childhood experiences in nature is one of the primary influential factors that leads to environmental stewardship. In a 2006 study by Cornell researchers Nancy Wells and Kristi Lekies, the authors found that adult concern for, and behavior related to caring for the environment is directly derived from partaking in nature activities like

hiking, fishing, hunting, and playing independently in the woods prior to the age of eleven. These results support the idea that the benefits of youth involvement in the great outdoors extend even farther than that of test scores and individual health outcomes. Indeed, I argue that one of the most important benefits of youth outdoor programming is that it could favorably affect issues such as environmental conservation, land use, and climate change through a future political constituency deeply rooted to nature.

While the literature supports the claim that benefits derived from school gardens and outdoor programing are numerous, there is a lack of empirical research done to assess which components of school gardens (e.g. planting, harvesting, science lessons, etc.) are most important in achieving specific desired student outcomes in both personal and educational spheres (Duncan and Collins et al., 2016). Other challenges that characterize the implementation of school gardens center on lack of funding, personnel, and time, with authors recommending the development of a 'broad base of support' between teachers, administrators, and parents to successfully sustain a school garden project (Ozer, 2007). These recommendations have been particularly helpful in shaping my own study by a.) informing my research of potential implementation challenges, and b.) identifying gaps within the knowledge of the literature. In keeping the challenges of project implementation in mind, it would be advantageous for my project to develop partnerships with teachers, administrators, and members of the greater community at Widen in order to best maximize potential funding opportunities and available personnel for garden maintenance. In terms of addressing limitations within the literature, I found it beneficial to focus my research on generating empirical data based on interviews,

student test scores, and participant observation to analyze student outcomes in the fields of STEM, health and nutrition, and SEL.

Conclusion

In essence, the enhancement of minority involvement in nature is an increasingly critical issue that many stakeholders within educational institutions, environmental organizations, and state and national park systems have researched and are actively seeking solutions. The literature reviewed shows that in order to increase minority awareness, participation, and inclusion in parks and the environmental community, a re-imagining of nature through visual images, systemic practices, and outdoor educational programming is an imperative. The notion that the great outdoors is limited to the sphere of 'wilderness' and national parks is not only problematic due to racist undertones in the creation of those landscapes, but also as its demarcation as a segregated space where underprivileged urban populations have little access to quality facilities in terms of transportation, culture, and inclusion (Byrne 2009, Finney 2014, Sister et al. 2009). The research calls for a new idea of the environment to be constructed and disseminated to the public that both reflects human involvement with natural resources, and also incorporates common outdoor green spaces such as yards, local parks, and school grounds (Anguiano et al. 2012, Cronon 1995, Gibson-Wood and Wakefield 2013, Sister et al. 2009). Moreover, research exploring the benefits of school gardens and outdoor programming taking place in local spaces support the concept that hands-on active outdoor learning promotes positive health outcomes in children and lowers stress, leads to improved self-

image, encourages environmental stewardship, and can improve science test scores (Wells and Evans 2003, Klemmer et al. 2013, Habib and Doherty 2007, Ozer 2007).

This review of literature has greatly informed my current research of designing, implementing, and evaluating an urban school garden. In terms of design, rather than creating an outdoor program at a distant park, I've selected a plot of land connected to a low-income majority Hispanic school in southeast Austin to create a school garden program. The garden is immediately accessible to over 500 students and their families, thus reaffirming that nature need not only exist in distant parks, it is also in the places closest to our homes and schools (Cronon 1995). With regards to implementation, my selection of 20 bilingual students and Spanish language instruction is intended to address the need for a re-envisioning of outdoor education, where programming is made more relevant to communities of color by offering bilingual services to a diverse audience (Santucci et al. 2014). Moreover, by continuing the curriculum for the duration of nine weeks, my program gives students the opportunity to develop in-depth learning opportunities that better foster relationships with the outdoors, rather than merely a one stop program or field trip (Stanfield et al. 2011). Lastly, the review of literature has helped inform the way I've evaluated the urban school garden program. Instead of focusing exclusively on student test scores to measure specific scientific concepts the students have mastered, I also administered interviews. These interviews were crucial in understanding minority beliefs, attitudes, and perceptions with regards to the lived experiences of my participants outdoors (Collins 2000). Ideally, this program could be replicated to continue to introduce children of color and their families to the outdoors though long-term, intensive, community led efforts. The fact remains, in a world divided

now more than ever, we need to explore ways in which stewardship of the environment and equal distribution of environmental benefits extends to all members of our body politic.

4. RESEARCH METHODS

This study uses a critical geographical, post-positivist approach to understanding Latino participation in outdoor nature programming within a school setting. Utilizing Cronon's "middle ground" theoretical framework, it promotes environmentalism through sustainable land practices in the outdoor areas closest to our homes. Finally, this research uses ethnography as the principal methodology to design, implement, and evaluate the effects of a school garden at Widen Elementary.

Design

Curriculum

Curriculum design for the project was developed to embed core components of Texas Knowledge and Skills (TEKS) of three main content areas: a) SEL, b) Scientific Inquiry, and c) Health and Nutrition. Using the district resource of Curriculum Road Maps (CRMs) for science, and health developed by AISD, during the 2017 summer term I designed a nine-week program providing students with hands-on experiential learning through the cultivation, maintenance, and harvesting of a school garden with the goal of promoting student interest in the outdoors. Each lesson was forty-five minutes and was organized into six sections: materials needed, vocabulary, activity, evaluation, closing, and anchors. Lesson plans featured fourth grade level science TEKS centered on life science concepts such as observing organisms and their habitats, collecting and recording data, and describing the flow of energy through a food web. These lessons were taught in

both Spanish and English to accommodate English Language Learners (ELLs) and to foster cognitive academic language proficiency (CALP) in Spanish and English.

Recruitment

On 6 September 2017, I began recruitment for the school garden program. Because of my research goal of ascertaining STEM, nutrition, and health outcomes in Latino students, I recruited from only bilingual classrooms. The school district (AISD) requested that I draw from fourth grade classes because of testing concerns in fifth grade. To recruit these students, I gave a five-minute presentation in Spanish to two fourth grade classrooms explaining the garden program and distributed a parent consent form and a student consent form in both Spanish and English. I also circulated a flier written in Spanish explaining program specifics. My objective was to recruit fifteen to twenty fourth grade bilingual students at Widen that would participate in the program to plant and harvest a school garden. These selected students were scheduled to work outside once a week for forty-five minutes during their allotted science time in the garden and would engage in planting, maintaining, and harvesting fresh produce. By 15 September 2017 I had recruited twenty fourth grade bilingual students. There were thirteen boys, seven girls, and four students in Special Education (two with intellectual disabilities and two with autism). Throughout the course of the program, two students (two boys) relocated to different schools and dropped out of the program.

Pre-Program Activities

Previous grants obtained by the school through the Whole Foods Foundation resulted in the initial infrastructure of a garden on school grounds through the purchase of garden tools (shovels, rakes, wheelbarrow, etc.,), the construction of eight raised garden boxes placed in the school courtyard, and initial planting of several crops (i.e. arugula, cilantro, parsley, fennel, and carrots). Prior to programming in early September, I organized a school garden work day where staff and members of the community came to clear debris, till soil, and weed and maintain existing garden plots. We arranged tree stumps as seats around a wooden table and organized gardening/science tools to form an outdoor classroom and I painted a fresh coat of paint on stumps and gathering table. Additional materials were purchased for planting, pest management, and garden maintenance.

IRB Management

In June of 2017 I applied for IRB review of my project. I submitted the application detailing research design, duration, and evaluation measures. In addition to these components I also provided a recruitment script in both Spanish and English, parent and student consent forms in both languages, and the scope and sequence of lesson plans. I then corresponded with the IRB Regulatory Manager at Texas State for the next two months to make the revisions that she recommended. Modified items included simplifying language, explaining potential risks in greater detail, and including a photo release. By August 2017, the IRB committee determined that my research procedures

were consistent with a comprehensive research design and did not expose my subjects to unnecessary risk. The project was approved at the Exempt Review level, enabling me to move forward with research.

Implementation

Using interviews, focus groups, and participant observation I hypothesized that community gardens would help students acquire scientific knowledge in biology and land management, improve their knowledge of food systems, and produce measurable increases in their social and emotional learning. Beyond these gains, I anticipated finding that community gardens would also increase children's attention spans and foster a sense of community and school pride. To test these arguments, I implemented garden programming over the course of nine weeks from 19 September 2017 to 15 November 2017. Students came from two different fourth grade bilingual classes and I made arrangements with their classroom teacher to pull them during their science time. One group of ten students was pulled in the afternoon on Tuesdays (Group A) and the second group of eight students (Group B) was pulled Wednesday mornings. For the first lesson, I emphasized rules and behavior expectations as we created a community contract and made a visual anchor to post rules. Students were also trained in how to use garden tools and equipment as they began planting. I organized planting in eight different raised garden beds per sunlight needs for each crop and assigned a number for each plot. We planted arugula, radishes, lettuce, cabbage, and fall/winter flowers in raised beds one through five because those beds receive more shade throughout the day. We planted

carrots, basil, spinach, and Swiss chard in sunnier plots where more daylight was available. Each subsequent week for the next nine weeks I taught a new lesson involving STEM content, or health and nutrition concepts as we weeded, watered, and maintained the garden. By lesson four, I had divided students into groups of three and four to work collaboratively together to accomplish various garden tasks to emphasize SEL. Our most common chores were watering, weeding, and debris removal (leaves and sticks). Each team rotated duties with every lesson until all groups had cycled through each task. Crops began sprouting by week two and were ready for harvest by mid-November. My curriculum culminated in a Harvest Festival event where students learned how to harvest, clean, and prepare the vegetables they grew for our salad.

