SHIFTS IN SENSE OF PLACE DUE TO ENVIRONMENTAL EDUCATION: CALIFORNIA’S NORTHERN SAN JOAQUIN VALLEY

A Thesis Presented to the Faculty of California State University, Stanislaus

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Interdisciplinary Studies

By Heather T. Lewis
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CERTIFICATION OF APPROVAL

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by
Heather T. Lewis

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ABSTRACT

The Airport Neighborhood is a disenfranchised community in California’s Northern San Joaquin region. With local manufacturing distribution centers located in the west and Modesto City-County Airport in the east, Oroville Wright Elementary is a centralized location for the residents of the Airport Neighborhood. In the Airport Neighborhood it is possible that socioeconomics and demographics effect underrepresented Hispanic youth’s desire to participate and self-identify in environmental education programs. When children participate in environmental education programs, they learn environmental concepts that are associated with strengthening critical thinking. It is suggested that short-term co-curricular environmental education can shift a young person’s sense of place. In the case of disenfranchised students, we proposed that it can increase a positive attitude towards their outdoor environment. This study took place with 5th grade students and with a nonprofit environmental organization, Tuolumne River Trust. The Tuolumne River Trust provides environmental education lessons on the Tuolumne River and the rivers’ watershed. Students drew mental maps before and after their environmental education lessons. These maps were used to study if the students’ sense of place is associated with the Tuolumne River prior to their environmental education lessons. Minor changes in the mental maps revealed that it is vital that the disenfranchised student’s should participate in co-curricular programs. Also, environmental education programs need to promote family participation and include bilingual services.
INTRODUCTION

Even short-term, co-curricular environmental education may shift a young person’s sense of place. Sense of place is the feelings or perceptions that a person has of a place. Environmental education may increase their positive attitudes towards the natural environment. Disenfranchised children within California’s northern San Joaquin Valley are least likely to participate in co-curricular environmental education programs due to poor socioeconomics and demographics within communities (London et al. 2011). Even though Americans support environmental education, our knowledge towards environmental awareness is narrow (National Environmental Education Foundation 2015). Nearly one-third of residents in the northern San Joaquin Valley are vulnerable to environmental health risks in relation to the socioeconomics and demographics within communities (London et al. 2011). Compounding the environmental hazards in these communities, northern San Joaquin Valley residents often financially struggle to send their children to participate in traditional environmental education programs, such as outdoor education camps. Disenfranchised families often rely on their neighborhood elementary school to provide co-curricular eco-pedagogy. Drawing mental maps is a useful technique to identify the shift of a child’s sense of place due to co-curricular environmental education programs. Mental maps are useful tools for identifying places of importance and how space is utilized (Den Besten 2010). In this case I examined if disenfranchised students who participated in a short-term environmental education
activity increased their positive attitudes towards their outdoor environment. The study was conducted in Modesto, California’s Airport Neighborhood (Figure 1).
Figure 1. Study Site Map
Disenfranchisement and the Environment

Environmental racism can be seen in impoverished and disenfranchised communities throughout the United States. Environmental racism refers to the exposure of minority groups to “harmful chemicals, pesticides, and other toxins in the home, school, neighborhood and workplace” (Bullard 1999). Disenfranchised communities of African Americans, Hispanic Americans, and Native Americans are more likely to experience environmental racism in comparison to privileged white communities (Wise 2003). Environmental racism is often experienced at the scale of local neighborhoods (Bullard 1999). Disenfranchised communities are more likely to be located near landfills and toxic waste sites than privileged neighborhoods (Pulido 2015). When land is inexpensive due to poor regional socioeconomics and demographics, corporations are able to purchase the land for a cheaper price compared to going to an area where land is more expensive based off of higher socioeconomics and demographics. Disenfranchised neighborhoods that are neighboring freeways are more than likely to be exposed to air pollution, such as diesel soot, that can cause adverse health effects in children (Grigg 2012). Residents of disenfranchised communities that experience environmental injustice often face inadequate access to proper health care, have a lack of knowledge about their physical environment, and have few opportunities to learn about environmental policies and procedures (Reisch and Philip 2015). Residents of disenfranchised communities are more prone to develop asthma, cancer, and other health related problems (Martin and Do 2014).
In the northern San Joaquin Valley, Hispanic residents often face significant environmental racism. Hispanic children are more likely to have higher levels of lead in their blood than non-Hispanic white children (Quintero-Somaini and Quirindongo 2004). Children of farmworkers are more likely to be exposed to pesticides, which is correlated with high rates of childhood cancer (Quintero-Somaini and Quirindongo 2004). Eighty percent of United States farm workers are Hispanic (National Agricultural Workers Survey 2013). Farm laborers are susceptible to exposure of pesticides that linger as residue on exposed surfaces such as skin and garments or are inhaled (Damalas and Koutroubas 2016).

Despite many social and economic barriers, disenfranchised Hispanic residents are concerned about environmental justice. Surveys conducted by the Sierra Club in 2012 and 2016 revealed that the Hispanic residents in the United States worry about the negative effects of excessive fossil fuel use, climate change, and environmental protection of the land (Sierra Club and NCLR 2012 & Sierra Club 2016).

Within the northern San Joaquin Valley, the disenfranchised population often consist of a majority of low-income immigrants and their families from Middle America and Southeast Asia (United States Census Bureau 2014). Research has revealed that asthma and other respiratory illnesses are more than likely to occur for residents of the San Joaquin Valley due to its agricultural economy (London et al. 2011). Poor communities are also more susceptible to experience environmentally health related hazards such as exposure to pesticides (Huang and London 2012). This
type of exposure is more common within rural disenfranchised communities. Residents of these rural regions of the northern San Joaquin Valley, are susceptible to exposure of “toxic byproducts” that can alter their health due to working in an agricultural economy (London et al. 2011). A noteworthy example of environmental degradation within the northern San Joaquin Valley occurred in Merced County at the Kesterson Grasslands, where polluted irrigation water infamously deformed the fauna. Not only was wildlife and vegetation effected, but the groundwater that farmers use for agricultural purposes was contaminated (Garone 2011).

