

Investigating Children's Field Trip Experiences Through Sketch Maps

Shadi Maleki*

Clark University

Emily Warren

Texas State University

Ronald R. Hagelman III

Texas State University

Aspen Navarro

Texas State University

Miranda Wait

The Meadows Center for Water and The Environment, Texas State University

*Corresponding author, Shadi Maleki, SMaleki@clarku.edu

Accepted August 31, 2021

Abstract

Research related to the ways in which children learn, perceive, and engage with nature remains ongoing, but there is a need for new methods of investigation and analysis into this important topic. This study examines children's representations of nature through the examination of maps drawn by 1st-8th grade students following a school-sanctioned field trip at the Meadows Center for Water and the Environment at Texas State University in San Marcos, Texas. Data were collected through an interactive process which encouraged children to observe nature through different activities organized in the context of field trips. At the end of the field trip, participants drew a map of their experience and explained the elements included in their maps. Over 700 maps were analysed to assess students' representations of their field trip experiences as well as their cartographic skills. Overall, this study found that children have positive emotions to nature and natural elements. Also, using sketch maps to explore students' field trip experiences offers a robust education strategy and can render valuable quantitative data and qualitative information on children's outdoor experiences and cartographic skills.

Keywords: environmental education; children's geographies; children's drawings, informal science education, sketch maps, nature mapping

Introduction

Previous research indicates outdoor activities that encourage children to experience nature can positively impact a child's overall wellbeing (Adams & Savahl, 2017) and can help form positive attitudes toward nature lasting well into adulthood (Collado & Corraliza, 2017; Otto & Pensini, 2017). However, in rapidly urbanizing and technologically enabled communities around the world, children's opportunities for spending time in natural settings can be limited. Informal environmental education programs, such as nature field trips, can motivate children to get involved in nature activities while spending time outdoors. Our study proposes a method for data collection that leverages school-organized field trip experiences with hand drawn *sketch maps* (Harwood & Rawlings, 2001; Wilmot, 2002) and written descriptions to assess children's perceptions of their field trip experiences. In addition to providing a platform for teaching basic maps skill, both quantitative data and qualitative information can be garnered through the mapping exercise to gain insights into the individual and group field trip experiences.

Sketch mapping and drawing are frequently used to capture children's understanding of various concepts as they help capture children's internal thoughts and their interpretation of a phenomenon (Söküt Açar *et al.*, 2019). Also, these methods help children to express their thoughts more spontaneously about what they observe whether it is a phenomenon or interaction between various elements (Villarroel *et al.*, 2018). Drawing is sometimes accompanied by writing, known as the 'draw and write' technique, allowing children to explain their drawings and/or provide extra information (Ahi & Atasoy, 2019).

This study adopted a mixed-method design under a phenomenographic framework (Feldon & Tofel-Grehl, 2018; Kalvaitis & Monhardt, 2012) to explore children's experiences of nature during an educational field trip. To guide our analysis, we developed the following research questions leveraging both quantitative data (Q1) and qualitative information (Q2) from our sample of children's maps:

- Q1: What are the most common field trip elements in children's maps?
- Q2: What are the qualitative themes emerging from children's descriptions of their maps?
- Q3: What cartographic features do children use in their maps?

Question 1 renders nominal data reflecting the children's propensity to include various field trips elements in their sketch maps, offering some insight into what characteristics of the field trip resonated with them the most. Question 2 relies on the qualitative values expressed in the written comments and descriptions that children provided with their field trip sketch maps. Quantitative and qualitative characteristics of these data and information were considered alongside visual examples culled from the map database to better understand how

children reflect on their own experiences during the nature-based field trip. The third research question renders nominal data reflecting the children's propensity to include cartographic design features reflective of their Texas Essential Knowledge and Skills aligned geographic education standards.

Background

Children and Nature

Today with alternative play options due to video games, children have fewer opportunities to experience nature, play or learn about science outdoors, and are less motivated to visit green spaces (Ramsay *et al.*, 2017). This phenomenon is known as *nature deficit disorder*, a term coined by Richard Louv (2008) to describe the negative effect of children being disconnected from nature and natural processes. Children who spend more time in nature seem to have better overall health (Hordyk *et al.*, 2015). Spending time in nature can also improve children's sense of autonomy, creative thinking, and scholarly performance (Collado *et al.*, 2016; Louv, 2011; Matsuoka, 2010). It has been shown that these programs improve children's cognitive abilities and psychological health (Thorburn & Marshall, 2014). By providing direct experience in natural settings, these programs can also enhance children's attitudes to environmental stewardship (Kinder *et al.*, 2015). Thus, it is crucial for children to have the opportunity to explore nature within their communities in order to develop their own sense of responsibility toward nature (Asah *et al.*, 2018).

Experiential Learning through Field Trips

Field trips have been shown to be an effective method of informal learning (DeWitt & Storksdieck, 2008; Hoover, 2020), even if they are short in length (Sellmann & Bogner, 2013). Research indicates that children develop a deeper understanding of nature after a direct exploratory field experience (Ramlo, 2019). Field trips have been found to be associated with positive emotions and memories in children (Heras, Medir, & Salazar, 2020). Even in the case of some adversities and discomfort, children tended to remember these as positive personal stories. Children appreciate field trips because they are often highly engaging and hands-on (Hoover, 2020). Even children, who had negative experiences in the previous field trips often prefer to try them again (Lai, 1999).

In general, children like outdoor learning activities because they are realistic, interactive, and fun (Hudak, 2003). Thus, outdoor education programs often have positive effects on children's understanding of natural elements (Lindemann-Matthies, 2002). These experiences can change children's view of nature in a significant way. For example, a 11-day study with 7th grade students in Turkey found that students' perceptions of water elements and living organisms changed noticeably after students had been immersed in an intensive field trip

experience about water features and pollution in a natural setting (Genc, Genc, & Rasgele, 2018).

