Just Your Friendly, Neighborhood Park Ranger: How Park Rangers can help facilitate environmental learning in the classroom, an experience with snakes

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ABSTRACT

Environmental education and interpretation programs hosted by Park Rangers offer audiences an opportunity to learn about science and nature through direct and hands-on interactions. However, programs offered at parks may be underutilized by schools and teachers. In the state of Tennessee, Park Rangers function as their park's interpretive specialist. Teachers and Park Rangers can work together to curate meaningful, hands-on learning opportunities for students to encourage long-term, positive change in attitude towards the environment and conservation. For this project students were offered a survey both before and after an interpretive program with a snake. These surveys measured student's attitude toward snakes and snake conservation in Tennessee. Furthermore, students that participated in the program attend one of two charter middle schools, which differed in student demographic make-up and conservation programming that allowed for student interactions with snakes in the field and classroom. Data gathered indicated that a single interpretive program had no significant impact on student attitude towards snakes, but that students were more likely to learn about snakes in their personal time following the interpretive program. Additionally, venomous snakes were perceived differently by the students from the two schools, suggesting that more research is needed to determine why the students from these two schools have different attitude scores concerning venomous snakes.

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I. Introduction

"You have one of the best jobs in the world," is one of the more frequently uttered phrases that I hear in my profession. Throughout every season, and for multiple reasons, visitors stop us to ask, "How did you get to be where you are today?" I cannot answer for other park professionals, but I know that without the influence of multiple environmental advocates during the previous decades, I would not be the Park Ranger I am today.

One of the most significant responsibilities of being a Park Ranger is that of interpretation of natural and cultural resources. Park Rangers and other park interpreters are tasked with communicating the importance of preserving culturally significant historic sites and conserving local natural resources so that a park guest is inspired to engage further with that resource (Mission, Vision, & Core Values, National Association of Interpretation, n.d.). Communication is characterized as a verbal sharing of information between one party and another, but interpretation goes deeper than verbal communication because the goal of the interpreter is to enlighten through multiple avenues of perception and to illicit a positive change in knowledge and opinion from the park guest (Smaldone, 2003). Thus, a skilled interpreter acts as a resource docent for the audience, connecting factual information, physical interaction, nostalgia, and novelty in a way that excites the senses and leads to inspired action. Tasked with this mission, interpreters work diligently to ensure that subsequent generations have

continued access to cultural sites and natural spaces, so that these sites can be enjoyed in perpetuity.

Environmental Interpretation & Education

Although they share a similar goal to inform the public, notable differences exist between environmental education and environmental interpretation (Bogner, 1998; Duerden & Witt, 2010; Smaldone, 2003). Smaldone (2003) articulates one key distinction: environmental education is fact driven; whereas, environmental interpretation is communication driven, and this communication happens on an emotional level. Smaldone (2003) also states that environmental educators work with a captive audience motivated by extrinsic goals, but interpreters communicate information to voluntary audiences motivated by intrinsic goals. These differences are rarely discussed in the literature; rather, most authorities blend the two modes of information sharing under the single umbrella of environmental education (see Ballantyne & Packer, 2002; Ballouard et al., 2011; Bogner, 1998; Dettmann-Easler & Pease, 1999; Duerden & Witt, 2010; Emmons, 1997; Horsley & Green, 2018). However, acknowledging and understanding the motivation of the audience is beneficial to the interpreter. With this knowledge, an interpreter can adapt her or his communication style to best fit the needs of the audience. Furthermore, the most successful form of environmental interpretation involves long-term, hands-on, experiential learning opportunities that engage the audience on an emotional level (Ballantyne et al., 2005; Ballantyne & Packer, 2002; Morgan, 1996). This multi-pronged approach to interpretation is complex and, therefore, not easily applied to every educational

opportunity, but elicits long-term attitude change in the audience (Ballantyne et al., 2005; Ballantyne and Packer, 2002), which is the ultimate goal of the educators and interpreters alike.

Interpretive Programming in TSP

Park Rangers, interpretive staff, and other employees of Tennessee State Parks (TSP) follow standard operating procedures and policies when creating educational programs, especially those programs developed for school groups. To ensure that proper protocol is followed, Park Rangers and Interpretive staff are trained in TSP procedures. Following training, these employees know how to access information on the Tennessee Core Curriculum website and to integrate the Core Curriculum Standards into interpretive programming write-ups, which are summaries of the program with an explanation of the curriculum standards covered so that, an educator reading the interpretive write-up knows which curriculum standards will be covered. Rangers and interpretive staff regularly partner with local educators to create unique program experiences encompassing the elements of these core curriculum standards both in the field (at state parks and natural areas) and in the classroom. Educators who are not already established with a park can request an interpretive program through their local state park.

School groups make up a large proportion interpretive audience at TSP. Between January 2021 and 2023, Tennessee State Park Rangers and Seasonal Recreators recorded 643,192 total interactions with park guests (internal tracking data, TSP, accessed June 2023). These interactions took place both in the field and at off-site

locations, including schools, municipal recreation centers, churches, and libraries. School groups represented 152,090 people (1,969 school group interactions). Of these school group interactions, wildlife was the primary theme of about 11,500 (26.94%) of the programs.

Snake Programs in Schools

The purpose of this study was to inform students who were visiting either a Tennessee State Park or a Tennessee Natural Area about the actual risk, versus perceived risk (Skupien et al., 2016) if a snake is encountered, and to determine if the attitude of students changed following a single, hands-on interpretive program lead by a uniformed Park Ranger. While working in state parks, I have encountered many visitors who acted aggressively during a snake encounter, typically resulting in the death of the snake. Conversations with these visitors revealed that the information they believed about snakes was largely false and built on folklore and superstition. Additionally, visitors seem to be unable to identify native snake species, and mistakenly believe that non-native snake species, such as boas, pythons, and coral snakes, inhabit Tennessee. However, conversations with recently hired Seasonal Interpretive Recreators (SIRs), usually college students with little to no prior exposure to snakes, revealed that these misconceptions may be changed when factual information is relayed by a trusted source, such as a uniformed Park Ranger. Most SIRs work for parks from May through August. By the end of their service term, many SIRs who began their term wary of interacting with snakes became more comfortable with the animals. This attitude change following extended exposure to wildlife is predicted in Ballouard et al. (2012)

and Bogner (1998), but this type of exposure is not feasible for most of the general public.

To improve the perception of snakes, this project examined the attitudes towards snakes of middle school students through a single interpretive program. I hypothesized that: (1) student attitude toward snakes will be positively impacted following an interpretive program; (2) students from a school with regular interactions with snakes in the field or classroom will have higher initial acceptance of snakes than students from a school that provides them with few, if any, opportunities to interact with snakes; and (3) students' support of snake related conservation efforts will increase following an interpretive program.

II. Materials & Methods

Participants

This project examined the perceptions and attitudes of middle school students towards snakes. Students attended one of two middle schools located in Tennessee. during the 2021-2022 academic year. Both were charter schools located in a region with majority White population. Middle School A was located in an urban area (majority White population of 75.9%; census.gov, accessed June 2022); whereas, Middle School B was located in a rural area (majority White population of 98%; census.gov, June 2022). Although both schools were located in majority White areas, demography of the student population differed significantly between them. Minority enrollment (Black, Hispanic or Native American) in School A exceeded 95% (TSP internal data, June 2023); whereas, Minority enrollment in School B was approximately 10% (TSP internal data, June 2023).

School B was located within 5 miles of an area managed by State Parks, and teachers used the natural features of this managed area, including a creek, woodland, prairie, hiking trails, and camping sites, for regular school activities and special functions. Furthermore, School B encourages teachers to host environmental professionals, such as Park Rangers, State Foresters, and hydrologists, throughout the school year. During these events the students have the opportunity to participate in interpretive programs with the resource professionals both in the field and in the classroom. In comparison, although School A was located within 5 miles of a city-managed greenspace with hiking trails, ball fields, and a recreational center, the school did not use the space for regular class functions.

Protocols set in place by the Middle Tennessee State University (MTSU) Institutional Review Board (IRB) governed how the schools and students were contacted and recruited as participants in my study. I sampled 140 sixth and seventh grade students from 11 classes. The mean age of the respondents from School A was 12.6 (n= 34); whereas the mean age of the respondents from School B was 12.9 (n=64).