**Co-Curricular Environmental Education**

In the late 1970’s, educators and environmental scientists wrote the United Nations Education, Scientific, and Cultural Organization (UNESCO) Tbilisi Declaration. It promoted the implementation of eco-pedagogy into primary and secondary (K-12) education for social and academic development. The Tbilisi Declaration states that, “special attention should be paid to understanding the complex relations between socioeconomic development and the improvement of the environment” (Hungerford 2010). Thus, the program National Environmental Education Foundation was also established to assist in promoting environmental literacy. The foundations’ goal is for children to become environmental literate (National Environmental Education Foundation 2015). Environmental education needs to include principles and guidance that promotes sustainability, interdependence and systems thinking, lifelong learning, developing a sense of place, direct real world experiences,
integration of multiple disciplines, and experiential learning (National Environmental Education Foundation 2015).

Over the last 40 years, interest in environmental education has increased. Throughout the United States, parents have encouraged schools to include environmental education lessons into traditional curriculum (Carrier 2007). By integrating environmental education curriculum into K-12 education, this can inspire children to perform better academically, increasing cooperative learning and civic responsibility (Strife 2010). The California Department of Education has created curriculum that aligns environmental education with state standards (California EEI 2016). Environmental education is an optional component throughout the K-12 curriculum, although it is part of the Next-Generation Science Standards (California Department of Education 2013; NGSS Lead States 2013). Including environmental education programs into K-12 curriculum may be costly (Chapman 2014). Allocating funds for environmental education programs can be a difficult task for underperforming K-12 school sites when they must provide additional academic enrichment programs to improve scores on standardized state tests. Given the unequal funding structure of California public schools, school sites that are located in disenfranchised communities often don’t have funding for enrichment programs (Darling-Hammond 2013).

Studies have shown that Hispanic parents have complex and multifaceted motivations for providing a good education to their children (Hwang and Vrongistinos 2010). According to Hong and Anderson (2006) 60 percent of
Latino/Latina parents supported sending their children to an environmental center for education lessons. However, disenfranchised students, including poor Latino students, participate in environmental education programs at lower rates than white, middle-class students (Hong and Anderson 2006). Living in a disenfranchised region, race and income play an important role in determining what families and communities can afford, including educational opportunities (Downey 2008). Hong and Anderson (2006) found that 47 percent of Latino community leaders believe financial assistances is needed to increase Latino participation in environmental education. Higher income families can financially support their child to participate in academic support programs and join co-curricular activities, compared to poor disenfranchised Hispanic youths (Delgado-Gatian 2007). Thus, children within poverty infringed communities, such as the Airport Neighborhood in Modesto, CA (Figure 2).
Figure 2. Modesto City-County Airport Adjacent to the Airport Neighborhood
In the northern San Joaquin Valley a vast majority of disenfranchised community schools are Title I Schools that focus on improving the sites academic performance index. In order to be considered a Title I school site, the school has to have a minimum of 40 percent of its students to be recognized as low-income [Section 1114(a) (1) of Title I of ESEA] (California Department of Education 2016). On average funding for U.S. schools typically comes from three components, forty-five percent from local property taxes, forty-five percent from the state, and ten percent from the federal government (Turner et al. 2016). The value of property will vary between neighborhoods and associated school districts (Turner et al. 2016). Property values are lower in the northern San Joaquin Valley than the nearby San Francisco Bay Area. Thus, many schools in the northern San Joaquin Valley have less resources to provide environmental education than schools in adjacent regions. An alternative to direct environmental education is co-curricular education, such as community presentations and field-trips, afterschool programs, summer camp, and clubs.

Developing a Sense of Place through Environmental Education

Adding co-curricular environmental education to traditional school curriculum strengthens a child’s knowledge and attitude of environmental stewardship towards their community. In order for K-12 students from disenfranchised communities to access environmental education, parents and afterschool programs may turn to co-curricular environmental education programs that promote environmental stewardship. Participating in environmental education programs, can influence a
child’s thought processes of the importance and awareness of environmental stewardship in their community.

Environmental education programs have a tendency to provide children with more positive attitudes towards nature. Children that participate in co-curricular environmental education programs are more appreciable of the environment (Strife 2010). Co-curricular environmental education programs encourage critical thinking of a location, its significance, and historical values (Hutson 2011). Thus, when children participate in environmental education programs there may be a shift in a child’s sense of place in nature. When humans are exposed to nature through various forms, humans are able to internalize and reflect upon their environmental place or surrounding. Tuan emphasized that place may emerge at various levels (1977). Regardless of one’s age, it is possible to develop some type of sense of place with the environment. Sense of place reflects a personal connections that humans have with their world. Tuan believes that “place is an archive of fond memories and splendid achievements that inspire the present…” (1977). Sense of place affects the characteristics of responsibility that humans develop (Massey 2004). Caring about the natural environment can be vital component of human existence and duty.

When children participate in environmental education programs they become more responsible for decision making on environmental concerns (Carrier 2007). This indicates that a child may have gained a greater comprehension and/or a greater appreciation for the environment. I suspect this is due, in part, to a shift in sense of place. Developing a sense of place that includes nature allows humans to express
various forms of environmental stewardship. When children participate in outdoor education programs, they are encouraged to examine details of the natural landscape with guidance from teachers and educational aids. In outdoor education programs this can occur as children learn environmental lessons while in nature (Stewart 2008). The students may create mental stories that includes more natural characteristics in their sense of place. In the case of disenfranchised students, environmental education might increase disenfranchised students’ positive attitudes towards their outdoor environment. Cartographic and written activities during an environmental education program can reveal a student’s perceptions of environment (Aucoin 2011).