Children's Understanding and Feelings About Nature and Wildlife

Children's understandings, perceptions, and preferences about wildlife and natural elements are shaped primarily by their nearby environment and the geography of the place where they live (Wals, 1994; Yilmaz & Kahraman, 2015). For example, a study found that children from the Bahamas showed stronger preference for aquatic species, invertebrates, and lizards than children from North Carolina (Shapiro *et al.*, 2017). On one hand, children in urban areas are more inclined to recognize the differences between natural and human-made settings and are more likely to associate a higher aesthetic value to the presence of other people in open spaces. In contrast, children in rural areas are more likely to associate a lower aesthetic value with human presence (Muderrisoglu & Gultekin, 2015). Overall, engaging children in field trips encourages physical contact with wildlife and can play an important role in improving children's understanding and attitudes towards wildlife, including unpopular species such as snakes or other reptiles (Ballouard *et al.*, 2012).

Like adults, children are more likely to prefer mammals and birds to invertebrates and reptiles; however, differently from adults, children seem to like certain types of animals such as butterflies and turtles (Borgi & Cirulli, 2015). Some studies found different preferences among children based on gender. For example, girls seem to more likely prefer cute animals like pets, contrary to boys, who seem to prefer native and exotic wild animals (Schlegel & Rupf, 2010; Shapiro *et al.*, 2017). Age (Ahi & Atasoy, 2019), culture (Gillespie, 2010), and experiences with hazards (Pellier *et al.*, 2014) can all influence the way children relate to nature.

This paper presents one easily deployed method for gathering the expressed perceptions of students who have participated in a field experience. The method renders quantitative data and qualitative information reflecting on those features and ideas that resonated with the children immediately following the field experience.

Methods

This study used a mixed-methods approach to explore participants' experiences during a school-sponsored, nature-based educational field trip. This approach renders quantitative data regarding the types of features represented in the maps and qualitative insights through the student's own written comments and map design. Two methods of data collection were used: 1) sketch maps and 2) written descriptions.

Written descriptions were collected to aid in the interpretation of the hand drawn maps. These descriptions were also helpful to capture further details

that would not have been understood only by looking at the maps. The combination of sketch maps and written descriptions allowed us also to explore children's field trip experiences through their personal representations. One benefit of packaging our data collection within an educational field trip learning module is that it allowed for us to gather interpretations of their field trips among a large number of children in a relatively brief amount of time; as opposed to other qualitative methods such as interviews, which might render more robust information.

Participants

The participants of this study were 1st-8th grade schoolchildren whose teachers signed up for a school field trip at The Meadows Center for Water and the Environment at Texas State University in San Marcos, Texas (Meadows Center) between July and December 2017. The participants were from the cities of Weslaco and San Antonio, the small towns of Comfort and Roskany, and some were home schooled. The group types of participants consisted of school programs, public schools, home school, summer camps, boy scouts, and girl scout groups. A total of 850 students participated in the field trip of which 762 submitted their maps for our research. Eighty (80) students were elementary students (1st and 2nd grades), 15 students were from a local girl scout group (1st-8th grades), 68 students were home schooled (3rd-8th grades), and 687 students were in middle-school (5th-8th). Each visiting school group to the Meadows Center selected the date and times of their field trip, and the activities that fit best within their desired timeframe.

Education Coordinators Role and Training

In the weeks prior to field trip bookings, training sessions were organized for Meadows Center Education Coordinators to ensure that appropriate information was collected from, and provided to, teachers prior to the field trip tours. A data collection protocol was prepared and provided to each Education Coordinator. This helped the data collection to remain consistent. Education Coordinators were trained on the research goals, meaning of nonidentifiable data collection, and an overview of the importance of following the data collection protocol. They also provided the teachers with the required information about the educational and research aspects of the mapping activity.

Interpretive Guides Role and Training

Interpretive Guides are Meadows Center employees who deliver the educational modules during field trips and are typically Texas State University undergraduate students. Prior to the field trips, the Interpretive Guides received appropriate training on the data collection protocol, research goals, nonidentifiable data collection, and an overview of the importance of following the data collection

protocol for quality research. All field trips were led by two Interpretive Guides, who led the group through different activities located throughout the Meadows Center. The Meadows Center Education Coordinators supervised the field trips and the mapping activity. The Interpretive Guides also collected the maps and archived them digitally.

Field Trip Options

All field trips included a ride on a glass-bottom boat, which allowed participants to look down into Spring Lake and to view the underground springs that supply the lake. Other activities that participants could choose from included a tour of the wetlands and the Discovery Center Aquarium, where the participants can view examples of the plant and animal species inhabiting the springs. Other hands-on activities included All the Water in the World, Water Conservation Game, Bug Picking. Each field trip was on average two and half hours long, and participants got involved into two to four activities previously selected by their teacher. These activities were created to teach participants age-appropriate environmental and applied STEM concepts, the value of the natural world, the story of water as a connector between natural systems, the causes and consequences of natural systems impairment, and what each participant can do to mitigate impairments (Appendix I).

Data Collection

Data Collection Instrument

The data collection instrument was a letter size white sheet of paper (8.5" x 11"). The front of the sheet included two blank spaces at the top left corner for children to write their teacher's and school's names, and the rest of the space to draw a map of their field trip (Figure 1. A). On the back of the sheet (Figure 1. B), children were asked to explain what they included in their map.