Survey Instruments

I created a pre-experience survey, post-experience survey, and follow-up post experience survey. The pre-experience survey was given to students at least one week before I administered the interpretive program at the school, and the post-experience survey was administered immediately following the program. The follow-up post experience survey was administered one month after the program; however, because of low response rate, I did not analyze the follow-up post-experience surveys.

The first section of all surveys consisted of the MTSU IRB approved informed consent disclosure (Appendix). Survey questions included five-point Likert scale questions, binary Yes/No questions, and multiple-choice questions (Appendix). Students were given the option to include a note for the researcher at the end of each survey. Students could decline to answer any of the questions on the survey. The pre-experience survey included 41 conservation and attitude assessment questions and two demographic questions. The post-experience survey included 37 conservation and attitude assessment questions and two demographic questions. All surveys were taken on a screen device (e.g., cell phone, computer, or tablet), but an option to take a paper survey was available. Students accessed the surveys either via a link distributed to them by the teacher, or via a QR code scanned from my computer. Surveys were collected anonymously, and no identifying information was collected. I emailed a link to the pre-experience survey to the teacher $\leq$ one week prior to the interpretive program. Students who did not submit the survey before the program were given the option to complete the survey the day of the program. When this occurred, the students took the survey in the presence of their teacher and me. Additionally, I was in the classroom when students completed their post-interpretive program surveys.

The survey distributed to students was modified from questionnaires created by Reimer et al. (2013), Skupien et al. (2016), and Horsley & Green (2018). Items in the questionnaire focused on student attendance to educational park events, attitudes toward snakes, attitudes toward conservation efforts, and intent to learn more about snakes. The Likert-scale questions were measured on a five-point scale (Example: *1 =*

Strongly Disagree, 2 = Somewhat Disagree, 3 = Neither Agree Nor Disagree, 4 = Somewhat Agree, 5 = Strongly Agree). The questionnaire was checked for validity and consistency by education specialists and Park Rangers acting in a volunteer capacity. For this study, I focused on a subset of the survey, specifically focusing on student attitudes toward snakes, and interest in snake conservation.

The Interpretive Program & Programmer

TSP Park Rangers are required to complete Certified Interpretive Guide (CIG) training through the National Association of Interpretation (NAI). Usually, training takes place within the first two years of employment. I am a CIG certified Park Ranger, and when I conducted the surveys, I had eight-years of experience in interpretive educational programming and six-years of experience in presenting programs with live snakes.

Although unscripted, in all of my interpretive programs I addressed themes that aligned not only with Core Curriculum Standards of Tennessee Board of Education for the appropriate grade level (State of Tennessee, *Academic standards – Science*), but also with my goals for the project. As opposed to a lecture-type presentation of facts about snakes, I encouraged students to ask questions during the program, and I prompted them to think critically by asking them questions. The Interpretive themes I covered included native snake natural history, food chains, food webs, trophic levels, ecology, snake conservation, conservation issues (e.g., human-caused mortality, habitat loss, and disease), snake identification, venomous versus poisonous snakes, snake folklore and myths, and the appropriate response when a snake is encountered in the wild. I also

encouraged teachers to participate in the program with the students. Depending on the number and types of questions asked, the interpretive program took from 40 to 50 minutes to complete.

Captive Snakes used for Interpretive Programming

I used three captive snakes during my interpretive programs at School A, including an Eastern Kingsnake (*Lampropeltis getula*), a Corn Snake (*Pantherophis guttatus*), and a Sinaloan Milk Snake (*Lampropeltis triangulum sinaloae*). I used four captive snakes during my programs at School B. The fourth snake at School B was another Corn Snake, which was maintained at the school, was handled regularly by school staff and students, and was often used for classroom activities. The origin of the Eastern Kingsnake was unknown, but presumedly was wild-caught and kept as a pet for several years before being donated to State Parks. Eastern Kingsnakes are presumed native to Tennessee, however, their range extends up to the southeast corner of the state and into Georgia. The Eastern Corn Snake is native to Tennessee (Niemiller et al., 2013), but the individual used was purchased as a non-native morph as it displays the wild-type phenotype for corn snakes in this region. The Sinaloan Milk Snake is not native to Tennessee, however, both the Scarlet Snake (*Cemophora coccinea*) and the Scarlet King Snake (*Lampropeltis elapsoides*) are native to Tennessee and are confused for the coral snake (as is the Sinaloan Milk Snake). This Sinaloan Milk Snake was used to dispel the myth of the coral snake rhyme and to teach students about Batesian mimicry and the usefulness of geography as a source of identification. The Corn Snake housed at School B was a captive-bred amelanistic individual.

III. Data Analysis

The final version of the pre-experience survey contained 41 items, whereas, the final version of the post-experience survey contained 35 items. The follow-up post-experience survey was excluded from the final survey results due to low response rate. Therefore, I analyzed only the pre-experience and post-experience surveys.

Differences between the pre-experience and post-experience questions were analyzed using the Wilcoxon rank-sum test. All analysis was conducted in R. To reduce the chance of family wise error rate (FWER), a Holm-Bonferroni adjustment was applied to all results. Several questions included in the pre-experience survey framed experience and exposure to parks relative to the Covid-19 pandemic; however, some students completed the surveys months after other students. and I decided these questions no longer seemed appropriate and excluded them from survey analysis. I also excluded four yes/no questions intended to determine if the students participated in a live program or in a virtual program. The purpose of the virtual program was to adhere to state COVID-19 guidelines; however, at the time the surveys were administered, COVID-19 restrictions pertaining to in-person attendance had been lifted. All students participated in the live interpretive program. The entire survey, including questions which were not analyzed, is included in the appendix. Eleven items from the pre-survey and post-survey were adapted from previous surveys (Table 1).

Table 1

Questions Adapted from Previous Surveys

Source	Source Material	Adapted Material
Horsley & Green, 2018	I am afraid of snakes	I am afraid of snakes
Horsley & Green, 2018	I would like to see some snakes in nature	I want to see a snake in the wild
Horsley & Green, 2018	There should be more laws to protect snakes	There should be laws to protect snakes
Horsley & Green, 2018	Snakes are an important part of nature	Snakes are an important part of the ecosystem
Horsley & Green, 2018	If I gave money to snakes, it would be a waste	Spending money to protect snakes is a waste of resources
Alves et al., 2014	Which of the following actions you would take in an eventual encounter with a snake: (a) let the snake go away, (b) scare off the snake to the bush, (c) tries to capture it, (d) ask someone to kill it, (e) you kill the snake	If I were to find a snake in the wild I would (a) scared of the snake, (b) scare the snake away, (c) kill the snake
Tomazic, 2011 (as referenced in Horsley & Green, 2018)	I would like to learn about different snake species	I would like to learn more about snakes during my personal time
Prokop et al., 2009	Greater resources should be dedicated to snake protection	Snakes should be protected
Reimer et al., 2013	This animal has as much right to live as any other	Snakes have the same right to live as any other animal
Reimer et al., 2013	An important part of my community is the wildlife I see there from time to time	An important part of my community is the wildlife
Reimer et al., 2013	It is important that all Indiana residents have the chance to learn about the animals in the state	It is important for people to have the chance to learn about native snakes

IV. Results

I received (137) pre-experience and (121) post-experience surveys from students. Students from School A submitted (67) pre-experience surveys and (47) post-experience surveys; whereas, students from School B submitted (70) pre-experience surveys and (74) post-experience surveys. To summarize overall attitudes of students to snakes, I organized questions into the following categories: pre-exposure to snakes (five

questions, Table 2), beliefs and attitudes toward snakes (12 questions, Table 3), perceived risk of snake encounter (five questions, Table 4), potential for conservation mindedness (three questions, Table 5), snake interaction following the interpretive program (two questions, Table 6), and overall opinion of the snake program (five questions, Table 7). I compared the pre-experience and the post-experience surveys of the schools to achieve these p-values. I adjusted p-values using the Holm-Bonferroni correction to conserve FWER.