**Using Mental Maps**

Mental maps may be used to depict how we interpret our world. Using mental maps can allow us to learn how individuals respond physically, verbally and expressively to their spatial surroundings (Tuan 1975). A common example is when adults create an informal mental map when providing locational directions to a place (Sinton et al. 2013). Incorporating mental maps can strengthen ones knowledge of familiar locations (Jung 2014). In fact, much like the effects of languages, mental images may be map-like in structure (Blumson 2012). Mental maps can allow us to construct and accumulate an understanding of the participants within a direct setting (Tuan 1975).

Researchers have long used mental maps to study how children perceive their world. Mental maps allow researchers to identify places of importance to children and how they utilized space (Eigenheer 1987). Mental maps can represent how a child
will evaluate their community’s meaning. A child’s map may reveal his/her emotions associated with the location. Thus, mental maps are a powerful tool to use when identifying a child’s sense of place. Incorporating mental maps into an environmental education activity is beneficial for teachers and environmental educators as it can reveal a child’s perception of their community and nature. For example, research has shown that mental maps are useful tools to reveal cultural barriers such as language dilemmas (Jung 2014). Previous work has been done at Orville Wright elementary where school children used hand-held GPS receivers to map their neighborhood (Hauselt and Helzer 2012). Thus, incorporating mapping techniques is one way to further explore a child’s sense of place.

Mental maps may also be used comparatively. In examining the relationships that children have with nature, Den Besten (2010) studied mental maps created by children from different socioeconomics and demographics communities. The mental maps that Den Besten (2010) analyzed revealed how a child experiences socioeconomic and demographic constraints and the association of culture within their neighborhood. Eigenheer compared perceptions of America by contrasting mental maps drawn by students in Nottingham, England and Sacramento, California (1987). Eigenheer found that children’s views were influenced by television show. Using a child’s hand-drawn maps can reveal changes in behavioral attitudes of the mental mapper (Aitken and Bjokklund 1988).

This study compares mental maps drawn before and after an environmental education activity. Mental maps can assist in identifying the positive or negative
accounts of how humans have identified their sense of place with nature. In essence, mental maps allow us to learn about the mental mapper’s environmental perception through visual and silent communication. In our study, we expect to find that the students will draw more natural features after the environmental education activities.

**Study Site**

This study is centered in California’s northern San Joaquin Valley. Orville Wright Elementary School is located in the Airport Neighborhood on the periphery of the City of Modesto in Stanislaus County (Figure 1). In Stanislaus County, 14.2 percent of individuals live below the poverty level, with 15.4 percent of Hispanic residents and 22.1 percent of Asian residents living below the poverty level (American Community Survey 2016). In the northern San Joaquin Valley, many Hispanic and Southeast Asian residents live in poor disenfranchised communities. Southeast Asian and Hispanic people are commonly employed as farm laborers in the San Joaquin Valley (Walker 2004). In Stanislaus County only 37.5 percent of residents are high school graduates (including equivalency) and less than 5 percent have a Bachelor’s degree or higher (American Community Survey 2016). In 2008, nine percent of northern San Joaquin Valley Hispanic residents had earned a university degree (Hauselt and Helzer 2012). Hispanic people have the highest drop-out rate in higher education of any large demographic group in the United States (Zalaquet 2006). From 2001 to 2012, schools in the northern San Joaquin Valley had an increase in the percentage of the English Language Learners (ELL) from approximately 20 to 25 percent (Pogue et al. 2014).
The Airport Neighborhood is located between two of Modesto’s major industrial development centers: the Modesto City-County Airport and the E&J Gallo Winery (Figure 1 & 2). This industrial area of Modesto includes a mixture of residential housing, rural farm land, with small shops and liquor stores (Figure 3). The south-side of the neighborhood is bordered by the Tuolumne River and the Tuolumne River Regional Park. Orville Wright Elementary (K-6th grade) is at the center of this neighborhood. It is a *Title One School*, where over 95 percent of the students receives Free and Reduce Lunch (Ed-Data 2017). Over 85 percent of the Orville students are Hispanic and over 45 percent are classified as ELL (Ed-Data 2017).
Figure 3. Airport Neighborhood in Modesto, California
METHODS AND PROCEDURES

This mental mapping project was conducted in partnership with the Tuolumne River Trust (TRT) and Orville Wright Elementary School. TRT is a non-profit organization with three locations: San Francisco, Modesto, and Sonora, California. The TRT’s advocates for environmental stewardship and education. TRT provides co-curricular, instruction for residents and school children, develops partnerships with stakeholders, and assists with restoration projects. For many years TRT has partnered with K-12 schools throughout the Modesto region, including Orville Wright Elementary School. During the 2016-2017 school year, TRT and Orville Wright Elementary partnered to provide in-class environmental education demonstrations and field trips to the Tuolumne River Regional Park. This mental mapping project examined the effects of one of the in-class TRT workshops and field trip for fifth graders at Orville Wright Elementary School.

To assess if the environmental education activity/field trip changed the perspective of the school children, I conducted a pre and post mental map activity. Children were asked to draw maps/pictures of their neighborhood in reference to the river before the classroom presentation and then a second map/picture of their neighborhood in reference to the river after the field trip.