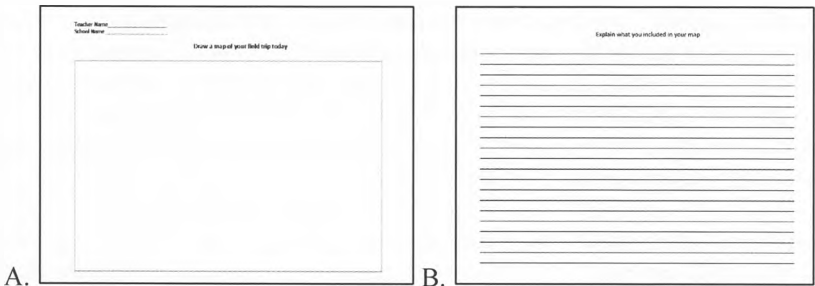


Figure 1. Figure A and B show the data collection instrument (8.5" x 11" paper). Section A shows the front page where children were asked to draw a map of their field trip. Section B shows the back of the page, where children were asked to explain what they included in their maps.

Mapping Activity

The sketch mapping method is frequently used to learn about children's understanding of the environment (Söküt Açar et al., 2019). Therefore, this research adopted the sketch mapping method to learn about participants' experience of an educational field trip. Prior to the formal data collection, we conducted a pilot study in April of 2017 to check the logistics and finalize the activity procedures. The pilot study proved to be helpful for testing the data collection instrument based on the feedback received from interpretive guides. Also, the language used in the statement and other statements during the mapping activity were revised by the Institutional Review Board (IRB) at Texas State University to be appropriate and easy to understand for children in the 7 to 14-year-old age range.

The formal data collection started occurred between July 5 and December 15, 2017, during which 765 maps were collected. The mapping activity happened during the field trip, but not always in the same order. The duration and order of the activities changed based on the activities that teachers signed up for when they registered their class. The mapping activity took between 15 to 25 minutes, and it was conducted in three phases in an outdoor setting.

In the first phase, the interpretive guides explained the purpose and procedures of the activity to the participants. Interpretive Guides then asked the participants to take up to 15 minutes to draw a map of their field trip. In the second phase, the participants were asked to turn the sheet over and answer the open-ended question explaining what elements they included in their maps. This phase took about 5 minutes. At the end of the activity, the maps were collected and scanned. Children were offered the chance to keep their maps if they wanted to. In the third phase, after collecting participants' maps, interpretive guides took about 10 minutes to involve the participants in a learning module about cartography and maps by showing the participants several examples of thematic maps and discussing the importance of cartographic elements. This phase was purposely done after the mapping activity to avoid influencing participants' perceptions of the fieldtrip in any ways.

Analysis

The mapping instrument was designed to capture data that could be analysed both qualitatively and quantitatively. The data analysis was organized in two phases. First, children's maps were analysed using visual content analysis. Also, Chi-square statistical testing of goodness-of-fit with an interval level of $\alpha = 0.05$ was employed to check the significance of the frequency analysis results. In the second phase, the written descriptions that accompanied the maps were qualitatively analysed using content analysis techniques to capture further insight into children's experiences of their field trip.

Visual Content Analysis of Children Maps

Visual content analysis is used to examine children's perceptions and experiences of a phenomenon (Rose, 2016). To analyse children's maps, two researchers conducted the visual content analysis cross-checking every map for the type and number of elements. A total of 762 maps were visually analysed, and a coding matrix was developed by identifying all the features included in the children's maps. The coding matrix included a-priori codes based on the existing literature, as well as emerging codes. A sample of maps was coded and discussed in depth by a team of researchers to eliminate any inconsistency in interpreting maps. During the data entry, the codes were updated continually until an exhaustive list of all the features present in the maps was obtained.

Three main coding categories were identified: natural environment, built environment, and people. The natural environment refers to non-human living (flora and fauna) and non-living species (sky, sun, and water), while the built environment refers to all types of facilities provided for human use (trails, buildings, boats, vehicles, and roads). The third category, people, refers to the presence of people (the map authors themselves or other people) in the maps.

Content Analysis of Written Descriptions

A total of 762 maps were collected but only 491 contained a written description on the back of the map. The rest of the maps (271) were left blank. The written descriptions were qualitatively analysed to identify the main themes and subcategories. Word frequency analysis and tag clouds were also conducted using NVivo 11, a QSR computer software program.

Results

Elements of Children's Maps

Children's maps were analysed based on the type and frequency of natural and human-made elements included in their maps (Table 1). The quantitative results are organized under four themes: non-human living, non-living elements, built environment, and people. These themes were further categorized under ten subcategories: flora, fauna, sun, other sky elements, water, boats, trails, buildings, roads, and vehicles. Water (as river or lake) appeared to be the most frequent natural feature (89.4%) in children's maps. The second most frequent feature in the maps was buildings (74.7%), referring to Spring Lake Hall, the main building of the Meadows Center, and where Discovery Hall and the aquarium are located. Trails (63%) and boats (62.3%) were the next frequently drawn features by children. Children also included flora (52.8%) and fauna (31.9%) that they observed either in the environment or through different activities. A small percentage of children (12.2%) drew people, including themselves, their friends, teachers, and environmental interpreters.

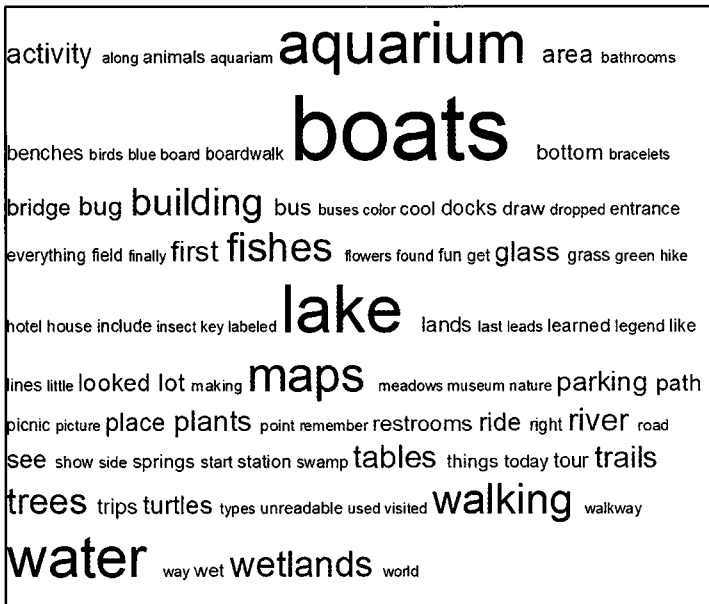
The Chi-square statistical test was used to test the significance to the frequency results. As Table 1 shows, all frequency results were significant except for flora.