In general, students were more excited to hold the larger Eastern King Snake and the more colorful Sinaloan Milk Snake and less interested in holding the smaller Corn Snake. The largest snake by length was the Eastern King Snake (approximately 3.5 feet long) and the smallest snake by length was the Corn Snake (approximately 1.5 feet long). The king snake and the milk snake were the snakes most requested for photographs, holding, and touching, even though the milk snake was the most active of the snakes and the students were informed of the king snake's propensity to release a foul-smelling musk as a defense mechanism. No students were "musked" in the implementation of this project.

Exposure to Snakes Prior to the Interpretive Program

Students from School B reported greater exposure to snakes than the students from School A (Table 2). Response options for this series of questions includes a four-part Likert scale series (*1 = Never, 2 = 1 Time, 3 = 2-5 Times, 4 = More than 5 Times*) and a single *Yes/No* response question. Of the students from School A, 72.2% (N = 39) had either never or only once seen a snake in the wild, 41.1% (N = 23) had never touched a

snake, and 57.9% (N = 33) had never held a snake. In contrast, many students from School B had viewed a snake in captivity, with 82.1% (N = 46) of students stating that they had viewed a snake in captivity at least once. Additionally, 96.9% of School B students had touched a snake (N = 63), 78.4% (N = 51) had held a snake, 93.8% (N = 61) had seen a snake in captivity, and 95.4% (N = 62) had seen a snake in the wild at least one time.

Table 2

Pre-Exposure to Snakes, Questions associated with encounters students had with snakes prior to the interpretive program.

Response	School A	School B
	Within your lifetime, how often have you experienced the following activities - Viewed a snake in the wild	
Never	17	3
1 Time	22	2
2-5 Times	8	24
More than 5 times	7	26
	Within your lifetime, how often have you experienced the following activities - Viewed a snake in captivity	
Never	10	4
1 Time	16	6
2-5 Times	17	13
More than 5 times	13	42
	Within your lifetime, how often have you experienced the following activities - Touched a snake	
Never	23	2
1 Time	12	7
2-5 Times	8	29
More than 5 times	13	27
	Within your lifetime, how often have you experienced the following activities - Held a snake	
Never	33	14
1 Time	10	14
2-5 Times	5	17
More than 5 times	9	20

Table 2 (continued)

Response	School A	School B
	Have you ever attended an in-person educational snake program?	
No	42	25
Yes	15	40

Note. Students were asked how frequently they had encountered a snake prior to the interpretive program. N values are listed in the table.

Beliefs & Attitudes Toward Snakes

There was no significant difference in beliefs and attitudes between the pre-experience surveys and the post-experience surveys for either school (Table 3). Response options for this series of Likert scale prompts includes *1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree*. Because student attitudes did not change significantly following the interpretive program for this set of questions, I analyzed only the responses for the pre-experience surveys. For the survey prompt, "I want to see a snake in the wild," students from School A had a median response rate of 3 (N = 15) and those from School B had a median response rate of 4 (N = 12). Students from both schools conveyed largely positive attitudes to the prompts, "Snakes are an important part of the ecosystem," (School A median = 4, N = 28. School B median = 5, N = 55) and, "Snakes have the same right to live as any other animal," (School A median = 5, N = 42. School B median = 5, N = 57). Students from School A responded positively to the prompt, "Snakes should be protected," (School A median = 4, N = 35), but they were indifferent to having laws to protect snakes, (School A median = 3, N = 19), and spending money to protect snakes (School A median = 3, N = 21). Students from School B were in favor of laws to protect

snakes (School B median = 4, N = 36), believing that spending money to protect snakes was not a waste of resources (School B median = 2, N = 43) and that snakes should be protected (School B median = 5, N = 57). However, for the prompt, “I think snakes are dangerous,” students from School A had a median response of 4 (N = 19) and students from School B had a median response of 3 (N= 28) for the pre-experience survey. This is interesting as both schools A and B had a median response of 2 (N = 30, N = 48, respectively) for the prompt, “I am afraid of snakes,” suggesting that there may be a discrepancy between fear and perceived risk for the students. Few students from either school agreed with the statement, “All snakes should be killed,” (School A median = 1, N = 28. School B median = 1, N = 57). However, students from School A had a median response of 3 (N = 17) to the prompt, “Only venomous snakes should be killed,” while students from School B had a median response of 1 (N = 49) to this same prompt, suggesting that School A students were less tolerant of venomous snakes than non-venomous snakes, and less tolerant of venomous snakes than the School B students. Students from both schools responded positively to the statements, “An important part of my community is the wildlife,” (School A median = 4, N = 31. School B median = 5, N = 51), and “It is important for people to have a chance to learn about snakes,” (School A median = 4, N = 42. School B median = 5, N = 50).

Table 3

Beliefs and Attitudes Toward Snakes. Questions pertaining to beliefs and attitudes toward snakes both before and after the interpretive program.

Prompt	School A Adjusted p-value	School B Adjusted p-value
I am afraid of snakes	0.005	0.0056
I want to see a snake in the wild	0.025	0.0071
Snakes are an important part of the ecosystem	0.0056	0.0083
Snakes have the same right to live as any other animal	0.05	0.0045
Snakes should be protected	0.125	0.00625
I think snakes are dangerous	0.0042	0.005
There should be laws to protect snakes	0.0071	0.0042
Spending money to protect snakes is a waste of resources	0.0167	0.05
All snakes should be killed	0.0083	0.025
Only venomous snakes should be killed	0.0045	0.0125
An important part of my community is the wildlife	0.01	0.0125
It is important for people to have the chance to learn about native snakes	0.00625	0.01

Note. The value given compares the schools' post-experience surveys to the respective schools' pre-experience surveys.

Alpha level of significance is 0.05. Questions were adjusted with the Holm-Bonferroni method to conserve FWER.

Perceived Risk of Snake Encounter

There was no significant change in perceived risk of snake encounter for any of the questions following the interpretive program. For this set of questions, students were asked to anticipate their response to encountering a snake either in the wild or on their personal property (Table 4). These responses were rated on a five-point Likert scale and scored as *1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree.* For the prompt, "If I were to find a

snake in the wild I would be scared of the snake," students from School A had a median response of 3 (N = 10), while students from School B had a median response of 2 (N = 37). A similar response rate was found for the prompt, "If I were to find a snake on my personal property I would be scared of the snake," with students from School A neither likely nor unlikely to be afraid of the snake (median = 3, N = 8) and students from School B unlikely to be afraid of the snake (median = 2, N = 39). Students from School B strongly disagreed with the statement, "If I were to find a snake in the wild I would scare the snake away," (median = 1, N = 45); however, it is unclear if the students were unwilling to scare the snake away because they were interested in seeing it or if they were simply unwilling to scare it. Students from both schools had the same response to the prompts, "If I were to find a snake in the wild I would kill the snake," (median = 1, N = 30, N = 52, respectively) and, "If I were to find a snake on my personal property I would kill the snake," (median = 1, N = 28, N = 51, respectively).

Table 4

Perceived Risk of Snake Encounter. Students were asked a series of questions to measure perceived risk of snake encounter both before and after the interpretive program.

Prompt	School A Adjusted p-value	School B Adjusted p-value
If I were to find a snake in the wild I would be scared of the snake	0.0125	0.0125
If I were to find a snake in the wild I would scare the snake away	0.01	0.25

Table 4 (continued)

If I were to find a snake in the wild I would kill the snake	0.025	0.167
If I were to find a snake on my personal property I would be scared of the snake	0.067	0.01
If I were to find a snake on my personal property I would kill the snake	0.05	0.05

Note. The value given compares the schools' post-experience surveys to the respective schools' pre-experience surveys.

Alpha level of significance is 0.05. Questions were adjusted with the Holm-Bonferroni method to conserve FWER.

Conservation Potential

For this set of questions, students were asked how likely they were to participate in the listed activities both before and after the interpretive program to measure change in conservation potential (Table 5). These prompts were rated on a five-point Likert scale as *1 = Extremely unlikely, 2 = Somewhat unlikely, 3 = Neither likely nor unlikely, 4 = Somewhat likely, 5 = Extremely likely*. While no change in conservation potential was observed for the prompts, "Attend an educational discussion on snakes," (School A median = 3, N = 11. School B median = 4, N = 19), or "Create or maintain habitat in my yard to protect snakes," (School A median = 3, N = 17. School B median = 3, N = 12), a significant change for School B was observed for the prompt, "Learn more about snakes during my personal time," ($p = 0.0167$). 29 students from School B (median = 4) who took the pre-experience survey responded that they were likely to learn about snakes in their personal time. Following the interpretive program, 35 students from School B responded that they would likely learn more about snakes in their personal time

(median = 4). However, students from School A were neither likely nor unlikely to learn about snakes during their personal time (median = 3, N = 14).