I worked with TRT staff and the Orville Wright Elementary School fifth-grade teacher to obtain parental/guardian consent prior to the environmental education activity. This project was reviewed and approved by the California State University, Stanislaus’s Institutional Review Board (IRB) with special consideration
of working with children in schools. Working with the Orville Wright educator and the TRT environmental education coordinator, parental/guardian consent forms were available in Spanish and English (Appendix A). Additionally, on the day of the mental map activity we obtained verbal student assent to participate in the mental map study. We worked with fifth grade students that are approximately ten through eleven years old. The total class size was twenty-five students. Out of the twenty-five students, twenty-one students had signed permission to participate in the study. Out of the 21 students that had permission to participate in this study, all their mental maps were assessed.

In order to detect if a child’s sense of place in nature has shifted due to participating in the TRT and Orville Wright Elementary environmental education activity, students drew mental maps before and after the environmental education activity and field trip. The initial maps are important to establish a baseline (Hoeffel et al. 2013). For the pre-mental map activity participating students drew a picture of the Tuolumne River and the Airport Neighborhood before the environmental education activity began. Students were provided blank white paper and colored pencils. Students were asked to draw a picture of the Tuolumne River and the Airport Neighborhood and to provide details. The pictures were to include 10-15 objects and/or “emojis”. Students were given 10 to 15 minutes to draw and color their maps. Students drew their initial maps in a classroom at the school site. Students were asked to write only the first and last initial of their name and current grade level on the back
of their map and the word “pre” on the back of their map. These maps were individually collected and placed in an envelope labeled “pre”.

Then the TRT staff began the in-class environmental education workshop. The TRT staff primarily spoke English during the workshop. ELL students may not have had the same conceptual understanding than non-ELL students. During the first activity the TRT staff had nine students come to the front of the classroom to create a water trail. This activity demonstrated the different amounts of fresh water and salt water on Earth. Students were instructed to measure an amount of salt water and fresh water. While measuring out the amount of fresh water per student, statistical facts were read aloud detailing the importance of fresh water.

The second in-class activity consisted of having the students create their own three-dimensional model of the Tuolumne River Watershed. TRT staff distributed building material such as aluminum foil, sponges, clear containers, empty water bottles, and yogurt cups to the students. The aluminum foil represented landscape such as mountains. The sponges represented the riparian forest vegetation. The empty bottle of water and yogurt cup were used to simulate rain fall. The purpose of this activity was to inform the students of the passage of water through the Tuolumne River Watershed.

A week later the students, teachers, and TRT staff walked from the school site to the Tuolumne River Regional Park and participated in hands-on activities along the river for two hours. The students walked from the school to the river for approximately 15 minutes. At the river, students were broken up into smaller groups
that rotated to four stations: a nature walk, fish dissection, looking at aquatic creatures, and water sampling. Students were at each station for approximately thirty minutes. The nature walk involved having the students detect the sights and sounds of nature and TRT staff talked about riparian vegetation. The fish dissection consisted of having the students study the anatomy of fish species. At the third center students looked at native aquatic creatures and organisms. The last center involved collecting water samples of the Tuolumne River to detect phosphate.

The following day, we returned to the fifth grade classroom and had the students draw their post-maps of the river. Students were provided a second blank white paper and colored markers. They were asked to draw a picture of the Tuolumne River and the Airport Neighborhood. Students were asked to include 10-15 objects and/or “emojis” on their map. Students were provided up to 15 minutes to draw their pictures (mental map). Students were asked to write their first and last initial of their name and write the word “post” on the back. Once students were done with their picture (mental map), they were collected and placed in an envelope labeled “post”.

When evaluating the mental maps (pictures), the pre and post mental maps were reviewed individually to identify how a student associates with nature in their community before and after the co-curricular environmental education lesson. In order to identify the shift of a child’s sense of place in nature, both mental maps were matched with the correct set of student initials. Once both sets of mental maps were matched, the maps were also matched with the correct permission slip on file.
The mental maps were assessed by examining details such as the placement of people, hazards, amenities, detail of nature, and emotional icons. Positive map details included smiling faces, playing or working activities, plants, and animals. Negative details included hazards, violence, blank or upset faces, and trash. Neutral details include the school, cars, and airplanes (Table 1).

<table>
<thead>
<tr>
<th>Negative</th>
<th>Positive</th>
<th>Neutral</th>
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<tbody>
<tr>
<td>Violence</td>
<td>Happy Faces</td>
<td>Orville Wright Elementary</td>
</tr>
<tr>
<td>Winery</td>
<td>Vegetation</td>
<td>Airport</td>
</tr>
<tr>
<td>Trash</td>
<td>Tuolumne River</td>
<td>Planes</td>
</tr>
<tr>
<td>Sad Faces</td>
<td>Animals</td>
<td>Housing</td>
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<td>Fences</td>
<td>Legion Park</td>
<td>Vehicles</td>
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<tr>
<td>Gun</td>
<td>Sun</td>
<td>Markets</td>
</tr>
<tr>
<td></td>
<td>Clouds</td>
<td>Roads, Sidewalks, Road Signs</td>
</tr>
<tr>
<td></td>
<td>Blue Sky</td>
<td>People with blank faces</td>
</tr>
</tbody>
</table>

*Table 1. Division of Map Emojis and Icons*
A tally system for each map was used to categorize how many times a map element was used. Once all maps (pre and post), were tallied then each positive, negative, and neutral categories were averaged to represent the amount of detail per category. In order to compare the pre and post maps, elements were tallied that represented positive or negative “emojis” and neutral elements. Positive “emojis” consists of human characteristics such as happy faces, nature and various types of animals. Negative “emojis” consists of human characteristics such as sad faces, violence, fences, trash and industrial manufacturing centers. Neutral elements consists of buildings such as housing infrastructure, Orville Wright Elementary and the Airport. Five random maps were selected from this study to asses closer for the size and placement of the elements, and potential shifts in sense of place from the co-curricular environmental education activity with TRT.
RESULTS