Evaluation

As a participant observer I created detailed field notes after each outdoor garden session to reflect on student performance in relation to the learning objectives in the fields of a) SEL, b) Scientific Inquiry, and c) Health and Nutrition. These field notes have been integral to ascertaining any unforeseen benefits or challenges to the implementation of an urban school garden program. In addition to participant observation, I administered a pre- and post-test measuring knowledge and skills in the area of STEM education. Students were pulled from their classrooms in groups of five or six to take this test, with students in Special Education being exempt from test taking and instead given a writing prompt asking what they'd like to learn throughout the school garden program (*¿De qué quisieras aprender en el jardín?).* Students taking the test were given eight multiple

choice questions and four short answer questions all written in Spanish based on fourth grade TEKS. The first test was administered 11 September 2017, prior to participating in garden programming and the second test was administered the week of 27 November 2017 after students had completed all garden programming. All test questions were the same, with no changes being made to length or structure of the exam. The test was scored as follows: multiple choice questions were worth two points apiece, and short answer questions were worth four points apiece for a total of thirty-four points. A rubric detailing test scoring can be viewed below.

Full credit (4 points)	Student shows in depth knowledge of science/health content and has provided detailed examples or diagrams in response
Partial credit (3 points)	Student shows good knowledge and understanding of science/health content and has provided detailed example or diagram in response
Partial credit (2 points)	Student shows partial knowledge and understanding of science/health content and has provided some form of written evidence
Partial credit (1 point)	Students shows limited knowledge and understanding of science/health content
No credit	Student did not attempt to answer, or answer does not relate to prompt

Figure 2. Student scoring rubric

The average student pre-test score was 37.25 percent, reflecting a very limited understanding in grade level science content, and the post-test score was 51.5 percent demonstrating a 14.25 percentage point increase. Areas where students showed the greatest gains in terms of multiple choice questions were inquiries about plant needs for photosynthesis and identifying natural and man-made resources. Essay questions that reflected much growth were centered on appropriate disposal of food items and recyclables as well as explaining how bees benefitted flowers. Components that suggested student confusion and a lack of knowledge were multiple choice questions examining the oxygen-carbon dioxide cycle and essay questions about the food web, as few students answered those questions correctly.

In addition to tests, I also conducted individual interviews with student participants and their teacher, as well as a student focus group to gauge learning outcomes. Key indicators that I looked for to demonstrate growth in the areas of a) SEL were witnessed by teachers or the researcher as the student(s) demonstrating an increased ability to monitor their emotions, de-escalate conflict, and cooperate with peers, respect themselves, others, and the environment. Growth indicators for b.) scientific inquiry were an increased verbal or written understanding of natural systems like life cycles, natural resources, and ecosystems either through teacher or researcher observation. Lastly, evidence that indicated student progress in the area of c.) Health and nutrition were a greater willingness to eat fresh produce and improved knowledge about food nutritional content, which could be ascertained through participant observation, focus groups, or interviews. I began interviews 8 November 2017 and concluded 11 December 2017. Each interview I administered lasted between fifteen to thirty-five minutes and I pulled the

student individually from the classroom and interviewed them in the garden, or my work area in the hallway. I asked students at the beginning of each interview if they'd prefer to speak in Spanish or English or both and most responded to both. Each interview was semi-structured with questions ranging from why they wanted to participate in the garden program to how they felt outside or what they were learning about nature. Student interviews suggested that the most significant impacts the program had on participants were in cultivating an interest and concern for plants and animals, as well as fostering collaborative learning.

My focus group was comprised of five boys and our discussion took place outside in the garden. Students were asked questions related to likes and dislikes in garden, what their favorite garden jobs were, and if they felt different in any way. The advantage to the focus group was that students were more eager to participate and could engage in dialogue with one another. The disadvantage is that students often talked over each other or interrupted, and I had to mediate frequently to ensure equal participation from all.

Participatory Mapping

Using paper, pencils, and crayons students were also asked to draw a map of the garden from memory either after their test or at the end of their one-on-one interview. I was interested in seeing their representations of the natural and built environment and which features they remembered from the garden site. Students were also asked to label each component of the mental maps and were given up to thirty minutes to complete the task. Students drew the crops that we planted, tools that were used, and various aspects of

the school garden plot. Interestingly, the most common feature depicted was the table outside of the garden where we gathered before each lesson. Although nothing was grown on or around this table, it seems to be one of the most important garden aspects to students, which is reflected in the fact that 90 percent of students in Group A and 75 percent of students in Group B all drew the meeting table in some way, shape, or form.

Limitations of Proposed Methods

The limitations of these methods center on a limited population, high teacher and student mobility, and the institutional uncertainties/limitations of a low performing Title I school. First, this is a very small sample of students that would be used to measure student learning outcomes. The experiences of fifteen to twenty students would not necessarily be indicative of the greater population, nor would it produce quantitative results that would be statistically significant. Secondly, Widen Elementary has very high rates of student and teacher mobility resulting in high numbers of teacher turnover rates, and students leaving the school. This has made having a consistent group of students and teachers to interview throughout the course of nine weeks difficult, as two students left the school midway into the program, and the primary classroom teacher had little time to devote to the project. Lastly, institutional uncertainties like failing test scores and TEA intervention have created difficulties in establishing a school garden project. Garden programming was often interrupted or rescheduled due to current testing demands in a high stakes environment where students are evaluated on a weekly basis. Current middle of the year (MOY) test scores indicate that Widen will not meet AYP standards this year

in at least one index required by the state of Texas, resulting in the potential for the school to qualify as 'IR' (improvement required) once again, thus necessitating TEA intervention. A status of 'IR' exacerbates teacher turnover, intensifies emphasis on standardized test scores, and reduces enrichment opportunities outside of the classroom for students, thus decreasing teacher cooperation with the project.

Other limitations revolved around my own subjectivity and identity in relation to the project. Because of my role as a literacy specialist on campus, students identified me as a teacher and an adult in power. As I was interviewing student participants, some seemed nervous or uncomfortable being asked questions by an adult in a one-on-one setting, or they gave responses at times that they thought would please me. Other challenges centered on my research participants' oral language development in both Spanish and English. Many students had difficulty articulating in detail how they feel, think, or were affected by aspects of garden programming. A lot of participants answered in one-word incomplete responses, as is typical of children living in poverty. These incomplete responses lead to shallow insights and required me to rephrase questions multiple times to attempt to get meaningful information, which possibly made children feel uncomfortable and less likely to produce viable data.

With regards to testing, I've found that some of the students who made the most astute observations outside during programming didn't perform well on standardized tests. There seems to be a disconnect between the knowledge and skills that students gained through informal hands on learning and the way tests evaluate comprehension and mastery of these learning objectives. This leads me to think that both the measures used for this research study and standardized tests that school districts use to gauge student

knowledge and skills are often merely reproducing imperfect and partial representations of student academic achievement. A more complete evaluative process is called for to show a more thorough understanding of student success.

5. RESULTS AND OUTCOMES OF THE URBAN SCHOOL GARDEN PROGRAM

Figure 3. Image of student planting cabbage.
Photographed by the author 2017.

This research provided numerous insights into the benefits and limitations of urban gardening as a mechanism for teaching science, technology, and math skills as well as social and emotional learning. This chapter identifies how some of the most important outcomes in terms of SEL were an increased sense of well-being, self-esteem, and social integration of students with intellectual disabilities with their neuro-typical peers. Clear benefits of scientific inquiry noted in students were developing care and concern for the environment and improving test scores. Lastly, with regards to health and nutrition outcomes, this research noted an increase in students trying new vegetables, more physical activity embedded in the school day, and a continued desire to be outdoors.

The Benefits of School Gardens for Social and Emotional Learning

This investigation suggests that after participating in garden programming, students showed increased levels of well-being, better self-esteem, stronger familial bonds, and the presence of healthy peer relationships. These gains were self-reported by students, and also observed by myself and their classroom teacher. Perhaps some of the most poignant observations were that the school garden program functioned as a space where students with intellectual differences or disabilities could perform tasks alongside their peers in general education and feel capable, valued, and included.

Increased "Bienestar"

The research findings of this study confirm the notion that gardens have a positive impact on children's well-being. When interviewed about how they felt outside in the garden, nearly all participants responded that they felt "happy," "calm," or "free." One participant describes her experience in the garden like this:

> Researcher: How do you feel about nature after working in the school garden?
>
> Janet: Good. I get all dirty working outside. I feel relieved from all the stress that I have in the classroom. Because working in the garden you can forget all the stress that you have, it's just relaxing and you can just relieve your mind from it and just be yourself. You can just be yourself, and get messy, you can just be free and feel the air in your face, the rain on your head, it's so much fun especially when you're working with friends.

Janet's experience in the garden reinforces the claim from previous research that nature can reduce stress in children and lead to feelings of positivity and contentment (Louv 2014).

Figure 4. Image of smiling students planting pumpkin seeds.
Photographed by author 2017

Another example of a student who displayed feelings of contentment after working outside was Carlos. After completing the program, I asked Carlos what he'd noticed about himself after working outside in the garden.

> Carlos: I'm different
>
> Researcher: How?
>
> Carlos: Like… sometimes I got a little nervous when I go somewhere with my friends and I get depressed. At home I can feel alone.
>
> Researcher: How do you feel when you're outside?
>
> Carlos: Good, I play with my dogs and with my brother. And sometimes I play on the swings.