Table 5

Conservation Potential. Students were asked a series of questions to measure conservation potential both before and after the interpretive program.

Prompt	School A Adjusted p-value	School B Adjusted p-value
Attend an educational discussion on snakes	0.025	0.05
Learn more about snakes during my personal time	0.05	0.0167*
Create or maintain habitat in my yard to protect snakes	0.0056	0.0083

Note. The value given compares the schools' post-experience surveys to the respective schools' pre-experience surveys.

Alpha level of significance is 0.05. Questions were adjusted with the Holm-Bonferroni method to conserve FWER.

Exposure to Snakes Following the Interpretive Program

Every student who attended the interpretive program was given the opportunity to touch and hold the snakes. Students at School A had the opportunity to interact with three different species; whereas, students at School B had the opportunity to interact with these same snakes in addition to the school's captive corn snake. Two *Yes/No* response questions in the post-survey asked students about their interaction with snakes (Table 6). Teachers were also encouraged to interact with the snakes. Any student who did not want to interact with the animal was not forced to do so and was given the opportunity to either stand across the room, or put their head on their desk. Following the interpretive program, 84.6% (N = 33) of the students from School A

touched the snake and 45.7% (N = 16) of students held the snake. For School B 82.6% (N = 57) of the students touched the snake and 60% of students held the snake (N = 42).

Table 6

Exposure to Snakes Following the Interpretive Program. Students where asked how they interacted with the snake during the interpretive program.

Prompt	School A		School B	
	No	Yes	No	Yes
I have touched a captive snake	6	33	12	57
I have held a captive snake	19	16	28	42

Note. Students where asked how they interacted with the snake during the interpretive program.

Program review

Five prompts asking students to review the interpretive program were included in the post-experience survey. These prompts were rated on a five-point Likert scale and scored as *1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree*. There was no significant difference in student review of the interpretive program when the post-experience survey scores were compared (Table 7). Both schools responded with a median score of 5 for each of the prompts, indicating that the students enjoyed the program (N = 35, N = 70), learned something new about snakes (N = 36, N = 70), believed that the program was beneficial (N = 36, N = 69), would recommend the program for children (N = 36, N = 69), and would recommend this program to someone who is fearful of snakes (N = 36, N = 70). The post-experience survey results from both schools were compared to each other for each of these questions.

Table 7

Program Review. Students were asked their opinion of the interpretive program.

Prompt	Adjusted p-value
Using the scale provided, please rate the educational program you attended: - I enjoyed this program	0.02028
Using the scale provided, please rate the educational program you attended: - I learned something new about snakes during this program	0.05642
Using the scale provided, please rate the educational program you attended: - I think this program is beneficial	0.3082
Using the scale provided, please rate the educational program you attended: - I would recommend this program for children	0.6195
Using the scale provided, please rate the educational program you attended: - I would recommend this program to someone who is fearful of snakes	0.9744

Note. Students were asked their opinion of the interpretive program. The post-surveys for the two schools were compared to give the associated p-values using the Wilcoxon Rank Sum test.

The FWER was controlled by adjusting p-values with the Holm-Bonferroni correction. N = 107.

V. Discussion

According to the Theory of Planned Behavior (TPB), norms and beliefs can shape attitudes, and attitudes in turn shapes behavioral intent (Horsley & Green 2018). In regard to snakes, these belief systems are often influenced by culture and indirect experience (Alves et al., 2014; Ballouard et al., 2015; Kellert, 1984), and altering these attitudes and beliefs through information alone could prove to be difficult, as some studies show there is minimal to no correlation between knowledge and attitude (Dettman-Easler and Pease, 1999; Duerden & Witt, 2010). If the ultimate goal of the interpretive program is behavior change, then Duerden & Witt (2010) state that direct experience with an intervention leads to the greatest increase in environmental behavior scores, but Ballantyne et al. (2001) and Soga et al., (2016) suggest that true attitude change also requires a period of reflection, either personal or through

community driven conversations, following the program. I encouraged students to ask questions and have conversations during the program, and the students from School B took advantage of this opportunity, many students telling their own stories of snake encounters. Students from School A less frequently offered personal stories about snakes but did tell stories of other encounters with wildlife such as deer and raccoons. I did encourage students to tell their parents about this program, and that they could attend similar programs at their local State Parks. Future surveys should determine how many students discussed the interpretive program with their parents or guardians.

Prior research suggests that hands-on learning techniques, which involve the student interacting directly with the intervention (Morgan, 1996), are more effective in eliciting attitude change than the mere-exposure technique or the vicarious learning technique (Bogner, 1998; Duerden & Witt, 2010; Gangloff, 2011; Morgan & Gramann, 1989; Morgan, 1996; Reynolds et al., 2018). None-the-less, my data suggest that one hands-on learning experience of $\leq$ 60 minutes duration may not be sufficient to persuade students to change their attitude about snakes. My results are similar to those of Morgan & Gramann (1989) who discovered that a single hands-on experience with snakes did not greatly affect attitude score, and those of Gomez et al. (2004), who stated that any positive attitude change recorded immediately after the snake experience diminishes between one and seven days following the educational program. Additionally, although no significant change occurred in perceived risk of snake encounter following my interpretive program, students were unwilling to kill snakes and may or may not be afraid of a snake if encountered in the wild or at their homes.

Students from School A had little exposure to snakes prior to the interpretive program; whereas, prior to the interpretive program, students from School B frequently participated in programs involving snakes at a local state-managed natural area and in their classroom. Although ethnicity of individual students is not known and cannot be linked to specific responses, 95% of students attending School A are Black, Hispanic, or Native American, and 97% of students attending School B are White. Vaughn et al., (2022) indicate that demographics are associated with the degree of exposure to snakes for students: White students are more likely than Black students to participate in an educational program that would expose them to snakes. Difference in exposure to snakes was the only significant result correlated to race discovered by Vaughn et al., (2022). Kellert (1984) also described differences between Black and White participants, stating that Black participants were less knowledgeable of the natural world and less interested in nature and wildlife. The results from my project suggest that students from School B (majority White) may be more tolerant of venomous snakes than students from School A (majority Black, Hispanic, and Native American). Also, students from School B are more likely to learn about snakes during their personal time than students from School A, who are indifferent to learning about snakes during their personal time. None-the-less, students from both schools enjoyed the program and would be willing to recommend the program to others, even to those fearful of snakes. The difference in attitudes I found between the two student groups may be due to the regular exposure to snakes at School B from attendance at Ranger-lead programs and access to natural spaces. However, Ballantyne et al., (2001) concluded that student enjoyment of the

program does not necessarily correlate to improved conservation intentions. Further research is needed to determine if race is a confounding issue for attitude and conservation concern.

Attitudes Towards Snakes & Conservation Concerns

The success and support of conservation policies concerning wildlife species are largely influenced by public perception of those species (Alves et al., 2014; Ballouard et al., 2011; Ballouard et al., 2015; Böhm et al., 2013; Gomez et al., 2004; Jacobson and Marynowski, 1997; Reimer et al., 2013; Soga & Gaston, 2016). Attitudes towards snakes in general are largely negative (Alves et al., 2014; Bixler et al., 1994; Knight, 2008; Liordos et al., 2018; Polák et al., 2016; Vaughn et al., 2022). This negative and typically fearful attitude toward snakes is one of the primary barriers to eliciting public support for conservation programs to protect snakes (Ballouard et al., 2015). Negative attitudes pose a major conservation concern for snake species across the world (Alves et al., 2014; Ballouard et al., 2015), and without public support snakes will continue to be subject to harmful actions against them.