Table 1. Frequency and Chi-square results related to natural and built environment elements. A confidence level of 95% is considered for the results.

	N	%
Natural Environment		
Non-human living		
Flora <i>Chi Square = 2.31 (P = 0.128)</i>	402	52.8%
Fauna <i>Chi Square = 99.9 (P = 0.000)</i>	243	31.9%
Non-living elements		
Sun <i>Chi Square = 599.7 (P = 0.000)</i>	5.6	5.6%
Other sky elements <i>Chi Square = 691.7 (P = 0.000)</i>	18	2.4%
Water <i>Chi Square = 472.4 (P = 0.000)</i>	681	89.4%
Built Environment		
Boats <i>Chi Square = 46.3 (P = 0.000)</i>	475	62.3%
Trails <i>Chi Square = 51.4 (P = 0.000)</i>	480	63.0%
Buildings <i>Chi Square = 185.5 (P = 0.000)</i>	569	74.7%
Roads <i>Chi Square = 292.3 (P = 0.000)</i>	145	19.0%
Vehicles <i>Chi Square = 365.8 (P = 0.000)</i>	117	15.4%
People <i>Chi Square = 435.4 (P = 0.000)</i>	93	12.2%

Written Descriptions

Children's written descriptions were analysed using quantitative and qualitative analysis. The word cloud (Figure 2) uses size to show the frequency counts of the most popular words in the written descriptions. In addition to the single-word frequency, the word cloud shows various frequencies of word occurrences. The most common words were boats, lake, water, and river, followed by aquarium, fish, and animal. Participants used other words such as trails and trees to represent their hiking experiences along the trails while they walked through the wetlands and observed the surrounding environment. The least mentioned words were buildings, restrooms, and parking. These reflect features of the built environment onsite at the Meadow's Center. The word cloud also includes the 'making maps' expression, which shows children's interests in explaining their maps and mapping activity.



negative feelings were related to high outdoor temperatures as well as the duration of the field trip.

Table 2. Qualitative themes developed from the written descriptions. A total of 491 written descriptions were analyzed. About 14.5% of them reflected a positive feeling and 1.2% of them had a negative tone. The remaining 84.3% included neutral content such as a list of activities or places.

Themes	Description	Example Quotes
Positive feelings related to:		
1) Nature	Children's experiences of the field trip are centered mostly around an aesthetic appreciation of natural features seen during the trip. These features were referred to as specific elements such as the lake, river, trees, and fish or using a collective noun such as 'wildlife' or 'nature' itself.	"Amazing how nature is. The Meadow Center gives us an extraordinary introduction to Nature. There is all awesome lake, amazing aquarium and so much more. Here is a place to relax and have an awesome point of view of Mother Nature."
2) Favorite activity	Children explained their field trip experience based on which activity or natural feature was their favorite part of the field trip.	1) "I loved the glass boat ride." 2) "I put what I saw today. My favorite part of today was seeing the snake in the trees. I've always wanted to meet a snake and now I have."
3) Educational component	Children described their field trip experience explaining what they learned about nature and how it functions. Also, they associate their educational experience with a fun and pleasant field trip experience.	1) "We went there to learn about how everything needs water." 2) "We learned about endangered species." 3) "We went on a glass-bottom boat." 4) "We learned about all the water in the world and how it was split up." 5) "We learned about the water cycle. " 6) "We took part in an experiment. Notes: I used the

		numbers to indicate where we went when. This was a fun way to learn about some important stuff."
Negative feelings related to:		
1) Weather condition	Children reported that high temperatures affected their experience of the field trip.	"This map explains how hot our field trip is and what is here at our location. The sun is making us suffer and it's too hot here to even be here, but it's cool the things that we saw."
2) Amount of activities	Children stated that the field trip included too many activities than expected. However, high temperatures might be the reason why they felt tired.	"I felt like a fish eating paing. The other color was tan. It was hot outside only because I was outside. Too much work."
3) Duration of the field trip	Children reported that the field trip, including the traveling time to the Meadow Center, made the field trip to be lengthy.	"I included a green area which is for places where we been and pink area for areas I haven't been to, but I know exist. I prob. should have included the restrooms & other important necessary facilities, but I woke up @ 5 and I'm tired."

Children used the writing space on the data collection instrument differently. As Table 3 shows, some children used chronological order to explain what they did during different phases of the field trip. Other children did not follow a specific order and chose to describe instances of their field trip and mapping experience. Several children used this space exclusively to provide a descriptive legend as well as instructions for how to read their maps.

Table 3. Qualitative themes indicating to what purpose children used the written description space. A total of 491 written descriptions were analyzed. 16% of comments were written in a chronological order; 79% adopted a random format, and 5% were written in a form of a descriptive legend.

Chronologically	Children followed a chronological order to describe what they experienced during the field trip.	"1st - aquarium w/ turtles, fish, axolotl; 2nd - boat ride (very old) glass bottom, fish, plants; 3rd - Boardwalk & duck weed, cattail, 350 year old tree; 4th - bug/plant searching - cool babies bugs, fish; lake - cool lake with dope fish, turtles, birds, and plants; 5th - making a map of what we did."
Random	Children explained random instances of their experience and activities they got involved in during the field trip.	"I drew a bridge, water, and a house of education. I drew boats on top of the water and an aquarium and some benches were I'm at right now."
Descriptive legend	Children used the writing space to provide instructions for reading and interpreting their maps.	[black square] – "Parking lot/roads." [orange square] – "Paths." [pink square] – "Boat docks." [blue square] – "River." [red square] – "Aquarium." [green square] – "Entrance building." [purple square] – "scubing area."