Researcher: How do you feel about being outside in our garden?

Carlos: Great! I don't feel alone anymore. We protect plants and some animals. And if you don't water some plants they can die.

My conversation with Carlos reveals a shift in his sense of connection with others. His statements show that at times he had felt lonely, and depressed. However, when he talks about his involvement in the garden or just being outside, he seems to notice a change in his feelings and attitude that indicates greater levels of contentment and inclusion. This discussion confirms the idea that the school garden had a positive impact on the student's well-being, which can be seen in participants self-described sentiments of being happy and feeling good when they were outdoors working in the garden.

Another example of students increased well-being in the garden was witnessed when they were working in teams and performing routine tasks such as watering, weeding, and raking. Students were often laughing, smiling, and talking with each other about things they discovered that related to scientific content that we had studied. One girl even yelled for the whole group to come when she found a worm. She excitedly picked it up and cried out, "I see a decomposer!" Other delighted discoveries involved a boy weeding and struggling to unearth the root system. When he finally pulled out the large roots he held the plant over his head and excitedly showed myself and his peers. Students joy and enthusiasm in working outside shows how the garden operated as a safe space where students were free to make discoveries, have a good time, and share their joy with the instructor and peers.

Figure 5. Image of student weeding.
Photographed by author 2017

Increased Self-esteem

What's more, is that data from this research contends that students who participated in the garden program also experienced an increased sense of self-esteem evident through growing independence and self-reported satisfaction with new knowledge and skills. At the outset of programing, students initially needed direction and instruction in how to use garden tools and equipment to complete chores and maintain the garden plots. However, as time passed throughout the program, students began to work more independently and relied on each other for help, rather than utilizing an adult. By week five, many were eager to use the key to open the water spigot by themselves, maneuver the wheelbarrow independently, and use tools without assistance. The majority

of students also reported a growing sense of accomplishment in the new knowledge and skills that they had acquired in terms of growing their own food and being able to contribute to outdoor chores and work.

Figure 6. Image of student independently using garden tools for debris removal.
Photographed by the author 2017.

Student participants' increased levels of self-esteem were also indicated by their classroom teacher. As he responded to questions regarding changes in student behavior he replied:

> I notice that mainly… I guess that a difference I see in their behavior is a sense of pride because they are the chosen ones [who participate in garden programming] and they want to be able to go out and show that they are better than the other kids. I think it's good though-- they have like a sense of ownership, a sense of responsibility, and that they can accomplish things.

Garden programming also allowed for students with learning disabilities to develop self-confidence and a sense of responsibility as they worked alongside their neuro-typical peers using the same equipment, tools, and curriculum. Four students with autism or an intellectual disability were placed in mixed groups with general education

students and each group was given a specific job to accomplish. One student in special education recounted that she felt like she made new friends when she was asked how she felt about her teammates in the garden. She cited that learning how to complete some of the jobs and tasks that her group had done were her favorite memories. This participant's account suggests that not only did she feel a sense of pride and achievement in the duties she accomplished, but also felt greater confidence amongst her peers as she made new friendships.

Figure 7. Image of special and general education students working together.
Photographed by the author in 2017.

Social inclusion of students in special education can also be seen in the way that participants divided up tasks amongst themselves so that each member was responsible for contributing. For example, each member of a group was required to use tools to plant, water, weed, or clear debris regardless of whether they were in special education or

general education. As students became more cohesive teams, they started to train each other on how best to use tools, which plants to weed out, and what materials could be composted. At times, students with an intellectual disability were even able to show their classmates in general education how to best carry the watering can, hold a shovel, or use a magnifying lens.

Previous research explored within the literature has illustrated a correlation between increased initiative and self-direction and time spent in outdoor programming amongst children with intellectual or physical disabilities (Ewert and McAvoy 1987). These observations show that the school garden had the unexpected impact of not only reinforcing those findings, but that the garden served as a site of social integration for students with intellectual differences or disabilities. In addition to being included in everyday activities, students in special education who participated in garden programming were taught how to use the same materials in a multi-sensory environment where knowledge could be shared in various modalities, rather than indoors with only paper and pencil.

Strengthening Familial Bonds

Another positive effect of garden programming was the reinforcement of familial bonds. Numerous student participants reported that they were interested in taking part in the garden program because of positive experiences in nature they had with a family member. This previous exposure served as a springboard for student interest in the outdoors and continued to foster a sense of connection to family. Throughout

programming, many students spoke about gardens a family member tended to at home or outdoor experiences they had with family members. Even more students explained in their interview that they wanted to be able to help a family member with outdoor work and that after participating in the garden program, they felt like they were more capable of helping adults outside. As explained by Michael:

> I wanted to know more things about the garden. I thought that if I got in the garden program I could help my dad. And my dad knows so much about stuff outside and now I feel like I can help him with doing chores outdoors.

Michael's quote demonstrates not only a desire to assist his father with outdoor tasks and chores, but also an increased sense of confidence in his ability to help after having participated in the program. His growing level of self-assurance and desire to help his father reinforces the notion that the school garden helped strengthen family ties and build relationships.

Creating Healthy Peer Relationships and a Sense of Community

One of the most noticeable effects of garden programming with regards to student behavior was an increased level of cooperation amongst peers. At the beginning of garden programming, student cooperation was certainly a challenge. Both groups (especially Group B) had a tendency to interrupt each other, argue, and fight over resources. By the third lesson, student behavior became so disruptive that I cut programming short and took the group inside. After reflecting, I decided to make some structural changes to programming to better foster collaborative learning and cooperation.

First, I strategically placed students into teams with peers that I thought would work well together by considering energy level, ability to cooperate, academic aptitude, and gender. I then assigned a garden duty to each team and posted all jobs on a large whiteboard at the front of the garden with names of team members. Next, I reduced the amount of science content and spent more time focused on team building and hands on activities. Lastly, I reviewed rules and behavior expectations at the beginning of each lesson. After implementing these efforts, I immediately saw improvements in student teamwork and better-quality student relationships. Student arguments decreased in frequency, students were more inclined to share tools and materials, and they were noticeably more engaged both with instruction and each other.

Figure 8. Image of students working collaboratively to do specific garden tasks. Photographed by the author 2017.

My observations noting increased levels of cooperation amongst peers were supported with student accounts of what they learned during garden programming. Nearly all students responded that they felt positive about their classmates and that they had enjoyed "making new friends," or "spending time" with their peers. One student responded in her exit interview, "Everything was really fun, but the most exciting part of

it was enjoying it with my friends." Another commented that her classmates were "so nice, they were sharing and helping me. I feel bad for those kids inside." Other common themes were that they felt that their classmates helped them in some way, or that they had helped others with various garden tasks or shared materials.

To illustrate further examples of student cooperation we can also view the participatory maps that students created of the garden. As detailed in the methods section of this thesis, students were asked to create a mental map of the garden with all the important details that they could remember and to label each part. In addition to drawing the various crops and physical features of the garden, many children drew their peers performing garden specific chores as well. Some even labeled the students by name. This finding implies that students felt that their classmates were among the most important aspect of the garden, thus reaffirming my claim that this program helped foster healthy peer relationships and cooperation.

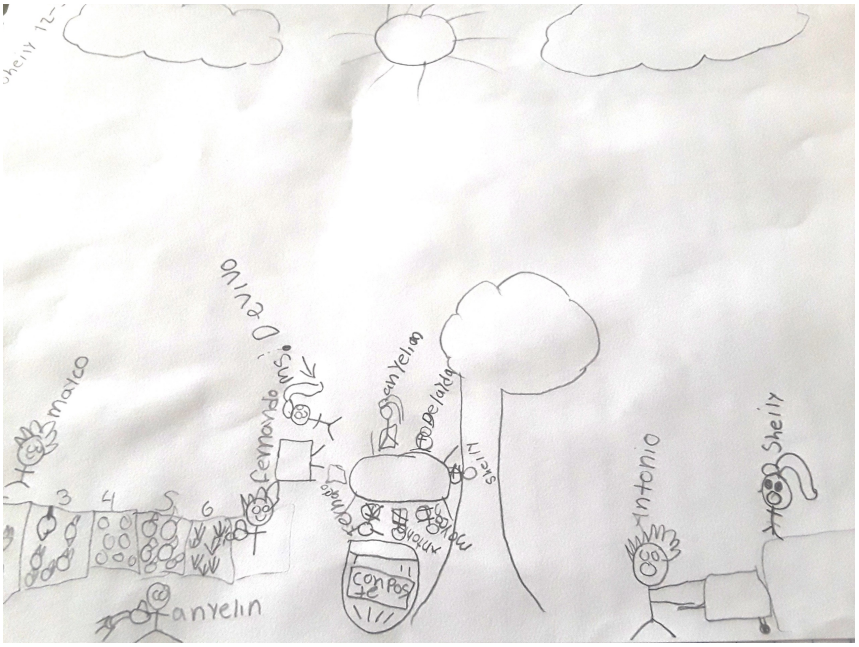


Figure 9. Mental map of garden created by student.
Photographed by the author 2018.

In addition to promoting positive peer relationships, my data also suggests that the school garden program cultivated a sense of community amongst participants. Beyond drawing themselves and peers in mental maps, virtually all students drew the table where we congregated to meet before each lesson and where we shared our ending harvest. Although nothing was grown on or around the table, it seems to be the most salient garden feature that students chose to represent. I interpret these findings as an indication that students felt a connection to our community gathering space and this man-made structure held the greatest importance to the children. Other implications of community can be seen in my field notes where I had documented poignant student quotes. On our last day of programming we harvested vegetables and prepared a meal together around the community table. Multiple children from both Group A and Group B commented that our shared meal "felt just like Thanksgiving!" as students assisted with serving food and drink and chatted amongst each other. I believe that their quotes reflect a certain sense of shared community that was possible due to their involvement with the garden program.