Map Elements/Emojis

I categorized the “emojis” and objects/icons that the children drew on each map into positive, negative, and neutral elements (Table 1). Positive “emojis” consists of human characteristics such as happy faces, nature and various types of animals. Negative “emojis” consists of human characteristics such as sad faces, violence, fences, trash and industrial manufacturing centers. Neutral elements consists of buildings such as housing infrastructure, Orville Wright Elementary and the Airport. I calculated the average of the mental map elements (Table 2). I found an average of seven positive objects on the pre mental maps, and an average of twelve positive objects on the post mental map. I found an average of 0.90 negative objects on the pre mental maps, and an average of 0.67 negative objects on the post mental map. I found an average of 6.5 neutral objects on the pre mental maps, and an average of 5.8 neutral objects on the post mental map.

<table>
<thead>
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<th>Negative</th>
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<td>Pre</td>
<td>14.4 (SD 4.5)</td>
<td>7 (SD 6.6)</td>
<td>0.9 (SD 1.6)</td>
<td>6.5 (SD 4.5)</td>
</tr>
<tr>
<td>Post</td>
<td>18.6 (SD 8.7)</td>
<td>12.2 (SD 9.1)</td>
<td>0.67 (SD 1.4)</td>
<td>5.8 (SD 4.1)</td>
</tr>
<tr>
<td>Change</td>
<td>+4.2</td>
<td>+5.2</td>
<td>-0.23</td>
<td>-0.7</td>
</tr>
</tbody>
</table>

Table 2. Mean Changes in Types of Emojis and Icons
While studying the detail of the mental maps elements, the post mental maps had a greater number of objects. The post mental maps detail representation is 18.6 compared to 14.4 for the pre mental maps (Table 2). The overall mental maps structure reveal that there are 5.2 more positive icons and emojis compared to an average decrease of 0.23 negative icons and emojis on the mental maps. When identifying the change of neutral icons and emojis on the mental maps there were -0.7.

**Built versus Natural Core**

Most of the pre and post mental maps had a combination of human and environmental objects. However, more of the mental maps centered on the built environment of the Airport Neighborhood than on the Tuolumne River. Few maps included the Tuolumne River. Out of the twenty-one mental maps, five students included the Tuolumne River in their pre-mental maps. From the post mental maps, six students included the Tuolumne River. On the pre mental maps, the students drew a total of 46 people and 39 houses. Then, on the post mental maps the students drew a total of 46 people and 44 houses. The Airport was included on eight pre mental maps and five post mental maps. One pre mental map included E & J Gallo Winery, while the post mental maps did not include the winery. Orville Wright School was observed on 7 pre mental maps and on 5 post mental maps. The river park along the Tuolumne River was not included in any of the pre or post mental maps. Based on tallying the mental map, the environmental icons that appeared the most were trees, animals, and vegetation. The pre mental maps had a total of 32 trees, 8 various types of animals,
and 46 various types of vegetation. When studying the post mental maps there was a slight increase of the environmental icons. The post mental maps had a total of 41 trees, 36 various types of animals, and 46 various types of vegetation.

**Pre/Post Comparison**

I compared the change between the pre and post mental maps for shifts in the types of environmental/natural and human/built objects. After the environmental education exercise there was a decrease in amount of positive urban icons (such fewer drawings of the school) and there was an increase in the positive environmental icons (such as trees) (Figures 4 & 5). After the environmental education activity, the maps show a decrease in negative objects/icons (such as trash along the river or streets) (Figure 6 & 7). The decrease in negative urban icons was almost significant (p-value = 0.115). Lastly, there was a borderline significant increase of neutral urban details, such as cars (p-value = 0.0515) (Figure 8 & 9). With the exceptions of the decreases in negative urban icons and increases in neutral urban icons, the changes were not statistically significant. Students also wrote words on their maps. “Airport Neighborhood” was written three times. “Tuolumne River” was written five times on the mental maps. “Orville Wright” was written five times on the mental maps. By adding the text, the students reveal how they mentally refer to the space.
**Figure 4. Positive Natural Change**

**Figure 5. Positive Urban Change**
Figure 6. Negative Natural Changes

Figure 7. Negative Urban Changes
Figure 8. Neutral Natural Change

Figure 9. Neutral Urban Change
Close Analysis of a Subset of Maps

For a closer analysis, five pre/post pairs were randomly selected. The pre and post maps were compared. While studying the pre mental map number 1, there is a large representation of an urbanized neighborhood setting with a small tree peaking over the fence. In the post mental map of number 1, the student drew a more detailed representation of their neighborhood and include a bit more vegetation (Figures 10 & 11). For mental map number 5, the student drew an urban setting with their school, an airplane, housing, and people walking and driving. In the post mental map number 5, there are slightly more details (e.g. two more clouds and a sun) and the Orville Wright Elementary lawn is green (Figures 12 & 13). The pre mental map from number 7 focused on the river and has some details, such as 37 rocks drawn in the bed of the Tuolumne River. The post mental map number 7 is more detailed, with a sun, blue skies, and 72 rocks drawn in the Tuolumne River (Figures 14 & 15). Pre mental map number 13, has one tree with a few houses, while the post mental map number 13 includes vegetation, a blue sky and animals with people (Figures 16 & 17). The pre mental map number 20 had no vegetation, but the post mental map number 20 had two green (small and big) trees (Figures 18 & 19). Thus the post mental maps, with more details and natural/environmental objects, show possible signs of a shift in sense of place.
Figure 10. Pre Mental Map Number 1

Figure 11. Post Mental Map Number 1
Figure 12. Pre Mental Map Number 5

Figure 13. Post Mental Map Number 5
Figure 14. Pre Mental Map Number 7

Figure 15. Post Mental Map Number 7
Figure 16. Pre Mental Map Number 13

Figure 17. Post Mental Map Number 13
Figure 18. Pre Mental Map Number 20

Figure 19. Post Mental Map Number 20
Additional Observations

As students were participating in the eco-pedagogy activities with TRT, students conversed in English and Spanish. This was also reflected in the parent permission slips, with eleven signatures on the English Permission Slips and ten signatures on the Spanish Permission Slips (Appendix A). Based on the style of the signatures, it is probable that some students signed the permission slips. However, there were no Spanish words written on the maps.