The written descriptions provided an opportunity for the children to describe in their own words what they were conveying through their maps without influence from the researchers. Children used this space to explain what they included on their maps which resulted to be very helpful for interpreting their maps, as well as gaining more insight about their feelings and emotions. Interestingly, while many students tried to include all activities done during the field trip, some students explained only their favorite activities. Others provided a descriptive legend to help with understanding their maps.

Cartographic Elements of Children's Maps

Table 4 represents the frequency and Chi-square results related to cartographic features in children's maps. Only about 17% of children used basic cartographic

elements. Among these, the majority (65.4%) included text on their maps; slightly less than half (41.7%) used an overhead perspective, and about the same percentage (38.6%) used a combination of overhead and oblique perspectives. About 19% of children used only an oblique perspective, and less than 1% did not use any specific perspective. More than half of the children (51.6%) used multiple colors, and about 44% used one color only. A small group of children did not use color and chose to draw their maps using a black pencil (4.6%). Children maps were organized differently; a little less one-fifth of the maps (18.1%) used directional arrows to show the chronology, while the rest were drawn in a non-specific order.

Table 4. Frequency and Chi-square results related to basic cartographic features.

	N	%
Cartographic convention <i>Chi Square = 333.3 (P = 0.000)</i>	129	16.9%
Perspective <i>Chi Square = 330.1(P = 0.000)</i>		
Overhead	318	41.7%
Oblique	143	18.8%
Combination	294	38.6%
None	7	0.9%
Chronological order <i>Chi Square = 309.9(P = 0.000)</i>	138	18.1%
Text <i>Chi Square = 71.8(P = 0.000)</i>	498	65.4%
Color <i>Chi Square = 290.0(P = 0.000)</i>		
One color	334	43.8%
Multiple colors	393	51.6%
None	35	4.6%

Discussion

Children's experiences of their field trips were expressed in their written descriptions and maps. Children's maps shared common themes related to their experiences, but the type and frequency of features that children included in their maps differed significantly. The results are discussed under three themes to discuss research questions posed earlier in this article.

Nature Connection

Children described the natural landscape to which they were exposed during their field trip experience in ways that reflected their interactions with natural elements present on the landscape. This finding aligns with previous studies that found children's view of nature is rooted in their nature experiences (Yilmaz & Kahraman, 2015) and interaction with natural elements (Villarroel et al., 2018).

The fact that children included several natural elements, including flora and fauna, as well as non-living features such as sky, water, and sun in their maps showed a clear connection to nature. In addition, the prevalence of water elements in the maps showed the importance of Spring Lake in shaping children's experiences about the natural environment that they visited during the field trip. Also, the presence of boats in the maps referred to the experience of the glass-bottom boat ride on the lake, which is in line with the high presence of the lake feature in children's maps. Overall, the dominant presence of natural elements in children's maps confirms that a direct exploratory field experience helped children develop a deeper understanding of nature and its elements (Ramlo, 2019).

Positive and Negative Feelings about the Field Trip Experience

Children's written descriptions demonstrated a deep appreciation for nature, as described by words like "amazing," "awesome," and "love" about the lake and the surrounding environments. Most children expressed their positive feelings about memorable moments of the field trip. This is in line with Heras et al.'s study (2020) that found children showed positive emotions after being on a nature field trip. Even when they complained about something such as hot weather, the experience was overall positive for most participants. For example, they wrote "the hiking trail was HOT, but interesting" or "The sun is making us suffer and it's too hot here to even be here but it's cool the things that we saw." Similar to Lai (1999), these statements show that despite some difficulties and negative experiences most children remember the field trip as fun, educational, and interesting.

Children's written descriptions revealed further information about their feelings and emotions relative to the field trip. For example, one child wrote, "my favorite part of today was seeing the snake in the trees. I've always wanted to meet a snake, and now I have." As another example, many students mentioned discovering "new bugs" during the field trip. These results confirm the Ballouard

et al.'s (2012) finding that field experience can draw children's attention to unpopular species such as snakes; an experience that could rarely occur in the urban life.

The map symbols and the written descriptions showed that the buildings in children's maps were mostly representing the Meadows Center's main building, Spring Lake Hall, with the Discovery Hall and the aquariums, where children learned about endangered species and the important role of water for living ecosystems. Children's positive feedback about the learning aspect of the field trip was also shown in their written descriptions. Interestingly, children's descriptions showed particular attention to the historical value of the main building, which used to be a hotel in the past.

Some children focused their maps on a single favorite activity. For example, Figure 3 shows a clear focus on the glass-bottom boat ride and Spring Lake. Also, the natural environment is more dominant compared to the built environment as the number of natural features (fish, aquatic vegetation, lake, and the sun) exceeds the human-made features (boat). However, very few children included details about what they saw and observed during their visit to the Discovery Hall and the aquariums. This can indicate children's preference for outdoor activities compared to indoor activities. Other children who did not focus on a particular moment, used text and symbols to represent the activities, locations, and the environment they experienced during the field trip. Children even included details about the transportation from their school to the Meadows Center.

In some of the maps, the presence of nature was dominant (Figure 4). This was represented by using 1) a higher number of natural elements in the maps, 2) greater area occupied by natural features, and 3) larger symbol size for natural features. A small group of children drew people in their maps, but only a few specified who those people represented (e.g., Figure 5). Although this is not sufficient to draw any conclusions, it can be indicative of the increasing disconnect between children and nature (Louv, 2008) as children may view themselves separated from the natural world (Payne, 2014).