Figure 10. Image of students enjoying harvest festival at the end of programming.
Photographed by the author 2017.

Still more information supporting the concept that the garden was instrumental in building communities and school pride were the comments, observations, and shared participation among staff members of the school. Throughout the duration of programming as plants began to sprout and the garden area became more maintained and organized, teachers began commenting that the garden was looking "so much better" "beautiful," or "impressive." Other teachers asked if they could get involved with the garden by planting seeds and taking their classes outside to teach them how to weed, water, and care for the seedlings. Two other teachers in Pre-K began scheduling time with me so that they could bring their classes outside to plant vegetables, learn science vocabulary, and document their findings. One of the student participants even noticed the change in attitude toward school community and commented, "I feel like you stepped in and started a garden program, and I feel like the school is improving every day."

Teacher and student positive comments and involvement in the garden show that the garden was an active force that helped bring members of the school together to collaborate, cooperate, and form partnerships. This evidence supports my initial hypothesis that the school garden would be effective in helping bring members of the school together to form a more cohesive community and instill a sense of school pride.

Cultivating Care and Concern for the Environment

Cultivating a sense of care and concern amongst students for plants and wildlife has been a principal outcome of this research, what I refer to as the "care and concern effect." Nearly all student participants reported that their favorite aspect of garden programming was planting seeds, watering plants, and caring for crops that we grew in the garden. Additionally, many students had a specific favorite memory associated with a wildlife encounter that they had throughout the duration of the program. For example, one student reflected on finding a lizard in the school garden and capturing it in his hands before releasing it to the wild. Other students recalled that their favorite memories were observing a praying mantis with a magnifying lens at the beginning of class one day. One girl mentioned that seeing a dead rat by our compost pile was the most interesting thing she had seen during her time in the garden. Even more students remembered seeing an opossum in one of the trees in the garden as animal control came to remove the potentially sick animal. All of these memories contributed to participants developing an affection towards local wildlife that lead them to have an increased desire to interact and care for animals we encountered in the wild.

Figure 11. Image of student capturing lizard.
Photographed by the author 2017.

Moreover, when asked what they thought they were learning about in the garden, students overwhelming mentioned their a) increased understanding of caring for plants through watering, and b) providing adequate soil, and sufficient sunlight. The "care and concern effect" is also evident when students responded to questions like, "What did you learn about yourself?" or "How do you feel about nature?" at the end of programming. One of the repeated themes was that students expressed an ethic of concern related to environmental well-being either through wanting to help the environment, or a desire to be more protective of plants and animals. This idea is apparent in Fernando's interview:

> Researcher: How do you feel about nature after working in the garden?
>
> Fernando: Now I like all the plants and insects. One day Jared and me saw a cricket and I wanted to save it. I felt bad for him and wanted to help…. And I want to help all the birds and insects that are in danger. I want to help everything.

Fernando's statement is indicative of how nearly all (sixteen out of eighteen) participants reported feeling more motivated to treat plants and animals well, thus supporting the idea that student concern for the environment had increased due to participation in the garden program. Student interest in the environment is also evident in a conversation with Angelique when she was asked about how she felt about nature.

Researcher: Why did you want to participate in this program?

Angelique: Because it makes me feel like I'm more outside and I like nature.

Researcher: What do you think you're learning about when you're outside in the garden?

Angelique: Ummm about the plants, the decomposers, how they help the plants. And to take care of the environment.

Researcher: How would you take care of the environment?

Angelique: Like to pick up trash to make sure there's nothing that can hurt [the plants] close to them.

Figure 12. Image of student sorting plastic and trash found in garden.
Photographed by the author in 2017.

Other examples of the "care and concern effect" are present in student interviews where participants recalled a specific wildlife encounter as one of their favorite garden experiences. Many remembered an opossum trapped in a tree, one student mentioned a lizard, and others brought up specific insects they had discovered while gardening as being the most significant memories that they had. Not only did these students simply remember the animals they saw, they expressed concern over the well-being of the wildlife they encountered, by asking questions about its welfare and handling insects and small animals gently. This positive treatment of animals endorses the notion that one of the main outcomes of the garden program was instilling affection toward flora and fauna.

While it could be argued that possibly students already had an interest in wildlife prior to programming, this research indicates a marked increase in participant care and concern for the environment, as seen in student discussions, participant observation, and interviews. The students who reported a change in their thoughts, feelings, or behavior almost all explained how previously they had been uncaring at times toward the environment by either killing insects, stepping on plants, or leaving trash. Twelve participants conveyed the idea that now they were much more "gentle," "caring, or "helpful" to their local environments by leaving plants and animals in peace (*dejar en paz*) and throwing away their trash. Furthermore, specific components of curriculum were devoted to inspiring this conservation ethic through adult modeling of positive behavior and attitudes toward plants and animals. Any insects that the instructor found were always handled with care and curiosity, rather than fear or violence.

Other components to curriculum that encouraged student care and concern for the environment were the rules we established at the outset of programming. One of the primary rules was "Respect all living things/ *Respeta todos los seres vivos*" and it was intended for students to treat each other well in addition to their surrounding environment.

Lastly, students were given many opportunities to independently explore the garden environment throughout the duration of a lesson. Student exploration of the grounds was designed to facilitate discovery, freedom, and encounters with various types of plants and animals in the natural world. The rationale behind implementing this component of curriculum was twofold: to first and foremost provide students with an opportunity to engage with the natural world, and also to establish alternative ways of knowing and caring about the environment through the eyes of a child, rather than a vision imposed by an adult.

By examining the literature, we can see that critical scholars have asserted that some of the key components for minorities to establish connections with nature are language, storytelling, and lived experiences (Anguiano et al. 2012). Thus, I found it imperative to provide my students with opportunities to explore, a safe space to communicate with one another, and unstructured time to build memories. These elements helped construct an alternative way for my students to understand the environment that wasn't solely reliant on scientific concepts, but rather situated nature as an extension of their social sphere that incorporated community, oral storytelling, and imaginative play.

Figure 13. Image of student harvesting radish.
Photographed by the author in 2017.

Improved Academic Performance

Students demonstrated improved academic performance in the field of scientific inquiry in the form of marked differences between pre and post testing, and through teacher observations of changes in classroom performance/behavior. The most successful science topics were taught multiple times, however the requirements of standardized testing proved to be a limitation to the garden's reach.

Examples of increased knowledge in scientific inquiry can be seen in student academic performance by comparing the pre and post science test. This test consisted of fourth grade level science content and was organized into seven multiple choice questions and five essay questions. The ten students in Group A began programming in September with an average test score of 35.5 percent. After participating in garden programming for nine weeks, students took the same test again and the group scored a collective average of 56 percent, revealing a 20-percentage point increase. The eight students in Group B

started programming with an original mean test score of 34.6 percent and ended with a post program average of 47.4 percent, demonstrating a 12.8 percentage increase.

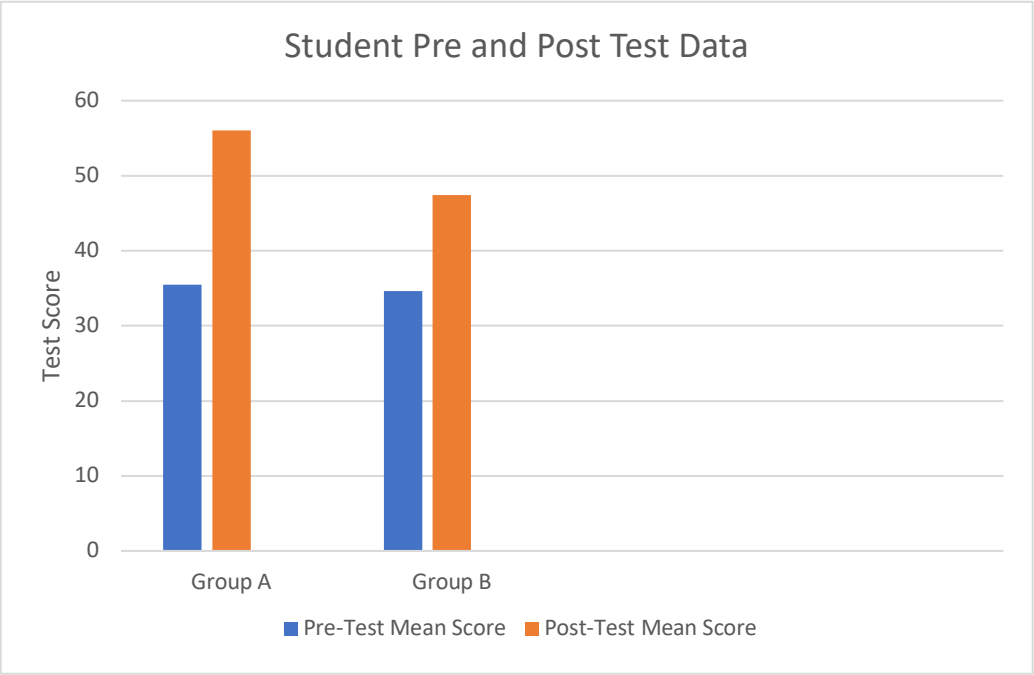


Figure 14. Bar graph documenting student pre and post-test scores.