The student’s discussions consisted of a mixture of positive and negative experiences with the Tuolumne River. For instance, one student told an environmental educator that the Tuolumne River flooded a family member’s house. Other students told the environmental educators that during the summer time, they will come down to the river to fish with their family members. Other students said this was the first time that they came to the river banks, because their families feel that this park is not safe.
DISCUSSION

The children in this study drew two sets of mental maps. These maps showed physical elements of the community, such as a market, street signs, and/or the rivers. These elements were typically a mixture of human and natural objects. They showed processes happening in space, such as a man jumping out of an airplane. These maps showed the spatial relationships between the objects: small, large, north, south, containment, etc. These maps showed the perceptions and feelings of the children. And the maps showed the imagination of the children (Soini 2001). The parts of the maps function together to tell a child’s story. Thus while the maps were analyzed by deconstructing the elements, I discuss them holistically.

The Community and the Environment

Mental maps are valuable tools for representing a person’s perception (Jung 2014). In this project I found the children generally represented natural elements such as trees, birds, dogs, bushes, the river, clouds, blue skies, grass, and the sun. Based on tallying the mental map, the environmental icons that appeared the most were trees, animals, and vegetation. When studying the post mental maps there was a slight increase of the environmental icons. For instance, there was an increase of total trees from 32 on the pre mental maps to 41 on the post mental maps. Interestingly, there was a large increase in the number of animals, from 8 on the pre-mental maps to 36 on the post mental maps. Birds were the most common animal. These icons don’t represent the entirety of the natural elements in the airport neighborhood (insects, nocturnal animals, rodents), but reflect what the children included in their worldview.
For decades geographers have used mental maps to study the relationship that humans have with their culture and the landscape (Gillespie 2010), and this study built on that literature.

The direct effect of the environmental education lesson was negligible on the mental maps. Few of the planned activities were depicted on the mental maps. For instance, children were shown petri dishes of tadpoles and bugs during the activity, but only one student drew aquatic organisms (probably tadpoles) on the post mental map. Another activity discussed invasive species along the river walk, but only one post map included water hyacinth in the Tuolumne River (Figure 15). Although the water hyacinth is noticeable for any November visitor to the River Park, the participant maybe added the water hyacinth due to the activity.

While the direct effect the environmental education lesson was negligible on the mental maps, I did see overall shifts in the representation of nature on the maps. After participating in the TRT co-curricular environmental education there was an increase in the detail of nature in the post mental maps. For example, one post mental map, contains additional environmental icons that were not present in the pre mental map: more rocks, green trees, a bird, the sun, and water hyacinth (Figures 14 &15).

Even on pairs of pre and post mental maps that did not have the Tuolumne River, I still saw increases in environmental icons. For instance, there were three pre maps, little to no vegetation or nature (Figures 12, 16 & 18). But the post mental maps of those students included noticeable environmental features such as trees and the sky (Figures 13, 17 & 19). This can possibly be related to when the students
participated in their nature hike and were asked questions about their environmental surrounding. We can make reference to this as their environmental cognition, since they are thinking of the way to organize and structure their map (Gillespie 2010). The more mobile that children are in their environment, the more thorough a person’s cognitive map is (Gillespie 2010). Thus, this is requiring the students to think critically about their environmental and physical surrounding.

These student’s pre and post mental maps consist of sidewalks with people walking or riding in vehicles to locations in the Airport Neighborhood. When counting the amount of people in the pre and post mental maps there 46 people on both. Even though there is a slight increase in natural elements in the post mental maps, there is an absence of having the children include themselves being in nature. For instance, these post mental maps do not involve having children pick up trash in their community. Instead these post mental maps primarily consist of people walking around to various locations in the Airport Neighborhood such as the school, Orville Wright, nearby houses, stores and industrial buildings.

Some of the post mental maps features grass along the sidewalks, a tree or bush near a building, and sites of clouds with a sun and birds. Participating in environmental education as a child is vital due to these children will be the ones making future decisions of environmental issues and problems (Carrier 2007). When studying the post mental maps of the urban settings I noticed that the students did gain some knowledge about the environment due to a tree or two. Environmental education does have a great effect on children’s well-being cognitively, physically
and socially (Strife 2010). Schools that offer environmental education programs to their students have increases in students test scores and GPA’s (Strife 2010).

**The Heart of the Community**

The Tuolumne River was not central to the children’s sense of place, despite being the major environmental feature in the neighborhood. However, the activity may have had some effect on the participants (at least in the short-term). In both the pre and post maps, children focused on the built and human space: houses, their school and the airport. Additionally, most maps included roads. Thus, from the student’s mental maps I conclude their built environment is a main important component of self-identifying with their sense of place. The peripheral nature of the river is also reflected in the school artwork. In the cafeteria of Orville Wright, a large mural is on the wall that states, “O.W.S. Respect, Responsibility, Perseverance”, with the city of Modesto and an airplane flying in the background. However, the mural does not include the Tuolumne River. In both pre and post maps, most children drew houses in the center of their maps. Prior to the activity three of the maps focused on the airport and the E&J Gallo Winery. These are spaces that the children do not use.