Cartographic features

Although Texas schools teach geography and elements of mapping every year, starting with the first grade, the results of this study raised questions regarding the effectiveness of cartography education in schools. Only a small group of children showed the ability to draw a sketch map that included basic map features such as a legend, north arrow, scale, and title. Geography curriculum developers and teachers can use this information to improve geography teaching and children's true knowledge.

Although a small number of children included a legend on their maps, many provided information about how to read their maps as well as a

descriptive legend on the back of their maps. The most accurate maps included realistic shapes of features, while several maps used imaginary shapes. However, future research is required to understand whether children's use of cartographic elements such as size, area, and the color was proportionally compatible with reality and whether it varies based on age or other demographic characteristics.

Sample of Children's Maps

A sample of children's maps is shown below to represent the diversity of their drawings discussed in the previous sections.

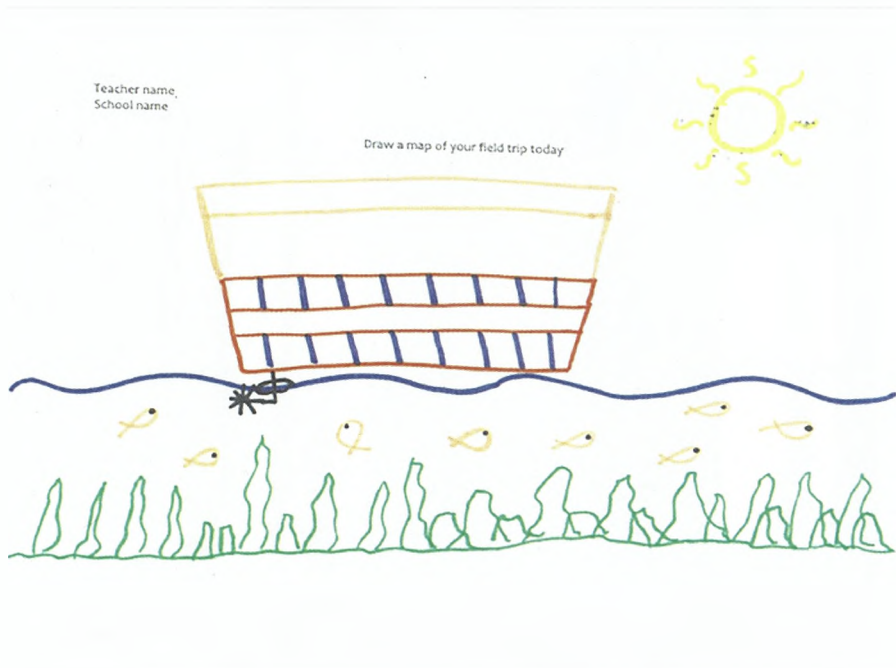


Figure 3. This map, represented in the form of a drawing, shows the sun, fish, aquatic plants, the lake, and both at the center. The dominance is with the natural features, and the focus of this picture is on the glass-bottom boat ride, the author's favorite activity.

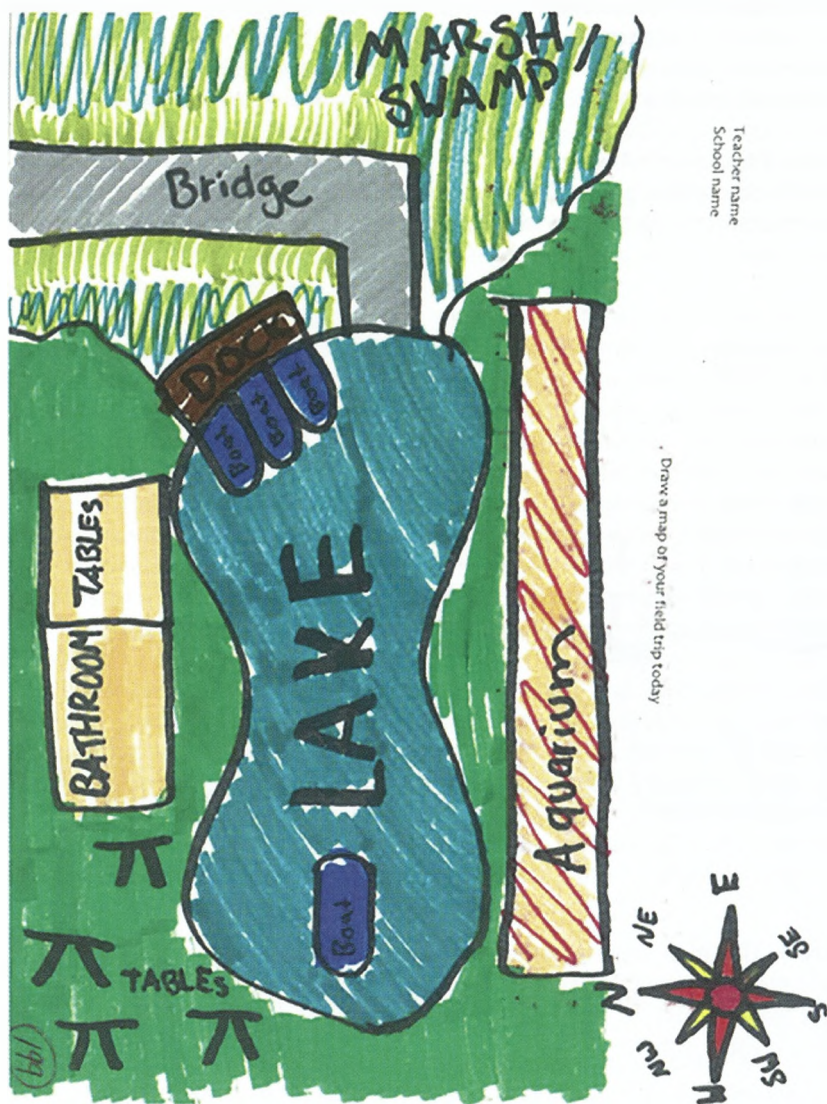


Figure 4. This map does not follow a chronological order and is drawn based on the locations that the author visited during the field trip. The colors and shapes match the true colors and shapes of the features. Despite the higher frequency of the anthropogenic features, the natural features occupy a larger area on the map with the lake is at the center.