Areas where students showed the greatest academic gains were content strands focused on plant needs for photosynthesis and identifying natural and man-made resources. Essay questions that reflected significant student growth between pre-and post-test concentrated on appropriate disposal of food items and recyclables, the importance of natural resources, as well as explaining how bees benefitted flowers. A detailed example of student growth can be seen in the essay question, "What are natural resources and why are they important?" On students' original pre-test, the majority left the question blank or answered with an incomplete response that showed limited understanding of the concept. However, on students' post-test, fifteen

out of twenty correctly identified examples of natural resources and how they benefit people, the environment, or the planet. This marked increase demonstrates how participating in the school garden has not only greatly improved students' understanding and knowledge of natural ecosystems, but also has been able to transfer into improved test scores.

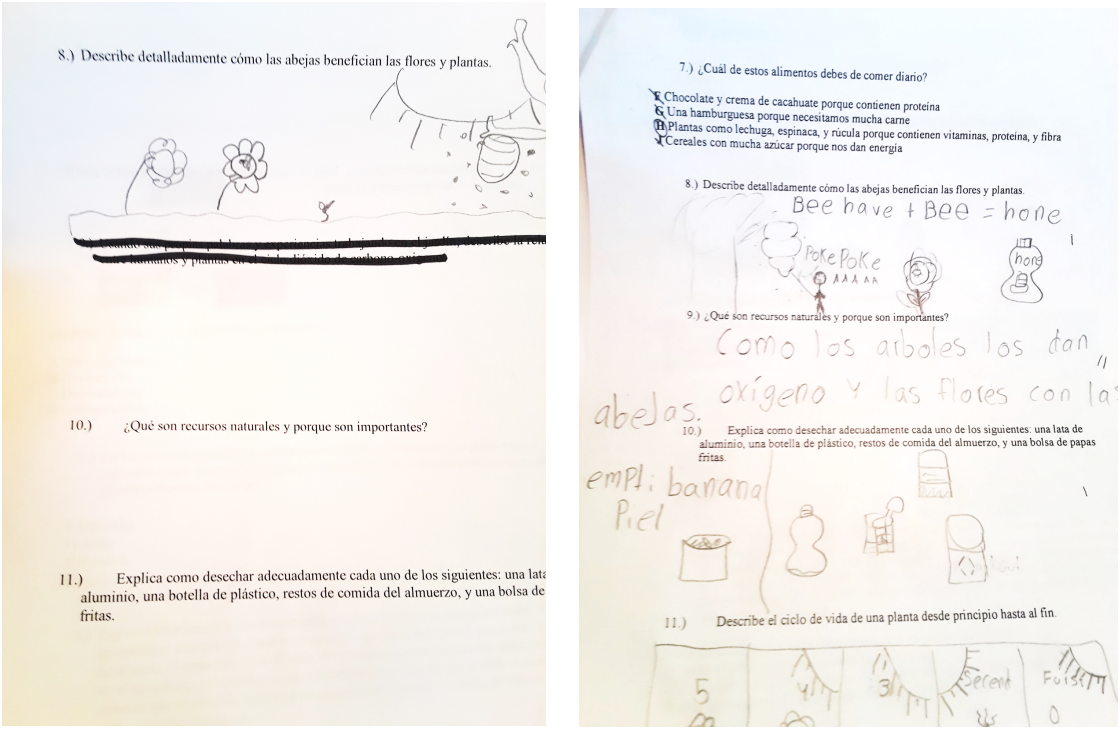


Figure 15. Image comparing student pre-test and post-test.
Photographed by the author in 2018.

Components that suggested student confusion and a lack of knowledge were multiple choice questions examining the oxygen-carbon dioxide cycle and essay questions about the food web, as only a few students answered those questions correctly. These results suggest that students performed better with content that we studied for multiple lessons and that they had numerous opportunities to master. For example, areas

where the students excelled—such as food disposal and plant needs—were repeated concepts that required the students to actively water plants, assess how much sunlight they needed and spread compost to provide nutrient rich soil. Similarly, food disposal was also a recurring topic that students got hands on practice in terms of recycling plastic and aluminum bottles and cans, as well as disposing food waste into the compost. When asked about what they learned about recycling, nearly all students explained that leaving plastic in nature had harmful effects on the environment and that it should be reused or recycled.

Figure 16. Image of student outdoor learning environment.
Photographed by the author in 2017.

More evidence of improved student academic performance was observed by the students' classroom science teacher. This teacher reported a marked increase in student participation during classroom science lessons from children who had participated in the garden program as opposed to their peers who had not. When asked if he noticed any changes in academic performance with regards to garden participants he replied:

> Mmmhmmm [nods in affirmative]. I feel like when it has been, when the garden matches any topic in science they are the first to contribute, like they cite what

> happened in the garden, like 'Oh we saw that in the garden' or 'I remember that from outside in the garden. I mean especially in science they would notice like a broad correlation between what was happening out there and what we were studying. Like when we learned about the water cycle or living organisms they're always the first kids to raise their hand or volunteer.

This research study shows that students spending more time outside in our school garden has a positive direct effect on their willingness to participate in class, demonstrate knowledge, and make connections to scientific content in class. Teacher observation also supports that students in the garden program have greater mastery of science content as compared to their peers who did not participate. Moreover, conversations with the classroom teacher also indicate higher levels of interest amongst students in scientific content after participating in school garden.

Contradictions of Informal and Standardized Testing

While the results of this research study support the idea that hands-on informal science lessons have a positive effect on student academic performance, there were multiple challenges in implementing the garden program while also teaching grade level science content. My biggest constraint was insufficient time. Students were only pulled once a week for forty-five minutes. Over half of our allotted time in the garden was spent on tasks like weeding, watering, and maintaining crops, which left little time to delve into more complex topics like the oxygen/carbon dioxide cycle. Simply put, my initial curriculum design was far too ambitious, as I packed too many concepts in each lesson and underestimated how much time would be needed for garden upkeep. Tension between informal and formal learning also occurred because of my goal to increase

student test scores in science, however the more time we spent devoted to formal science lessons with pen and paper, the less time we had to explore the garden and participate in outdoor experiential learning.

Figure 17. Image of students watering basil plants in raised garden beds.
Photographed by author 2017

Another incongruity between informal learning and standardized testing is evident in how some of the most engaged students performed poorly on their post-test. Some of the most inquisitive students who regularly made quality observations, asked complex questions, and displayed higher level critical thinking skills only made minimal gains on their assessment. Their lack of noticeable, quantifiable progress would imply that the garden program had little influence on their academic performance, however testimony from their classroom teacher and my field notes as a participant observer suggest otherwise. These findings suggest that not all students respond well to standardized tests, therefore multiple testing modalities are needed to more accurately measure student development. The need to get students to perform well on standardized tests results in largely ineffective educational practices that ultimately disengage students of color from

science content. In low-income minority schools in Austin, the most conventional ways of teaching science involve paper and pencil activities indoors with little to no practice in applying those skills to real world situations. Due to pressure from administrators, the district, and TEA, teachers find themselves coerced to train students to correctly select a multiple-choice answer rather than think critically, make inferences, and forge connections between themselves and the natural world. This results in many low-income students being underprepared or disinterested in STEM skills activities and content, leaving out a critical population in developing the future of the science and technology sector.

Through re-examining the literature, I argue that minority disengagement with science could be rectified through careful and deliberate outdoor education programming that shifts curriculum away from the notion that nature and science occur only in distant places like national parks or laboratories, inaccessible to today's urban youth. Instead, critical scholarship has asserted that the most effective way to promote citizen scientists engaged with the outdoors is through hands-on experiences in familiar environments where students can see the interplay between scientific processes and ecology of living systems (Cronin 1995, McCown 2011).

Impacts on Health and Nutrition of Urban School Gardens

This study asserts that after participating in garden programming, students experienced an increased amount of exposure to healthy foods, and more active lifestyles by working outside. While these benefits were noteworthy, other findings imply that

there was not a significant change in overall student diet or nutrition. This is possibly due to the short duration of the program, or the large amount of nutrition curriculum that was cut from the program in order to focus on scientific content. Although changes in student diet were negligible, data does promote the concept that participation in the garden was influential in encouraging continued involvement in the great outdoors.

Increased Exposure to Healthy Food

Student and teacher interviews as well as participant observation suggests that school garden programming resulted in some added health benefits to student participants, however these results weren't as notable as impacts made in science education and SEL. While being interviewed, every participant responded that they had tried new vegetables since beginning the garden program. All students taking part in the program had the opportunity to taste basil, lettuce, arugula, cilantro, and radishes. Students were not required to try any of the crops and some were more eager than others to sample our harvested vegetables. Many students informed me that they had never tried some of these vegetables, with their time in the garden being their only exposure to certain crops.

Figure 18. Image of produce harvested from school garden.
Photographed by the author 2018.

Few Changes to Diet or Eating Habits

Although all students tried new produce throughout the duration of garden programming, many reported not enjoying the taste of some of the vegetables that we grew. For example, the arugula that we used for salads had a very bitter, acidic aftertaste and most students disliked the taste and didn't want to eat a full serving. During our harvest celebration, students were eager to try many of the foods we had grown as well as some additional vegetables we purchased from a market, yet they threw away large quantities of fresh produce, resulting in food waste. Student and teacher interviews from this study also indicated that there was little change to student diets over the course of nine weeks, with few children noticing any changes in what they ate on a regular basis.