Multiple accounts cite fear or disgust as being the primary reasons why people dislike snakes and why snakes are perceived as harmful or dangerous (Alves et al. 2014; Ballouard et al., 2015; Knight, 2008; Liordos, et al. 2018; Öhman & Mineka, 2003; Prokop et al., 2009; Rádlová et al., 2019; Tierney and Connolly, 2013). Knight (2008) determined that public support of conservation measures largely depends on the aesthetic value of the species; species that are viewed as ugly, such as snakes, spiders, and bats, are less likely to illicit as much public support as more charismatic species,

such as mammals and birds. Both Emmons (1997) and Liordos et al. (2018) reported that snakes elicited emotions of both fear and disgust for most participants in their study, citing that participants were fearful of and, therefore, unwilling to encounter snakes in the wild. There are multiple proposed explanations for fear acquisition. Öhman & Mineka (2003) state that fear is an evolutionary response to dangerous reptiles and this fear was retained from human's mammalian ancestors. In contrast, Bixler et al. (1994) states that fear is acquired through one or multiple pathways of learning, including direct contact, vicarious learning, and information received through instruction. Information received through instruction includes information gained from the media, such as television, news, or internet programs, (Ballouard, et al., 2011; Bixler et al., 1994), written literature, and oral stories. Oral stories include first -and second-hand accounts, myths, and folklore, are prevalent in the Southeast, especially when snakes are the topic of conversation (Alves et al. 2014).

Snakes are often the subject of myths and folklore, and cultures around the world have their own version of snake myths (Alves et al. 2014; Liordos et al., 2018; Manfredo et al., 2009). In the southeastern United States, myths and folklore about snakes are embedded into the culture as well as the religion of the people (Alves et al. 2014; Ballouard, et al. 2013). As a Park Ranger, I hear many of these stories from park visitors. Although entertaining, many of them contain false information and may end in the extermination of the animal. The inaccurate information about native snakes may lead to fear (Alves et al. 2014; Ballouard et al., 2015), and unwarranted fear is likely a reason that many people kill snakes, even those that are harmless. One reason I conduct

interpretive programs with snakes is to inform the public and to dispel myths about snakes. For example, one of the most prevalent and enduring myths that I encounter concerns native Cottonmouth Snakes (*Agkistrodon piscivorus*). Cottonmouths occur primarily in west Tennessee, with scattered populations in middle Tennessee; however, no populations have been reported in east Tennessee (Niemiller et al., 2013). Regardless of the known distribution, I often hear park visitors discuss finding and killing cottonmouths in East Tennessee. I take advantage of these opportunities to inform participants in my programs that geography is helpful when attempting to identify a snake, and that knowing which snakes occur in a region and how to properly identify them can help protect both people and the snake from harm. Although untested, this direct communication with both adults and children generally elicits a positive response, although occasionally adults outright verbally refuse to believe information contradictory to their established beliefs. Children infrequently state their refusal to believe factual information about snakes. Based on my results and experiences, I suggest a study that specifically targets snake misinformation in the Southeast to better understand this discrepancy in beliefs between children and adults.

Children are the future stakeholders of our natural spaces. Understanding their attitudes toward conservation efforts and how they perceive wildlife (Ballouard et al., 2015), especially uncharismatic and feared species will help us develop better educational programs. Children acquire fear of animals between the ages of 4 and 7 (Berger, 2010; Bixler et al., 1994), but are less likely to be fearful of snakes than adults (Ballouard et al., 2012). Presumably, these fears are acquired later in life through

cultural messaging (Alves et al. 2014; Ballouard et al., 2015; Knight, 2008; Öhman & Mineka, 2003). As the child becomes an adult, they are more influenced by cultural expectations, which may lead to undesired conservation attitudes towards uncharismatic and feared species if not managed early on in their learning (Ballouard et al., 2015; Pilgrim et al., 2007). Repeated environmental interpretation experiences, both in the classroom and on-site in the natural area, are expected to improve both short term and long-term conservation attitudes overall (Bogner, 1998; Gangloff, 2011; White et al., 2018). Although it may be difficult for researchers to spend their time leading field trips for young students, Park Rangers are able to fill the gap between biological research and public interaction by hosting both field and classroom based interpretive programs (Duerden & Witt, 2010).

Ballantyne et al. (2001) touched on the benefit of environmental interpretation to affect attitude scores when concluding that some of the success in their environmental learning case study was due to community and parent involvement in student environmental projects. Similar results were also recorded by Soga et al. (2016) who determined that willingness of students to conserve biodiversity was directly affected by the conversations they had with their parents and peers. In these roles, the students who participate in the education program are the captive audience. The students then interpret the information they learned during the program with the voluntary audience composed of family, friends, and community members. Effectively, the students become environmental interpreters for their community and family following their participation in the environmental education program and these

informal interpretive conversations improved the attitudes of students concerning environmental issues. Students surveyed in this project believed that the interpretive snake program was beneficial and stated that they would be likely to recommend this program to someone who is fearful of snakes. Interpreters should encourage students to speak with their parents or other community members following a snake program, and interpreters should even consider working with teachers to create at home assignments for the students to complete with their parents. These additional "dinner table" conversations may help to improve the overall negative attitude toward snake species in non-formal, intimate settings (Ballantyne et al., 2001).

Ballouard et al. (2012) determined that the willingness of children to protect snakes increased by 77% following a hands-on, experiential learning opportunity at government-managed forest areas where the students were given the freedom to locate, handle, and analyze wild snakes in a managed habitat. Unlike other hands-on interpretive programs, Ballouard et al. (2012) used experiential learning and allowed students to act in the role of field researcher. Information provided to the students only included natural history of the snake species; the researchers avoided influencing the attitudes of students by choosing not to share information regarding conservation. This approach, which involved both a hands-on learning experience and an experiential learning opportunity, yielded significantly positive change in student attitude score towards snakes. Additionally, following the field trip significantly fewer students declared that they were afraid of snakes, and significantly more students declared that they liked and thought it important to protect snakes. This type of program uses both a

cognitive and behavioral approach to student learning (Morgan, 1996), and the hands-on interaction allows students to forge an affective relationship with the wild snake. Furthermore, student perception of the field experience is more favorable if students believe that they are free to interact with the environment in a way that makes them most comfortable (Bixler et al., 1994). This field excursion produced the desired result because it was created in such a way as to illicit the most positive response possible from the students through multiple avenues of behavioral learning.

However, in an experiment designed by Skupien et al. (2016), it was discovered that there was no significant difference in attitude score (here defined as Wildlife Acceptance Capacity) between those who participated in a classroom experience and those who participated in a hands-on field day. Skupien et al. (2016) sought to determine if public perception of the American alligator (*Alligator mississippiensis*) would change following a classroom based educational program or an interpretive field excursion, with the goal of improving the wildlife acceptance capacity (WAC) of alligators by public. Both intervention groups scored higher WAC following the presentation or excursion interventions than the control group; however, the WAC scores of the classroom presentation and the field excursion were not significantly different. Both interventions had an educational presentation component, and both engaged the audience and afforded them a novel experience to view an alligator. One intervention allowed the participants to engage directly with the alligator while the other allowed participants to engage directly with the natural environment. Even though there was no statistical difference in WAC scores between the two

interventions, the authors concluded that both interventions were of value to conservationists, and that live alligator observations or direct contact with an alligator was critical to illicit strong emotional response and attitude change.

Prior to this survey project, some students from School B participated in field excursions to search for herps such as salamanders, toads, and snakes on property managed by State Parks. During these field excursions the students viewed the animals and recorded information pertaining to species, size, and coloration. Some of the School B students who participated in this field excursion also participated in the survey. It is unknown if students from School A were ever granted this opportunity to view snakes in the wild as part of their educational curriculum. School A's pre-experience survey exposure scores were likely due in part to these types of field excursions. Further research is needed to better understand the difference in student attitude scores before and after a field excursion versus a classroom experience (Ballouard et al., 2012; Reynolds et al., 2018; Skupien et al., 2016).