Figure 5. This is a multi-color map with various natural and anthropogenic features. The lake occupies the largest area, and the natural features are more dominant. The map is mostly focused on the two most significant experiences related to the glass-bottom boat and the aquarium. Also, this map used text and design to provide information about the weather on the day of the field trip, which was a hot day (see the angry sun on the map). The author drew himself/herself in the lake to emphasize the frustration of being on a field trip on a hot day.



Figure 6. This map shows the field trip in a chronological order based on the field trip's activities. The map is a multi-color map, including various symbols to describe each activity and the location where the activity was conducted. The lake symbol has the largest size and occupies a larger area in proportion to other symbols. Also, the text is used to provide further explanation for the symbols, as well as the child's observations and thoughts.

Conclusion and Future Research

This study examined elementary and middle school children's representations of a nature field trip using sketch maps. Through an interactive process of data collection children were encouraged to observe natural elements and wildlife. In the next step, students were invited to draw a map of their experience and explain what elements they included in their maps. Children included mostly their observations of the main natural features, such as the lake and wildlife, related to the activities they conducted during the field trip. Interestingly, even though children were not asked to talk about their feelings, some children used the space on the back of their mapping sheet to express their feelings and experiences. However, the use of cartographic elements in children maps was limited. These results highlight the need for a re-evaluation of the effectiveness of the scholastic geography curriculum in Texas. Educators can use this information to focus more on their teaching strategies and children's learning processes to improve their geographic and cartographic knowledge. Overall, this study confirmed that nature field is an attractive informal education opportunity for children that combined with activities such as map making can become an effective tool for geography education. Nature field trips are valuable especially for children living in urban areas with limited access to experiencing nature. In addition to encouraging children connection to nature, these experiences are unique teaching/learning occasions in the outdoor environment. The mapping activity resulted to be an effective way for collecting children's experiences of nature through an interactive and joyful process.

One of the limitations of this study was the lack of access to individual student's grade. Due the IRB restrictions, the researchers did not require children to write any personal information on their maps. However, children were asked to write their grades but most of them forgot to do so. The individual grades would have been useful for cross grade comparison of the maps. Post COVID-19 restrictions, map collection will resume at the Meadows Center and future data collection will include additional student and school data and will open the door to further analysis of the role of grade level and school district demographics. Other limitations included the varying time, duration, and order of the activities. Future research intends to pay closer attention how these differences could potentially affect children's perceptions of the field trip and what strategies could be used to reduce these biases.

Acknowledgments

Many thanks to the staff and leadership of the Meadows Center for Water and the Environment at Texas State University, San Marcos, Texas. Their collaboration and commitment to student learning enabled the successful completion of the project.

References

- Adams, S., & Savahl, S. (2017). Children's discourses of natural spaces: Considerations for children's subjective wellbeing. *Child Indicators Research*, 10(2), 423-446.
- Ahi, B., & Atasoy, V. (2019). A phenomenographic investigation into preschool children's relationships with nature through drawings. *International Research in Geographical and Environmental Education*, 28(4), 281-295.
- Asah, S. T., Bengston, D. N., Westphal, L. M., & Gowan, C. H. (2018). Mechanisms of children's exposure to nature: Predicting adulthood environmental citizenship and commitment to nature-based activities. *Environment and Behavior*, 50(7), 807-836.
- Ballouard, J. M., Provost, G., Barré, D., & Bonnet, X. (2012). Influence of a field trip on the attitude of schoolchildren toward unpopular organisms: an experience with snakes. *Journal of Herpetology*, 46(3), 423-428.
- Borgi, M., & Cirulli, F. (2015). Attitudes toward animals among kindergarten children: species preferences. *Anthrozoös*, 28(1), 45-59.
- Collado, S., & Corraliza, J. A. (2017). Children's perceived restoration and pro-environmental beliefs. *Journal of Asian Behavioural Studies*, 2(2), 1-12.
- Collado, S., Íñiguez-Rueda, L., & Corraliza, J. A. (2016). Experiencing nature and children's conceptualizations of the natural world. *Children's Geographies*, 14(6), 716-730.
- DeWitt, J., & Storksdieck, M. (2008). A short review of school field trips: Key findings from the past and implications for the future. *Visitor studies*, 11(2), 181-197.
- Feldon, D. F., & Tofel-Grehl, C. (2018). Phenomenography as a foundation for mixed models research. *American Behavioral Scientist*, 62(7), 887-899.
- Genc, M., Genc, T., & Rasgele, P. G. (2018). Effects of nature-based environmental education on the attitudes of 7th grade students towards the environment and living organisms and affective tendency. *International Research in Geographical and Environmental Education*, 27(4), 326-340.
- Gillespie, C. A. (2010). How culture constructs our sense of neighborhood: Mental maps and children's perceptions of place. *Journal of Geography*, 109(1), 18-29.
- Heras, R., Medir, R. M., & Salazar, O. (2020). Children's perceptions on the benefits of school nature field trips. *Education*, 3-13, 48(4), 379-391.
- Harwood, D., & Rawlings, K. (2001). Assessing young children's freehand sketch maps of the world. *International Research in Geographical and Environmental Education*, 10(1), 20-45.