This could be a result of several reasons, and I hypothesize that the most likely factors were associated with a short program schedule, few vegetables that students enjoyed eating, and a lack of emphasis on nutrition throughout the garden curriculum. With regards to program duration, it should be noted that students were only pulled to

work in the garden once a week for forty-five minutes over the course of half a semester. To expect significant change in diet, routine, or health habits, previous research argues that students need prolonged exposure to fresh fruits and vegetables in addition to nutritional education (Wansink 2016). Other factors that could account for limited change in student nutrition could be connected to a lack of tasty, familiar vegetables that were ready to harvest in the garden. Although we planted many vegetables in September, crops such as carrots, spinach, peas, and pumpkins were still not ready to harvest by the end of programming in mid-November, leaving students with limited appetizing vegetable options. This could have caused students to be less inclined to continue eating new vegetables that they tried in the garden, resulting in little dietary change.

Yet another possibility could be related to the near absence of health and nutrition instruction throughout garden programming. Due to pressure to show STEM academic progress to administrators and collaborating teachers, I cut out nearly all formal health and nutrition content during instructional time. Student pre-test results showed that all students were performing far below grade level in science, with the student average score hovering in the 37th percentile. Because of these scores, I determined that more time needed to be devoted to basic environmental science concepts, and teacher observation confirmed that students also needed additional time spent working collaboratively to encourage peer-to-peer cooperation. Unfortunately, instruction linked to health such as learning how to read nutrition labels and focusing on food groups was the first to be removed, as it's not a tested component on state standardized tests. The dearth of information on health and diet could easily have played a part in student reluctance to adopt healthier diets throughout our programming.

Working Outside Doing Physical Activities

While the data of this study implies that garden programming had minimal influence on students' dietary choices, results still indicate that participants experienced some health benefits from partaking in the program. Reoccurring themes from student interviews revolve around a sense of pleasure in doing active chores, physical exertion, and imaginative play. At the end of each lesson, students were tired and sweaty from running around outside and performing physical labor, yet enthusiastic to return to their work the following week. Several participants even reported going outside to play more often at home with friends as opposed to spending time indoors engaged with technology.

> Researcher: What have you noticed about yourself since being part of the garden program?
>
> Evelyn: Well the most part- the thing is that I felt like I was gonna have fun. I started to put down the tablet and TV and started going outside with my friends. And I started to calm down from the internet.
>
> Researcher: So, you're telling me that you've started to play outside more since being in the garden program?
>
> Evelyn: Mmmhmm. Like I feel energized when I play, and it helps me with everything that I need because I can see trees and all those beautiful things growing.

Evelyn's interview illustrates that one of the potential benefits of participating in garden programming was that students experienced an increased amount of physical activity outside with peers.

While outdoor learning in the garden seemed to offer many benefits, it certainly created multiple challenges as well. At the beginning of garden programming in

September, central Texas was hit with the effects of Hurricane Harvey. This resulted in a wet, rainy fall that led to large amounts of mosquitos covering all surfaces of the garden. Students had to be slathered with repellent at the onset of each lesson, but insects continued to create a distraction throughout programming. Several students reflected that mosquitos had been their least favorite part of their garden experience. Other challenges were associated with the weather, as rain made both science instruction and gardening difficult. Rainfall also made note-taking outdoors impossible, because students used notebooks to record data and observations. Working outside in the elements was often problematic due to the fact that students didn't have appropriate shoes or clothing for wet, muddy conditions. Moreover, dirty hands and shoes also created a logistical challenge because students had to clean up before transitioning to their next class. Washing hands took up an extra five minutes for each lesson, which cut down on instructional time and made focused note taking difficult. Some students even conveyed that getting muddy or dirty was their biggest challenge throughout programming.

Continued Involvement with the Great Outdoors

Despite these challenges, all students reflected a deep sense of enjoyment in participating in the program. Many were disappointed our last day of lessons because they wanted to stay in the program for the duration of the school year. All students expressed a desire to continue working in the garden and to be active outside. Continued student interest in working and playing outdoors is also evident in their exit interviews. Sheily commented that she'd like to be a gardener when she's older so that she can "take

care of plants and help things grow." Evelyn said that she'd like to be a "camp director when she grows up to help other kids be outside."

When asked what students wanted to be when they were older, many others responded with a career choice or hobby that required working outside such as a scientist, wildlife biologist, or paleontologist. A continued desire to be involved in outdoor activities can also be seen in comments the students made after the program had concluded. Over three months after the program ended, students who had taken part in garden programming would ask me in the hallway questions like "When are you going to open the garden again?" or "Can we help harvest the carrots?" or "When will you pick me up again to go to the garden?" I interpret these findings as being indicative of students building longer-term relationships with outdoor involvement, because of their sustained motivation to be outdoors, working in the garden.

Figure 19. Image of student observing plant growth with magnifying lens.
Photographed by the author 2017.

Summary of Results and Outcomes

This research study has offered many insights into the advantages and limitations of urban gardening as a means for teaching social and emotional learning, as well as scientific inquiry skills. The benefits of school gardens for social and emotional learning were numerous. Not only did students describe increased levels of well-being or 'bienestar' in interviews and participant observation, but also reported improved levels of self-esteem. When asked about how they felt outside in the garden, nearly all participants responded that they felt "happy," "calm," or "free." Furthermore, their classroom teacher also supported the claim that the students who took part in garden programming appeared to have higher degrees of self-esteem than those who didn't join the school garden program. He conveyed that garden participants showed an increased sense of pride in their work and were often the first students to raise their hands to answer questions related to science content. Another positive impact of garden programming was the reinforcement of familial bonds. Many student participants reported that they were interested in taking part in the garden program because of positive experiences they had with a family member in nature. During exit interviews, many said that they felt more capable of helping family members with outdoor work and wanted to spend more time with family outdoors.

Another noticeable effect of garden programming on student behavior was an increased level of cooperation amongst peers. Initially, students were reluctant to share materials and work collaboratively on garden-based learning and tasks such as weeding, watering, and debris removal. However, by the midway point of the study, I observed a

marked improvement in the way that students communicated with each other that promoted cooperative learning and increased productivity in completing garden chores. In addition to promoting positive peer relationships, my data also suggests that the school garden program cultivated a sense of community amongst participants. This idea is evident in student mental maps of the garden that show not only physical features of the garden like plants and tools, but also the students working with their classmates or gathered around our meeting table. Nearly all students drew the table where we congregated to meet before each lesson and where we shared our ending harvest, which suggests that our school/peer community was one of the most memorable features of programming.

Possibly the most salient discovery of this research with regards to the development of scientific inquiry skills has been student participants fostering a sense of affection for plants and wildlife, which I refer to in this study as the "care and concern effect." When students were asked what their favorite aspect of the garden program had been during their closing interview, nearly all responded that they most enjoyed caring for the plants and animals in the garden. Many students also reported a shift in attitudes towards plants and insects that indicated more careful treatment after participating in garden programming. This finding supports the idea that this program helped instill a connection to the environment amongst students.

Other key findings related to science content focus on improved academic performance in science. Upon examining student pre-and post-test scores, we saw a large jump in test results. Testing components where students showed the most progress were inquiries about plant needs for photosynthesis and identifying natural and man-made

resources. Other questions that revealed much growth were centered on appropriate disposal of food items and recyclables as well as explaining how bees benefitted flowers. The data suggest that students performed better with content that that they had numerous opportunities to master.

Although students saw an increase in science test scores after partaking in garden programming, tensions between informal and formal learning certainly occurred throughout this research project. While I wanted to provide students with as many hands-on outdoor opportunities as possible, I also found students to be significantly underprepared in mastery of grade level science content. Due to pressure to increase student test scores, I had to also focus on basic life science skills and concepts with pencil and paper indoors in an attempt to improve academic performance. The conflict between outdoor informal learning and indoor formalized lessons was a reoccurring theme throughout programming, requiring flexible lesson plans, and adjusted curriculum that almost always favored.

Lastly, I examined the impacts on health and nutrition of the urban school garden program. Student and teacher interviews as well as participant observation suggests that school garden programming resulted in some added health benefits to student participants, as students were exposed to more healthy foods. Students had the opportunity to taste all our vegetable crops, with many informing me that they had never tried certain vegetables such as radishes, arugula, or spinach. Although students were typically eager to try the vegetables we had grown, student and teacher interviews from this study indicated that there was little change to student diets over the course of nine weeks, and few children noticed any changes in what they ate on a regular basis. The lack

of impact on student diet could be a result of short programming, cut health and nutrition curriculum, or few tasty vegetables that students wanted to eat.

While the garden had little effect on overall student diet, results still indicate that children experienced some health benefits from joining in the program. Student interviews and participant observation support that outdoor physical activities were an important piece of program design, as multiple participants said that they got a sense of pleasure in doing active chores, exerting themselves physically, and engaging in imaginative play with friends. Yet another health benefit of our urban school garden is that it encouraged continued involvement with the great outdoors. As our project ended, nearly all students expressed an interest in being able to keep on working outside in the garden. Many were even disappointed our last day of lessons because they wanted to stay in the program for the duration of the entire school year. All students mentioned a desire to continue being active outside and learning more about plants and wildlife.

6. CONCLUSION

This research addresses the critical issue of how to best design, implement, and evaluate outdoor education programs geared toward minority youth. Despite the recognition that minorities have been traditionally deprived of many environmental benefits, previous research has been scant in offering potential solutions to bridge the gap between the exclusion of minorities in nature and developing comprehensive outdoor programming for diverse populations. This investigation sought to provide an applied approach to this issue through the creation of an urban school garden intended to connect Latino youth in Austin to nature by developing social and emotional learning, enhancing STEM skill acquisition, and gauging impacts on health and nutrition.