Ultimately, to gleam the greatest benefit from an environmental education program, the educator must incorporate elements of interpretation into the educational lesson, which includes hands-on experiential learning opportunities. However, the opportunity to partner with an environmental interpreter should not be overlooked, as the environmental interpreter may have valuable resources unavailable to the educator. Multiple sources conclude that educators and interpreters should produce collaborative projects, utilizing the cognitive benefits of the classroom and the affective benefits of the field to elicit the greatest change in student attitude (Alves et al., 2014; Brewer,

2002; Dettmann-Easler & Pease, 1999; Emmons, 1997; Slattery & Lugg, 2002; White et al., 2018). Interpretive resources available to educators include museums, parks and natural areas, and science facilities. Many of these facilities hire staff members whose role is that of environmental interpreter. Educators should utilize the resource of the interpreter to create a lesson plan that is not only adaptive to the field but also reflective of the goals of the education curriculum in the classroom. Further, Randler (2008) stresses the importance of reducing the novelty of experience by introducing the students to subject matter in the classroom before the field excursion. The interpreter should understand the goals of the educator and do their due diligence in creating a program which satisfies the requirements of the educator. While creating this survey I asked teachers specifically which topics they would like covered as part of their requirements to meet specific school standards. Through these conversations, I incorporated standards 6.LS2.2, 6.LS2.5, 6.LS2.7, 6.LS4.1 into the interpretive program (Tennessee Academic Standards for Science, June 2023). One classroom of School B students also received information covering standards 7.LS3.1 and 7.LS3.3 as these students viewed both the amelanistic Corn Snake and the wild-type Corn Snake and discussions with the students during the interpretive program led to conversations about genes, heredity, and inheritance.

Limitations

Although modeled after similar projects, the design of my survey had several limitations. The greatest limitation may have been the survey itself, as questions involving a Likert-scale response may not be the best method for accurately collecting

student attitudes and perceptions of snakes and conservation issues (Emmons, 1997). Ballantyne et al. (2005) discovered that structured interviews with participants in addition to the instructors recording their observations of the students yielded stronger data than open-ended responses. Similarly, Bixler et al. (1994) determined that relying on the interpreters to record unprompted expressions from the students yielded better results than relying on the students to record their own sentiments. Emmons (1997), Reynolds et al. (2018), and Soga et al. (2016) concluded that for long-term attitude change to occur and be sustained, students must reflect on their experience following the program. Although Likert-scale surveys may be the most popular and most convenient form of data collection for attitude scores, surveys that contain prompted, open-ended questions and a section for student reflection likely are more informative. Thus, student expressions of complex emotions, such as fear, disgust, desire, or affection should be noted so that student attitudes toward the subject matter, such as snakes, can be better understood. Indeed, I noted that students were insightful and curious about snakes, however, there were no prompted open-ended questions in my survey to reflect this insightfulness or any other emotion. I did not match the pre- and post- experience surveys of individual students and, therefore, I could not determine if the attitude of an individual student towards snakes changed because of their participation in the program. Also, the number of students who completed the pre-experience survey did not match the number of students who completed the post-experience survey, and not all of the questions within the survey had the same response rate (for example, many students declined to include their gender in the survey). The

students were allowed skip any question in the survey or leave the survey incomplete, which possibly skewed my results.

After the incomplete surveys were removed, post-experience survey responses for School A were low and post-experience survey responses for School B was greater than the pre-experience survey responses. Surveys with less than 80% completion were removed before analysis. Again, this issue may have been avoided had the surveys been matched.

Difficulties in retrieving consent waivers from parents of the students prevented me from surveying all students in attendance for the interpretive programs. Perhaps students need more than one week to retrieve parental consent before administration of the survey. Unfortunately, I received complaints about the length of the consent form from the teachers at both schools. Parents might have decided to not submit consent forms because of the time taken to read them. When constructing a survey, the length of both the questionnaire and the IRB consent forms should be considered. The near complete lack of responses to the follow-up post-experience survey may have been due to either the combined length of the survey and the consent form, or lack of incentive to complete the survey.

The teacher and the I were in the room while the surveys were being taken. My presence in the room could have introduced bias into the survey, because students may have selected the most positive answers (Bogner, 1998). I recognized that bias may be an issue, but I remained in the room to answer any questions the students may have had while taking the survey.

Notes from the Field

As a note on gender questions, one class of students from School B expressed annoyance that I could not identify the gender of the snakes and the students refused to participate in the program following this interaction. A similar situation occurred with a separate group of college-age students who were not part of this study. These students were disappointed that the gender of the snake could not be identified but that I used heteronormative gender terms to identify the snakes. Interestingly, both groups of students used the same verbiage to express their discontent and were concerned the snake was being misgendered. Possibly, the current political climate surrounding social justice and LGBTQIA+ rights have affected the students who anthropomorphized the snakes and placed great importance on correctly identifying animal gender (or non-gender). While this survey did include gender responses: "Prefer not to answer," and "My gender is not listed here," future surveys should consider how gender questions and subjects related to gender may be received by the audience.

I had another interesting interaction with a young female student who was not a participant in my research. This student wanted to hold, but could only view, the snakes because of early COVID-19 protocols. At the conclusion of the program the students were asked if they liked snakes. This student verbally responded that she did not. When I asked why, the student stated that she did not like snakes because she was not allowed to touch them. Although this information pertains to a single interaction, this student's response reflects the work of Morgan (1996) who found that female students not permitted to touch snakes were less likely to have positive attitudes toward snakes

than female students who could touch the snake. It is important to note the difference between the students having the ability to touch the snake versus the willingness to touch the snake. This student wanted to touch the snake but was denied the ability to and therefore concluded that she did not like snakes. If policy allows, students ought to at least be given the option to touch or hold the snake, as this physical interaction with the animal may have some implications for attitude change (see Ballantyne et al., 2005; Gangloff, 2011; Morgan & Gramann, 1989; Reynolds et al., 2018).

VI. Conclusion

Environmental education and environmental interpretation are two modes of communication to convey information about environmental issues, and they should be used together if the goals include a sustained change in attitudes and positive environmental conservation behaviors. Educators can accomplish these goals by incorporating hands-on, interactive learning activities into their curriculum, such as by visiting a park or having a park interpreter visit their classroom (see Alves et al., 2014; Ballantyne & Packer, 2002; Ballouard et al., 2011; Ballouard et al., 2012; Brewer, 2002; Chawla, 2015; Dettmann-Easler & Pease, 1999, 1999; Emmons, 1997; Gangloff, 2011; Pilgrim et al., 2007; Randler, 2008; Slattery & Lugg, 2002; White et al., 2018). Schools already use parks for personal development and outdoor skills; however, the creation of formal educational partnerships between schools and parks (Brewer, 2002; Slattery & Lugg, 2002), especially for those schools which attend underserved communities, may afford the students a new way to understand their place in nature and how communities interact with nature. Creating and maintaining partnerships with parks, or

other interpretive centers, will help expand the potential educational resources of a school and offer the students the opportunity to learn either in a novel environment, from an alternative source of information, or both (Brewer, 2002; Dettmann-Easler & Pease, 1999; Randler, 2008). The incorporation of environmental interpretive programming, when utilized intentionally and implemented soundly, may be a strong asset to help reverse the extinction of experience currently impacting our society (Slattery & Lugg, 2002; White et al., 2018).

Park Rangers stand at the nexus of conservation and the behavioral science, (Ballantyne & Packer, 2002; Duerden & Witt, 2010). Lack of interaction with nature is directly related to people's attitude regarding nature and the value they place on natural spaces (Soga & Gaston, 2016). Therefore, by working in conjunction with park interpreters, teachers can help conservationists curb this current environmental crisis while simultaneously meeting their educational standards and introducing their students to new and impactful experiences. Tennessee State Parks are committed to improving conservation efforts by working with everyday people, including teachers and students, to help create interpretive programming that is both meaningful and necessary to establish the seed of environmental stewardship.

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APPENDIX

Informed Consent Informed Consent for Online Studies
Information and Disclosure Section

The following information is provided to inform you about the research project in which you have been invited to participate. Please read this disclosure and feel free to ask any questions. The investigators must answer all of your questions. Please save this page as a PDF for future reference. • Your participation in this research study is voluntary. • You are also free to withdraw from this study at any time without loss of any benefits. For additional information on your rights as a participant in this study, please contact the Middle Tennessee State University (MTSU) Office of Compliance (Tel 615-494-8918) or send your emails to irb_information@mtsu.edu. (URL: http://www.mtsu.edu/irb).

Please read the following and respond to the consent questions in the bottom if you wish to enroll in this study.