- Hoover, K. S. (2020). Evaluating impacts of a wetland field trip: a case study with urban middle school students. *Applied Environmental Education & Communication*, 1-18.
- Hordyk, S. R., Dulude, M., & Shem, M. (2015). When nature nurtures children: nature as a containing and holding space. *Children's Geographies*, 13(5), 571-588. doi:10.1080/14733285.2014.923814.
- Hudak, P. E. (2003). Campus field exercises for introductory geoscience courses. *Journal of Geography*, 102(5), 220-225.
- Kalvaitis, D., & Monhardt, R. M. (2012). The architecture of children's relationships with nature: a phenomenographic investigation seen through drawings and written narratives of elementary students. *Environmental Education Research*, 18(2), 209-227.
- Kinder, T., Mesner, N. O., Larese-Casanova, M., Lott, K. H., Cachelin, A., & LaLonde, K. (2015). Changes in knowledge and attitude from a short-term aquatic education program. *Natural Sciences Education*, 44(1), 18-25.
- Lai, K. C. (1999). Freedom to learn: A study of the experiences of secondary school teachers and students in a geography field trip. *International Research in Geographical and Environmental Education*, 8(3), 239-255.
- Lindemann-Matthies, P. (2002). The influence of an educational program on children's perception of biodiversity. *The Journal of Environmental Education*, 33(2), 22-31.
- Louv, R., 2008. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Chapel Hill, N.C.: Algonquin Books.
- Louv, R. (2011). *The nature principle: Human restoration and the end of nature-deficit disorder*. Algonquin Books.
- Matsuoka, R. H. (2010). Student performance and high school landscapes: Examining the links. *Landscape and urban planning*, 97(4), 273-282.
- Müderrisoğlu, H., & Gültekin, P. G. (2015). Understanding the children's perception and preferences on nature-based outdoor landscape. *Indoor and Built Environment*, 24(3), 340-354.
- Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, 47, 88-94.
- Payne, P. (2014). Children's Conceptions of Nature. *Australian Journal of Environmental Education*, 30(1), 68-0075. doi:10.1017/aee.2014.26.
- Pellier, A. S., Wells, J. A., Abram, N. K., Gaveau, D., & Meijaard, E. (2014). Through the eyes of children: Perceptions of environmental change in tropical forests. *PLoS One*, 9(8), e103005.

- Ramlo, S. (2019). Examining Urban, American, Middle-School Students' Divergent Views of Nature Before and After a Field Trip to a University Field Station and Nature Preserve. *The Urban Review*, 51(2), 231-246.
- Ramsay, G., Dodds, R., Furtado, D., Mykhayletska, Y., Kirichenko, A., & Majedian, M. (2017). The barriers to millennials visiting rouge urban national park. *Sustainability*, 9(6), 904.
- Rose, G. (2016). *Visual methodologies: an introduction to researching with visual materials*. London; Thousand Oaks, Calif.: SAGE, 2012.
- Schlegel, J., & Rupf, R. (2010). Attitudes towards potential animal flagship species in nature conservation: A survey among students of different educational institutions. *Journal for Nature Conservation*, 18(4), 278-290.
- Sellmann, D., & Bogner, F. X. (2013). Effects of a 1-day environmental education intervention on environmental attitudes and connectedness with nature. *European Journal of Psychology of Education*, 28(3), 1077-1086.
- Shapiro, H. G., Peterson, M. N., Stevenson, K. T., Frew, K. N., & Langerhans, R. B. (2017). Wildlife species preferences differ among children in continental and island locations. *Environmental Conservation*, 44(4), 389-396.
- Söküt Açar, T., Inalpulat, M., Ayman Oz, N., Genc, L., Arslan, H., & Bobek Bagran, A. (2019). A journey to children's perceptions on forest fire through drawings in Canakkale Province, Turkey: Exploring the needs for alternative educative approaches. *Applied Environmental Education & Communication*, 18(4), 285-299.
- Thorburn, M., & Marshall, A. (2014). Cultivating lived-body consciousness: Enhancing cognition and emotion through outdoor learning. *Journal of Pedagogy*, 5(1), 115-132.
- Villarroel, J. D., Antón, A., Zuazagoitia, D., & Nuño, T. (2018). A Study on the Spontaneous Representation of Animals in Young Children's Drawings of Plant Life. *Sustainability*, 10(4), 1000.
- Wilmot, D. (2002). Investigating children's graphic skills: A South African case study. *International Research in Geographical and Environmental Education*, 11(4), 325-340.
- Wals, A. E. (1994). Nobody planted it, it just grew! Young adolescents' perceptions and experiences of nature in the context of urban environmental education. *Children's Environments*, 177-193.
- Yilmaz, F., & Kahraman, A. D. (2015). Science and Nature Perception in the Images and Pictures of the Children. *Procedia-Social and Behavioral Sciences*, 176, 650-658.

Appendix I

The following table shows the name and description of activities that participant involved in during the field trip at the Meadows Center for Water and The Environment.

Activity Name	Overall Concept
Glass Bottom Boat	Spring Lake's ecosystem and biodiversity
Bug Picking	Connecting with the natural environment
Wetlands	The importance of wetlands for water quality and biodiversity
Discovery Center Aquarium	Marine biodiversity and endangered species
All the water in the world	The importance of water as a limited resource and essential to all life on the planet
Water Conservation Game	The importance of water as a limited resource; water conservation practices in everyday life

Shadi Maleki Ph.D., *The Graduate School of Geography, Clark University, Worcester, Massachusetts, USA*

Emily Warren Ph.D., *Department of Geography and Environmental Studies, Texas State University, San Marcos, Texas, USA*

Ronald R. Hagelman III Ph.D., *Department of Geography and Environmental Studies, Texas State University, San Marcos, Texas, USA*

Aspen Navarro M.S., *Department of Geography and Environmental Studies, Texas State University, San Marcos, Texas, USA*

Miranda Wait, *The Meadows Center for Water and The Environment, Texas State University, San Marcos, Texas, USA*