My key research questions were, what role can community garden programs play in facilitating elementary school Latino students' achievement of learning objectives in the fields of a.) social and emotional learning (SEL) b.) scientific inquiry and c.) nutrition and health? What additional benefits do school community gardens bring to students at Widen Elementary? To answer these questions, I conducted a nine-week program designed to connect students with SEL, science content and health and nutrition lessons. To measure the effect garden programming had on these components, I administered a pre and post-test covering grade level science TEKS, engaged in participant observation and created detailed field notes after every program session. Additionally, as programming ended, I conducted a focus group of students, interviewed every participant and their teacher, and had students create mental maps of the garden to evaluate salient aspects of the physical environment.

This research draws on and contributes to critical literature surrounding constructs of wilderness, racial exclusion in the great outdoors, and OEE. In terms of my program design, I applied Cronon's concept of a 'middle-ground approach' by selecting a plot of land at a low-income majority Hispanic school for a school garden. This garden is accessible to over 500 families by foot or public transit, thus affirming Cronon's view that nature should be available to everyone, regardless of socio-economic status. With regards to implementation, I employed theory from critical race scholars to re-envision what outdoor programming could look like by offering Spanish language instruction to my 20 bilingual Latino students enrolled in programming. Furthermore, my program lasted nine weeks, which gave students the opportunity to develop more in-depth learning opportunities and form longer-lasting relationships with nature instead of a one-stop field trip. Lastly, I've drawn on the literature to help inform how I've evaluated this garden program through not only test scores, but interviews, focus groups, and mental mapping. These interviews and maps have been integral in understanding this sample of Latino children's thoughts, beliefs, and feelings toward the environment and how they interact with nature.

The key findings of this study center on the garden being conducive to SEL, developing scientific inquiry skills, and bolstering health and nutrition outcomes. The effect of school gardens with relation to social and emotional learning was clearly beneficial. Students reported increased levels of well-being in their interviews and also were observed by their classroom teacher and myself as enjoying themselves, smiling, and laughing while they were outside. Other claims by their teacher that support increased levels of well-being were student participants' greater degrees of self-esteem

and sense of pride in accomplishments evident throughout the school day. An additional impact that the school garden had on students was better cooperation and peer relationships, as many relayed that making "new friends," or "spending time outside with their team members" was one of their favorite aspects of programming.

When reviewing student achievement in scientific content, the most notable results came in the form of student participants developing a deep fondness toward plants and wildlife, which I've coined the "care and concern effect." Other note-worthy findings in science education pertained to increased academic achievement in science, as noted by their teacher and also in the rise of test scores measured between their pre-and post-test results.

Regarding health and nutrition, empirical data shows that although the garden had little effect on student nutrition, students experienced other benefits associated with participating in the program. For example, student interviews and participant observation suggest that students were exposed to new, healthy foods during programming that were grown in the garden. Other health benefits involved students doing active chores, exerting themselves physically, and engaging in imaginative play with friends. Finally, the garden program proved helpful in encouraging sustained involvement with nature, as many students reported that they'd like to choose a career outdoors, and all participants said that they'd like to continue working in the garden.

This research supports a growing trend in education of greening schoolyards and providing children with hands-on learning opportunities outdoors (Louv 2006). This study confirms that there are multiple benefits that urban school gardens provide in the realm of bolstering children's SEL, scientific inquiry development, and improving health

and nutrition. Moreover, I argue that school gardens are one of the most effective vehicles to connect children, especially children of color, to the great outdoors through active learning in accessible, familiar environments performing relevant tasks that promote responsible land management practices. I argue that gardens serve as particularly valuable systems for connecting children of color and low-income communities to nature because of the ability to plant them in accessible local environments (e.g. yards, schools, churches), and they are low cost to maintain. Moreover, they also function as a means to harvest healthy food that may not be available in low-income minority or immigrant neighborhoods typified by 'food deserts' where nutritious affordable food is scarce.

Further policy recommendations include reinforcing plans by the city of Austin's Cities Connecting Children to Nature (CCCN) initiative, which strives to provide equal access to nature for children in low-income, minority communities. Although the city currently has plans to enhance the 'recreational usability of public space,' by developing more public parks, I recommend allocating a significant portion of grant funding that the city has received from planning partners toward constructing school gardens in the most nature deprived sectors of the city, which have been identified using a GIS Nature Equity Interactive Map.

Further recommendations focus on adapting curriculum in school districts such as AISD to promote more hands-on active lessons for students by providing outdoor learning opportunities amidst formal science units. This study suggests that increasing the amount of time children spend outdoors learning informally about scientific concepts has the potential to boost science test scores, promote student self-esteem and cooperative learning. Therefore, I advocate for school administrators and educators to focus more on

outdoor learning that gives students authentic opportunities to interact with STEM content either in gardens or on school grounds. Many non-profits such as PEAS in Austin have well developed curriculum that both balances grade level TEKS with experiential activities outdoors. Ultimately, this research contends that perhaps the best catalyst for increased levels of student academic performance, health and well-being, and cooperation is not found within the confines of a classroom, but in the soil that supports the school's foundation.

APPENDIX SECTION

Detailed Lesson Plans

Lesson 1, TEKS featured:
4.1A: demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations; 4.2A: plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions; 4.3C: represent the natural world using models such as rivers, stream tables, or fossils and identify their limitations, including accuracy and size; 4.4B: use safety equipment as appropriate, including safety goggles and gloves.

Materials: Safety goggles, garden tools, notebooks, pencils, gloves **Introduction:** (10 minutes) students introduce themselves in circle and share what they'd like to do while participating in school garden program. Students collaboratively create community contract on chart paper. **Activity:** (20 minutes) Teacher then models appropriate/safe usage of garden tools using examples and non-examples. 4.1A Students given opportunity to practice weeding, raking, and shoveling using small garden hand tools. Vegetable seeds are planted in raised garden box plots, type, variety, and location is recorded. Appropriate safety equipment is utilized if using sharp tools (goggles and gloves) 4.4B	**Evaluate:** (10 minutes) Teacher explains that as scientists, our job is to observe the world around us and ask questions about what we see. Students record in science journal the landscape where garden will be noting special attention to land features, vegetation, and habitat. As an exit ticket, they must ask one question that they'd like to find out based upon their observations. 4.3C 4.2A e.g. "Why do plants on this side of the building grow better?" **Closing:** (5 minutes) Share questions whole group, clean tools, properly put away in shed, dismiss. **Anchors:** Community Contract **Vocabulary:** *observar, medio ambiente, hábitat, comunidad, pala*

Lesson 2, TEKS featured:

4.1B: make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic; 4.2A: plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions; 4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps.

Materials: garden tools, notebooks, pencils, gloves, compost bin, organic material (food waste), aluminum can, plastic bottle, garbage can, recycle bin **Introduction:** (10 minutes) students water plants, pull weeds, observe any noticeable changes in landscape, record in science journals. 4.2B **Activity:** (20 minutes) Teacher begins conversation around what natural resources are, how they're utilized and the need to conserve them. Students given opportunity to sort, organize, and classify materials like food waste, plastic, aluminum, glass and dispose of them properly in garbage, recycling bin, and compost. 4.1B	**Evaluate:** (10 minutes) **Mini lesson: plastic vs. apple** A plastic bottle and apple are both buried 6 inches into the ground. Students are asked to record their predictions of what will happen to both materials in the span of a week. 4.2A **Closing:** (5 minutes) Share predictions whole group, clean tools, properly put away in shed, dismiss. **Anchors:** Recycling graphic **Vocabulary:** *recursos naturales, recursos hecho por hombre, materia orgánica, materia inorgánica, descomponer*

Lesson 3, TEKS featured:

4.1B: make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic; 4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.9A: investigate that most producers need sunlight, water, and carbon dioxide to make their own food, while consumers are dependent on other organisms for food.

Materials: garden tools, notebooks, pencils, gloves, compost bin, ruler to measure sprouts **Introduction:** (15 minutes) students water plants, pull weeds, spread compost, and observe any noticeable changes in landscape, record in science journals. The apple and plastic bottle are dug up and students record results in science journals. 4.1B, 4.2B, 4.9A **Activity:** (20 minutes) Examine seedlings that have begun to sprout. Engage students in comparison between which seedlings have grown the most and least, assessing each site's access to sunlight, water, and nutrients. 4.9A Discuss: how producers need sunlight, water, and carbon dioxide to make their own food. Students asked to classify people: are we producers or consumers? 4.1B	**Evaluate:** (10 minutes) Students share their responses whole group and group creates producer/consumer anchor chart filled with organisms found in garden. **Closing:** (5 minutes) Final thoughts, clean tools, properly put away in shed, dismiss. **Anchors:** Producer/Consumer chart **Vocabulary:** *productores, consumidores, dióxido de carbono, oxígeno exhalar, inhalar*

Lesson 4, TEKS featured:

3.10C: investigate and compare how animals and plants undergo a series of orderly changes in their diverse lifecycles such as tomato plants, frogs, and lady bugs; 4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.4A: collect, record, and analyze information using tools, including calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, mirrors, spring scales, pan balances, triple beam balances, graduated cylinders, beakers, hot plates, meter sticks, compasses, magnets, collecting nets, and notebooks; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums; 4.10C: explore, illustrate, and compare life cycles in living organisms such as butterflies, beetles, radishes, or lima beans.