1) Purpose: The data collected through this survey will help us better understand how our wildlife programs influence public attitudes towards wildlife, specifically, how the public perceives snake species both before and after an interpretive educational program lead by a uniformed member of Tennessee State Parks staff.

2) Description: If you received an invitation to participate in this survey you registered for this event online through the Tennessee State Parks website. There are three surveys involved in this research: a pre-experience, post-experience, and follow-up post-experience survey. Before you participate in the snake program you will be asked to fill out the pre-experience survey. This survey will help us determine your attitudes and perceptions of snakes before the educational program. You will participate in an educational program with a uniformed Park Staff member either in-person or virtually. Some participants may not participate in either version of the program, but will be asked to fill out the survey if they viewed a snake housed within a State Park nature or visitor center or museum. The post-experience survey will be emailed to participants who completed the pre-experience survey. A follow-up post experience survey will be emailed to participants one month following the educational program. The data collected through the surveys will be analyzed and published as part of this master's thesis project.

3) IRB Approval Details
Protocol Title: Construction, implementation, and evaluation of survey instruments to determine implications of interpretive environmental programming on public perceptions of snakes
Primary Investigator: Leigh Gardner
PI Department & College: Middle Tennessee State University
Faculty Advisor: Dr. Brian Miller
Protocol ID: 22-21247ivm

Approval Date: 04/2022
Expiration Date: 04/2023

4) Duration: Each of the three surveys (pre-experience, post-experience, and follow-up post-experience) will take fewer than 10 minutes to complete. The interpretive educational program may take up to one hour, depending on the number and complexity of audience-initiated questions following the program.

5) Here are your rights as a participant:
• Your participation in this research is voluntary.
• You may skip any item that you don't want to answer, and you may stop the experiment at any time (but see the note below)
• If you leave an item blank by either not clicking or entering a response, you may be warned that you missed one, just in case it was an accident. But you can continue the study without entering a response if you didn't want to answer any questions.
• Some items may require a response to accurately present the survey.

6) Risks and Discomforts: Any time information is shared online there is potential risk involved. Qualtrics online software helps to ensure that your data is secure and private, however, we can not completely eliminate risks involved with online data sharing.

Interaction with a live animal involves inherent risk, including but not limited to the risk of scratch or bite, or exposure to animal urine, fecal matter, saliva or vomit. All participation in this program is voluntary and the participant may choose not to participate in any aspect of the program at any time. Hand washing and sanitation is encouraged following the program.

7) Benefits: There are no direct benefits to you for the participating in this survey. The data collected will be used to improve the quality of educational wildlife programs within Tennessee State Parks.

8) Identifiable Information: You will NOT be asked to provide identifiable personal information.

9) Compensation: There is no compensation or incentives for participating in this study.

10) Confidentiality: All efforts, within reason, will be made to keep your personal information private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections, if you or someone else is in danger or if we are required to do so by law.

11) Contact Information: If you should have any questions, comments, or concerns about this research study or possible injury, please feel free to contact Leigh Gardner (MS candidate and research conductor) by telephone 931-247-7537 or by email at lag4f@mtmail.mtsu.edu

-OR-

MTSU faculty advisor Brian Miller at Brian.Miller@mtsu.edu.

You can also contact the MTSU Office of Compliance via telephone at 615-494-8919 or by email at compliance@mtsu.edu. This contact information will be presented again at the end of the survey.

You are not required to do anything further if you decide not to enroll in this study. Just quit your browser.

Please complete the response section below if you wish to learn more or you wish to part take in this study.
We truly appreciate the time you're taking to complete this survey.

Participant Response Section

I have read this informed consent document pertaining to the above identified research

- ○ Yes (1)
- ○ No (2)

Q15 The research procedures to be conducted are clear to me

- ○ Yes (1)
- ○ No (2)

Q16 I confirm I am 18 years or older

- ○ Yes (1)
- ○ No (2)

Q27 I am the parent or legal guardian of a minor who is between the ages of 12 and 17. I have read the Informed Consent and grant consent for their participation in this survey.

- ○ Yes (1)
- ○ No (2)

Q17 I am aware of the potential risks of the study

- ○ Yes (1)
- ○ No (2)

Q14 By clicking below, I affirm that I freely and voluntarily choose to participate in this study. I understand I can withdraw from this study at any time without facing any consequences.

- ○ Yes (1)
- ○ No (2)

Perceptions of Snakes Pre-Experience Survey

Q1 Before the Covid-19 outbreak and subsequent restrictions (before March 2020), how many times a year did you do each of the following activities?

	Never (1)	1 time (2)	2-5 times (3)	More than 5 times (4)
Visited a Tennessee State Park or Natural Area (1)	○	○	○	○
Visited a Nature Center, Zoo, or Aquarium (2)	○	○	○	○
Participated in an educational program at a Tennessee State Park (3)	○	○	○	○
Participated in an educational snake program at a Tennessee State Park (4)	○	○	○	○

Q2 During the Covid-19 pandemic (past 24 months) how often did you do each of the following activities?

	Never (1)	1 time (2)	2-5 times (3)	More than 5 times (4)
Visited a Tennessee State Park or Natural Area (1)	○	○	○	○
Visited a Nature Center, Zoo, or Aquarium (2)	○	○	○	○
Participated in an educational program at a Tennessee State Park (3)	○	○	○	○
Virtually attend a nature or environmental program (4)	○	○	○	○
Participated in an educational snake program at a Tennessee State Park (5)	○	○	○	○

Q3 Within your lifetime, how often have you experienced the following activities?

	Never (1)	1 time (2)	2-5 times (3)	More than 5 times (4)
Viewed a snake in the wild (1)	○	○	○	○
Viewed a snake in captivity (2)	○	○	○	○
Touched a snake (3)	○	○	○	○
Held a snake (4)	○	○	○	○

Q12 Have you ever attended an in-person educational snake program?

- ○ Yes (1)
- ○ No (2)

Q4 Using the scale provided, please rate the following:

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I am afraid of snakes (1)	○	○	○	○	○
I want to help protect snakes (2)	○	○	○	○	○
I want to see a snake in the wild (3)	○	○	○	○	○
Snakes are an important part of the ecosystem (4)	○	○	○	○	○
Snakes have the same right to live as any other animal (5)	○	○	○	○	○
Snakes should be protected (6)	○	○	○	○	○
I think snakes are dangerous (7)	○	○	○	○	○
There should be laws to protect snakes (8)	○	○	○	○	○

Spending money to protect snakes is a waste of resources (9)	○	○	○	○	○
All snakes should be killed (10)	○	○	○	○	○
Only venomous snakes should be killed (11)	○	○	○	○	○
An important part of my community is the wildlife (12)	○	○	○	○	○
It is important for people to have the chance to learn about native snakes (13)	○	○	○	○	○

Q5 Using the scale provided, please rate how likely you are to participate in the following activities:

	Extremely unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Hold a live (nonvenomous) snake in my hands (1)	○	○	○	○	○
Touch a live (nonvenomous) snake (2)	○	○	○	○	○
Attend an educational discussion on snakes (3)	○	○	○	○	○
Learn more about snakes during my personal time (4)	○	○	○	○	○
Create or maintain habitat in my yard to protect snakes (5)	○	○	○	○	○

Q6 Using the scale provided, how would you feel if you encountered a snake in the wild? Please select one answer.

- ○ Very fearful (1)
- ○ Somewhat fearful (2)
- ○ Nether fearful nor safe (3)
- ○ Somewhat safe (4)
- ○ Very safe (5)

Q7 Using the scale provided, please rate the following scenario:
"If I were to find a snake in the wild I would…"

	Extremely unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Be scared of the snake (1)	○	○	○	○	○
Scare the snake away (2)	○	○	○	○	○
Kill the snake (3)	○	○	○	○	○
Call a resource professional such as a TN Wildlife Resources Officer (TWRA) or a wildlife removal service (4)	○	○	○	○	○

Q8 Using the scale provided, please rate the following scenario:
"If I were to find a snake on my personal property I would…"

	Extremely unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Be scared of the snake (1)	○	○	○	○	○
Scare the snake away (2)	○	○	○	○	○
Kill the snake (3)	○	○	○	○	○
Call a resource professional such as a TN Wildlife Resources Officer (TWRA) or a wildlife removal service (4)	○	○	○	○	○

Q24 I am 18 years old or older

○ Yes (1)

○ No (2)

Q25 Please select your age
1 (1)

▼ 18 (1) ... 120 (103)

Q26 Please select your age
1 (1)

▼ 12 (1) ... 17 (6)

Q10 Gender

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ My gender is not listed here (4)
- ○ Prefer not to say (5)

Q11 Use the space below to leave a note for the researchers (optional):

_____

Perceptions of Snakes Post-Experience Survey

Q1 Please select Yes or No to the following statement:
I have...