However after the activity, more students focused on spaces they actually lived and played in: Orville Wright Elementary School, their Houses, and the River. For instance one of the student’s mental map drew herself sun tanning in her front or back yard. Students drew themselves and other children walking from their house and crossing the road to walk to school at Orville Wright. The observed behavior that the children drew consisted of happy-face stick-people.
Developing a shared relationship with a child’s community and nature (wildlife and environment) can establish an individualized relationship for a child’s sense of place to occur (Aucion 2011). When the Orville Wright students were participating in their co-curricular environmental education, there were numerous positive discussions amongst the students and with the instructors, and students asked to stay longer. Students were intuitive in asking questions about the river flora, and were observed picking-up fallen leaves on the ground.

**Demographics and Language**

Research has revealed that one of the important components of capturing the Hispanic population to participate in environmental education is language (Hong and Anderson 2006). The Airport Neighborhood and Orville Wright Elementary School is a bilingual place. However this was not reflected in our results. Over 85 percent of the Orville Wright Elementary School students are Hispanic, and over 45 percent are classified as English Language Learners (ELL) (Ed-Data 2017). Although demographic and linguistic data were not systematically collected on the study participants, there were many children speaking a mixture Spanish and English. Some students spoke to each other in Spanish. During the environmental education activity along the river, there were only two Spanish speaking adults: one TRT environmental educator and one 5th grade teacher.

One of the environmental educators from TRT spoke Spanish with some of the ELL students. Despite the spoken Spanish, there were no Spanish words written on the student’s mental maps. Signs of bilingualism were absent on the student’s
mental maps. Language and sense of place are closely tied. Thus, the maps do not provide include the entirety of children’s sense of place. If the exercises with TRT staff had been performed in Spanish or had been truly dual language, then perhaps the outcome would have been different.

Parent participation in promoting environmental education is highly encouraged by the TRT and education advocates in general. Many of the Orville Wright parents speak Spanish as their primary language. Even though permission slips were written in English and Spanish, parental participation was non-existent. There were no parent volunteers during the classroom exercise. During the students fieldtrip to the Tuolumne River there were no parent chaperones. Many of the parents do not have the economic means to provide classroom support. A person’s sense of place has both elements of security and fear (Tuan 1990). Parents are important guides in shaping a child’s spatial security and/or fear. In polarized spaces, language can be an element of fear and/or security. So while the students may communicate with their family in Spanish, this element was removed during the environmental education activity. Perhaps future studies should encourage more parent participation during field trips, such as by holding the activities in the evenings or weekends. Additionally, environmental educators and teachers could invite parents to participate, instead of just sending permission slips.
CONCLUSION

The students had fun during the environmental education activity, but minimal changes in their environmental perceptions were observed in the mental map. As the students rotated from the stations set up from TRT volunteers and staff, the children were exposed to environmental vocabulary and experiential activities at the river. However, I recommend on-going participation in environmental education programs with the TRT for the children at Orville Wright to strengthen their relationship with nature. Developing long-term partnerships between co-curricular environmental education organizations and low-income schools would improves the access the Orville Wright students have to environmental education and activities. To further integrate the environmental lessons, the environmental education curriculum should be integrated into other subject’s matters that are taught in the classroom, such as the integration of environmental education in the Next Generation Science Standards (NGSS Lead States 2013). Additionally, the school and the environmental organizations could develop multi-year projects that students participate in from kindergarten-sixth grade. Such projects might necessitate a campus environmental center. Ideally, this would then allow the environmental education program staff to allocate more time to spend with the children outside with nature. Thus, the children’s environmental knowledge will be strengthened from both educational entities.

Another recommendation I developed from this project was to not only focus on one peripheral environmental feature, such as the Tuolumne River, but to also develop environmental education that holistically integrates the community. In the
mental maps, several students drew more wildlife near their homes (e.g. birds) than at the river. Their homes were often surrounded by trees. The students more often placed themselves near their homes, not the river. Perhaps, an environmental project should focus on the natural aspects of their school yard, homes, and roads. Instead of imposing an outsider’s view of the neighborhood, a project focused on the school and houses would reflect the starting point of how students see their neighborhood. For instance, students could measure air quality or water-run off quality at their school; and then connect their home to the river. Such project could be connected with other service projects in the area such as Habitat for Humanity.

Lastly, I recommend that future projects be bilingual and be more welcoming for the parental guardians of the students. Developing parent-friendly activities would improve the school-home connection of the environmental education. Over half of the students at Orville Wright Elementary as classified as having English as a Second Language (ESL) (Ed-Data 2017). As such, many of the parental guardians were probably not native-English speakers. Additionally, some of the parental guardians may not have basic reading competency in English or Spanish. While I sent home permission slips in Spanish and English for our study, and one of the TRT volunteers spoke with the children in Spanish, overall the study did not reflect the bilingual nature of the community. It was not surprising that the student’s mental maps did not include any Spanish language words or symbols. To better integrate the goals of the environmental education project onto the worldview of the students, I recommend developing dual-immersion environmental education activities. For instance, have
half of the stations with instructions and outcomes in Spanish. Additionally, educational activities should include school-home connections that students can share with their parental guardians. For instance, have the students create something that they can take home, or develop a display that parental guardians could view outside of school hours, such as a mural or poster project.

In the United States, environmental education is still lacking (Strife 2010). Having children participate in environmental education effectively at a continuous young age is imperative since a child’s attitude about the environment starts to develop early (Carrier 2007). However, there are both social and economic constraints to environmental education, especially for disenfranchised students. This study showed that short-term, co-curricular environmental education can minimally shift a child’s mental perceptions of their environment. Great changes would probably result if such activities were long-term, better reflected their neighborhood, and were bilingual.
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REFERENCES


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Last accessed 5 May 2018.