Materials: garden tools, notebooks, pencils, gloves, compost bin, organisms found in garden **Introduction:** (10 minutes) students water plants, pull weeds, observe any noticeable changes in landscape, record in science journals. 4.2B **Activity:** (20 minutes) **Organism scavenger hunt:** Students tasked with finding 3 living organisms in garden. Using cameras, students photograph each organism and record in science journal. Compare and contrast life cycle of plant with one of found organisms, done whole group. 3.10C, 4.4A	**Evaluate:** (10 minutes) Students write scientific refection on how organisms have both similar and different life processes. Students choose their favorite organism and illustrate, label and depict each stage of its life cycle. Photographs that students take are later glued into notebooks. **Closing:** (5 minutes) Share final thoughts whole group, clean tools, properly put away in shed, dismiss. **Anchors:** Life cycle illustration of plant, insect, mammal **Vocabulary:** *ciclo de vida, huevo, larva, pupa, adulto, metamorfosis*

Lesson 5, TEKS featured:

4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.2C: construct simple tables, charts, bar graphs, and maps using tools and current technology to organize, examine, and evaluate data; 4.2D: analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured; 4.9A: investigate that most producers need sunlight, water, and carbon dioxide to make their own food, while consumers are dependent on other organisms for food; 4.9B: describe the flow of energy through food webs, beginning with the Sun, and predict how changes in the ecosystem affect the food web such as a fire in a forest.

Materials: garden tools, notebooks, pencils, gloves, compost bin, ruler to measure sprouts **Introduction:** (10 minutes) students water plants, pull weeds, spread compost, and observe any noticeable changes in landscape, record in science journals. 4.2B **Activity:** (20 minutes) Continue to monitor seedlings that have begun to sprout. Take active inventory of various living organisms that call the garden habitat their home. Engage students in comparison between which seedlings have grown the most and least, assessing each site's access to sunlight, water, and nutrients. 4.9A Continue discussion: how producers need sunlight, water, and carbon dioxide to make their own food. What would happen if the environment were drastically altered? Introduce idea of climate change. 4.9B	**Evaluate:** (10 minutes) Students practice making graphs of all living organisms in garden to organize garden data with written response of how life would be impacted if large change to environment took place. 4.2C, 4.2D **Closing:** (5 minutes) Final thoughts, clean tools, properly put away in shed, dismiss. **Anchors:** Living organism graph **Vocabulary:** *La red alimenticia, productor, consumidor, dióxido de carbón, oxígeno, clima/ tiempo*

Lesson 6, TEKS featured:

4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.2F: communicate valid, oral, and written results supported by data; 4.3D: connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

Materials: garden tools, notebooks, pencils, gloves, compost bin, ruler to measure sprouts **Introduction:** (10 minutes) students water plants, pull weeds, spread compost, and observe any noticeable changes in landscape, record in science journals. 4.2B **Activity:** (20 minutes) Special visitor: Dr. Devine (Ph.D. academic advisor in Geography at Texas State University) Dr. Devine discusses opportunities available for students interested in pursuing careers in science, and what it looks like to be a real, live scientist. 4.3D Students ask questions, take notes, share what their favorite parts about being outdoor scientists are.	**Evaluate:** (10 minutes) Think-pair-share activity places students in partners where each partner says something they've learned while participating in garden program based on recordings in science journals. Once both partners have spoken, students share whole group. 4.2F **Closing:** (5 minutes) Final thoughts, clean tools, properly put away in shed, dismiss. **Anchors:** Who is a scientist? **Vocabulary:** *científico/científica, carrera*

Lesson 7, TEKS featured:

4.3B: draw inferences and evaluate accuracy of services and product claims found in advertisements and labels such as for toys, food, and sunscreen; 4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.1B: make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic.

Materials: garden tools, notebooks, pencils, gloves, compost bin, ruler to measure sprouts, bag of chips, bundle of carrots **Introduction:** (10 minutes) students continue to maintain garden by pulling weeds, occasionally spreading compost, and observing any noticeable changes in landscape, by recording in science journals. Students note which vegetables have grown the most. 4.2B **Activity:** (20 minutes) Special visitor: Coach Greg (Health and Fitness instructor, Widen Elementary) Coach Greg discusses how to read a nutrition label and the importance of a healthy, balanced diet to maintain an active lifestyle.	**Evaluate:** (10 minutes) Working in partners students compare and contrast the nutritional information from various healthy foods like vegetables, pretzels, and pita chips (go foods) with junk food like cookies and chips (whoa foods). Students record amount of calories, fat content, fiber, and protein and evaluate which foods are the healthiest/least healthy. Partners share their findings whole group at end of activity. 4.3B **Closing:** (5 minutes) Final thoughts, clean tools, properly put away in shed, appropriately dispose of wrappers, packaging used for activity 4.1B **Anchors:** Large nutrition label graphic **Vocabulary:** *nutrición, grasa, calorías, proteína, fibra, azúcar*

Lesson 8, TEKS featured:

4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.3A: in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student; 4.4A: collect, record, and analyze information using tools, including calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, mirrors, spring scales, pan balances, triple beam balances, graduated cylinders, beakers, hot plates, meter sticks, compasses, magnets, collecting nets, and notebooks; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums; 4.9B: describe the flow of energy through food webs, beginning with the sun, and predict how changes in the ecosystem affect the food web such as a fire in a forest.

Materials: garden tools, notebooks, pencils, gloves, compost bin, ruler to measure sprouts, thermometer, cameras **Introduction:** (10 minutes) students continue to maintain garden by pulling weeds, occasionally spreading compost, and observing any noticeable changes in landscape, by recording in science journals. Students note which vegetables have grown the most and begin to make predictions about which crops will be harvested first. 4.2B **Activity:** (20 minutes) Using cameras, students will work with a partner to document, record, and analyze organisms in their natural habitats. Students will record where each organism falls within the food web and whether it's a producer or consumer in their journals. 4.4A, 4.9B	**Evaluate:** (10 minutes) Share student food webs whole group. Ask students what would happen if any given organism went extinct within a food web and what effects on the ecosystem would take place. Engage students in debate, examining all sides of scientific evidence to reach conclusions, emphasis on critical thinking and logical reasoning. 4.3A **Closing:** (5 minutes) Final thoughts, clean tools, properly put away in shed, dismiss. **Anchors:** Class created food web chart **Vocabulary:** *red alimenticia, ecosistema, extinción, conservación*

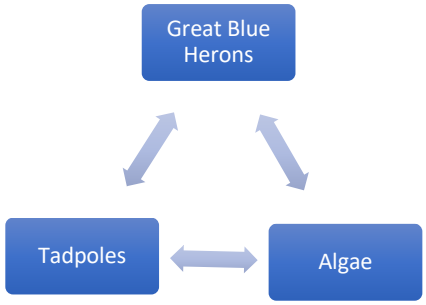
Lesson 9, TEKS featured:

4.2B: collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps; 4.3A: in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student.

Materials: garden tools, notebooks, pencils, gloves, compost bin, storage for crops **Activity:** (30 minutes) Students harvest all vegetable crops from garden, wash, clean, and organize produce by type. Produce will be made into salad to be shared whole group. **Evaluate:** (10 minutes) As students enjoy salad, class creates final graph representing garden vegetables. Share results. Engage students in discussion as to why some crops grew better than others. Which received the most sunlight? Nutrients? What type of produce was it, and what can we infer based upon our findings? 4.2B, 4.3A	**Closing:** (5 minutes) Final reflections, what we learned about science, health, nutrition, and community. **Anchors:** Class created garden graph **Vocabulary:** *cosechar*

Student Pre and Post Test (4th grade science TEKS)

1.) A partial food web of a pond ecosystem is shown below.



Which type of organism is missing from this food web?

A Decomposers
B Producers
C Predators
D Consumers

2.) Tropical climates have warm temperatures and abundant sunlight all year. What must be available for plants in these climates to make their own food throughout the year?

F Bacteria
G Birds
H Shade
J Water

3.) Some students are investigating the life cycle of the spotted salamander. They learn that these salamanders must live close to water and lay their eggs in water. After 20–60 days the eggs hatch as larvae that must stay in the water until they mature into adult salamanders. The students infer that the life cycle of the spotted salamander is similar to the life cycle of the frog because both animals_____.

A have long tails and strong jumping legs as adults
B live near water and produce larvae with wings
C lay eggs in water, which hatch into larvae that live in water
D produce offspring that hatch from eggs and look like adults

4.) Which of these is a renewable resource?

F Gasoline that contains some alcohol
G Wind produced by the uneven heating of Earth's surface
H Natural gas pumped from deep underground
J None of these

5.) Which one of these options is a man-made resource?

A Apples from a tree
B Water from the ocean
C Chickens on a farm
D A tire from a truck

6.) What would most likely happen to the carbon dioxide–oxygen cycle if Earth's large forests were all cut down?

F There would be more carbon dioxide in the atmosphere because fewer plants would be using it to produce their own food.
G The remaining plants would stop producing carbon dioxide, and animals would use less oxygen.
H The remaining plants would produce more oxygen, and animals would produce less carbon dioxide.
J There would be more oxygen in the atmosphere because fewer plants would be using it to produce their own food

7.) Describe in detail how bees are beneficial to flowers and plants.

8.) Using your own words and personal experiences, describe the relationship between humans and plants in the carbon dioxide–oxygen cycle.

9.) What are natural resources and why are they important?

10.) Explain how to properly dispose of each of the following: an aluminum can, a plastic bottle, food scraps from lunch, and a bag of chips.

11.) Describe the life cycle of a plant from start to finish.

12.) Draw a food web below of animals and organisms that could be found either in your neighborhood or at school.

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