APPENDIX
APPENDIX A

PARENTAL/GURADIAN CONSENT FORMS, ENGLISH AND SPANISH

Parental Consent Form

Dear Participant:

You are being asked to allow your child to participate in a research project that is being done to fulfill requirements for a Master’s of Science in Interdisciplinary Studies at California State University, Stanislaus. We hope to learn about the possible changes in a child’s sense of place that occur when a child participates in environmental education programs. If you consent, your child will be asked to draw two outdoor pictures with myself, the school staff, and the Tuolumne River Trust staff. The first picture will be drawn before their environmental education lesson during school. The second picture will be created after their fieldtrip at the Tuolumne River. Your child would receive about 10-15 minutes to draw their pictures. Your child would be asked to write their initials of their first and last name, and their current grade level on the back of their pictures. Approximately 30 children will participate.

There are no known risks to your child for participation in this study.

It is possible that your child will not benefit directly by participating in this study. The information collected will be protected from all inappropriate disclosure under the law. All data will be kept in a secure location. After the study, all of the pictures will be stored in a locked CSU Stanislaus faculty office for three years. My faculty sponsor and I will be the only researchers that has access to the pictures. Images of some of outdoor pictures will be included in the study publications.

There is no cost to you and your child beyond the time and effort required for your child to complete the outdoor pictures described above. Your consent for your child’s participation is voluntary and you are welcomed to be present during the study. Refusal to consent for you child’s participation in this study will involve no penalty or loss of benefits. You may withdraw your consent for your child’s participation at any time. Your child will still be able to participate in the Tuolumne River Trust fieldtrip even if he or she does not participate in the picture drawing activity.

If you agree to allow your child to participate, please indicate this decision by signing below. If you have any questions about this research project please contact me, Heather Lewis, at Hlewis1@csustan.edu or my faculty sponsor Dr. Peggy Hause at (209) 667-3557 or Phauselt@csustan.edu. If you have any questions regarding your rights, your child’s rights, and your child’s participation as a research subject, please contact the IRB Administrator by phone (209)667-3493 or email IRBAdmin@csustan.edu.

Sincerely,
Heather T. Lewis
Graduate Student
I have read and understand the information provided above. All of my questions, if any, have been answered to my satisfaction. I consent for my child to take part in this study. I have been given a copy of this form.

Student Name Printed ________________________________
Parent Signature _______________________________ Date _______
Parents Printed Name _______________________________
Formulario de Consentimiento Paterno

Estimado Apoderado,

Se le solicita permitir a su protegido participar en una investigación que se está conduciendo para completar los requerimientos de una Maestría en Ciencias en Estudios Interdisciplinarios en California State University, Stanislaus. Esperamos aprender sobre los posibles cambios en la percepción del espacio que ocurren cuando el niño participa en programas de educación ambiental. Si usted lo consiente, se le pedirá a su protegido que dibuje dos mapas del exterior conmigo, con el personal del programa extracurricular, y con el personal de Tuolumne River Trust. El primer mapa se dibujará durante sus clases extracurriculares, antes de sus lecciones de educación ambiental. El segundo mapa será creado después de su expedición al Rio Tuolumne. Su protegido recibirá entre 10 y 15 minutos para dibujar sus mapas. Se le pedirá que no ponga su nombre en sus mapas. En cambio, se le pedirá que escriba las iniciales de su nombre y apellido, y su grado escolar en el reverso de sus mapas. Aproximadamente 30 niños participaran en el estudio.

Este estudio no constituye ningún risco conocido para usted o su protegido. Es posible que usted o su protegido no se beneficien directamente por participar en este estudio. La información colectada será protegida de toda divulgación inapropiada por ley. Los datos serán mantenidos en un local seguro. Después de la culminación del estudio los mapas serán almacenados bajo llave en una oficina en CSU Stanislaus, por un periodo de tres años. Mi asesora académica y yo seremos los únicos con acceso a los mapas. Imágenes de algunos de los mapas serán incluidas en las publicaciones del estudio, pero las iniciales de los nombres serán borradas.

No hay ningún costo para usted y su protegido además del tiempo y esfuerzo requeridos para que su protegido complete los mapas descritos previamente. Su consentimiento para la participación de su protegido en este estudio es voluntario y usted es bienvenido a estar presente durante el estudio. Negar su permiso para la participación de su protegido no resultará en ninguna penalidad o pérdida de beneficio. Usted puede retirar su permiso en cualquier momento. Su protegido podrá participar en la expedición de Tuolumne River Trust aunque no participe en la actividad de dibujar mapas.

Si permite que su protegido participe, por favor indique esta decisión firmando abajo. Si tiene alguna pregunta relacionada a esta investigación por favor en contacto conmigo, Heather Lewis, a través del e-mail Hlewis1@csustan.edu, o con mi asesora académica Dr. Peggy Hauselt en el teléfono (208) 667-3557 o en el e-mail Phauselt@csustan.edu. Si tiene alguna pregunta con respecto a sus derechos, los derechos de su protegido, y la participación de su protegido como sujeto de investigación, por favor contacte a la Administración IRB por teléfono (209) 667-3493 o email IRBAdmin@csustan.edu.

Cordialmente,

Heather T. Lewis
Estudiante de Maestría

He leído y entiendo la información aquí providenciada. Todas mis preguntas, si he tenido alguna, han sido respondidas a mi satisfacción. Consiento que mi protegido a participe en esta investigación. Se me ha entregado una copia de este formulario.

Nombre del Estudiante con Letra de Imprenta
Firma del Apoderado _________________________________
Fecha ______________________________
Nombre del Apoderado con Letra de Imprenta __________________________________________