	Yes (1)	No (2)
participated in an in-person Park Ranger lead snake program (1)	○	○
seen a snake virtually during a Park Ranger lead program (2)	○	○
seen a live snake in a tank (3)	○	○
witnessed a snake being held by a Park Ranger (4)	○	○
touched a captive snake (5)	○	○
held a captive snake (6)	○	○

Q2 Using the scale provided, please rate the following:

	Strongly Disagree (1)	Somewhat Disagree (2)	Neither Agree nor Disagree (3)	Somewhat Agree (4)	Strongly Agree (5)
I am afraid of snakes (1)	○	○	○	○	○
I want to see a snake in the wild (3)	○	○	○	○	○
Snakes are an important part of the ecosystem (4)	○	○	○	○	○
Snakes have the same right to live as any other animal (5)	○	○	○	○	○
Snakes should be protected (6)	○	○	○	○	○
I think snakes are dangerous (7)	○	○	○	○	○
There should be laws to protect snakes (8)	○	○	○	○	○

Spending money to protect snakes is a waste of resources (9)	○	○	○	○	○
All snakes should be killed (10)	○	○	○	○	○
Only venomous snakes should be killed (11)	○	○	○	○	○
An important part of my community is the wildlife (12)	○	○	○	○	○
It is important for people to have the chance to learn about native snakes (13)	○	○	○	○	○

Q3 Using the scale provided, please rate how likely you are to participate in the following activities:

	Extremely unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Hold a live (nonvenomous) snake in my hands (1)	○	○	○	○	○
Touch a live (nonvenomous) snake (2)	○	○	○	○	○
Attend an educational discussion on snakes (3)	○	○	○	○	○
Learn more about snakes during my personal time (4)	○	○	○	○	○
Create or maintain habitat in my yard to protect snakes (5)	○	○	○	○	○

Q4 Using the scale provided, how would you feel if you encountered a snake in the wild? Please select one answer.

- ○ Very fearful (1)
- ○ Somewhat fearful (2)
- ○ Neither fearful nor safe (3)
- ○ Somewhat safe (4)
- ○ Very safe (5)

Q5 Using the scale provided, please rate the following scenario:
"If I were to find a snake in the wild I would…"

	Extremely Unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Be scared of the snake (1)	○	○	○	○	○
Scare the snake away (2)	○	○	○	○	○
Kill the snake (3)	○	○	○	○	○
Call a resource professional such as a TN Wildlife Resources Agent (TWRA) or a wildlife removal service (4)	○	○	○	○	○

Q6 Using the scale provided, please rate the following scenario:
"If I were to find a snake on my personal property I would…"

	Extremely Unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Be scared of the snake (1)	○	○	○	○	○
Scare the snake away (2)	○	○	○	○	○
Kill the snake (3)	○	○	○	○	○
Call a resource professional (such as TWRA* or a wildlife removal service) (4)	○	○	○	○	○

Q7 Using the scale provided, please rate the educational program you attended:

	Strongly Disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I enjoyed this program (1)	○	○	○	○	○
I learned something new about snakes during this program (2)	○	○	○	○	○
I think this program is beneficial (3)	○	○	○	○	○
I would recommend this program for children (4)	○	○	○	○	○
I would recommend this program to someone who is fearful of snakes (5)	○	○	○	○	○

Q17 I am 18 years old or older

- ○ Yes (1)
- ○ No (2)

Q18 Please select your age
1 (1)

▼ 18 (1) ... 120 (103)

Q19 Please select your age
Click to write Choice 1 (1)

▼ 12 (1) ... 17 (6)

Q9 Gender:

- ○ Male (1)
- ○ Female (2)
- ○ Third gender/ non binary (3)
- ○ My gender is not listed here (4)
- ○ Prefer not to say (5)

Q10 Use the space below to leave a note for the researchers (optional):

_____

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129
FWA: 00005331/IRB Regn. 0003571

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Wednesday, April 20, 2022

Protocol Title	***Construction Implementation, and Evaluation of Survey Instruments to Determine Implications of Interpretative Environmental Programming on Public Perception of Snakes***
Protocol ID	**22-2124 7ivm**
Principal Investigator	**Leigh Gardner** (Student) *Faculty Advisor:* Brian Miller
Co-Investigators	NONE
Investigator Email(s)	*lag4f@mtmail.mtsu.edu; brian.miller@mtsu.edu*
Department	Biology
Funding	NONE

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU IRB through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category *(7) Research on individual or group characteristics or behavior*. A summary of the IRB action is tabulated below:

IRB Action	**APPROVED for ONE YEAR**
Date of Expiration	**4/30/2023** *Date of Approval*: 4/20/22 *Recent Amendment*: NONE
Sample Size	ONE THOUSAND (1,000)
Participant Pool	*Target Population 1:* Primary Classification: **Adults (18 years or older)** Specific Classification: **General Population** *Target Population 2:* Primary Classification: **Minors (12 years or older)** Specific Classification: **General Population**
Type of Interaction	☐ Non-interventional or Data Analysis ☒ Virtual/Remote/Online interaction ☒ **In person or physical interaction – Mandatory COVID-19 Management**
Exceptions	NONE
Restrictions	**1. Mandatory ACTIVE Adult Informed Consent, ACTIVE Parental Consent and Verbal Child Assent.** **2. Other than the exceptions above, identifiable data/artifacts, such as, audio/video data, photographs, handwriting samples, personal address, driving records, social security number, and etc., MUST NOT be collected. Recorded identifiable information must be deidentified as described in the protocol.** **3. Mandatory Final report (refer last page).**
Approved Templates	*IRB Templates:* Adult Informed Consent, Parental Consent, and Child Assent Scripts *Non-MTSU Templates:* Recruitment Scripts
Research Inducement	NONE
Comments	NONE

Data removed from final analysis

The following describes data removed from this project before final analysis:

All surveys which had a completion rate of less than 80% were considered incomplete, and therefore removed from analysis.

Questions pertaining to exposure to natural areas in reference to the Covid-19 Pandemic:

Q1_1 Before the Covid-19 outbreak and subsequent restrictions (before March 2020), how many times a year did you do each of the following activities? - Visited a Tennessee State Park or Natural Area

Q1_2 Before the Covid-19 outbreak and subsequent restrictions (before March 2020), how many times a year did you do each of the following activities? - Visited a Nature Center, Zoo, or Aquarium

Q1_3 Before the Covid-19 outbreak and subsequent restrictions (before March 2020), how many times a year did you do each of the following activities? - Participated in an educational program at a Tennessee State Park

Q1_4 Before the Covid-19 outbreak and subsequent restrictions (before March 2020), how many times a year did you do each of the following activities? - Participated in an educational snake program at a Tennessee State Park

Q2_1 During the Covid-19 pandemic (past 24 months) how often did you do each of the following activities? - Visited a Tennessee State Park or Natural Area

Q2_2 During the Covid-19 pandemic (past 24 months) how often did you do each of the following activities? - Visited a Nature Center, Zoo, or Aquarium

Q2_3 During the Covid-19 pandemic (past 24 months) how often did you do each of the following activities? - Participated in an educational program at a Tennessee State Park

Q2_4 During the Covid-19 pandemic (past 24 months) how often did you do each of the following activities? - Virtually attend a nature or environmental program

The following were removed as students would not have the capability to call these resource professionals without the assistance of an adult:

Q7_4 Using the scale provided, please rate the following scenario: “If I were to find a snake in the wild I would…” - Call a resource professional such as a TN Wildlife Resources Officer (TWRA) or a wildlife removal service

Q5_4 Using the scale provided, please rate the following scenario: “If I were to find a snake in the wild I would…” - Call a resource professional such as a TN Wildlife Resources Agent (TWRA) or a wildlife removal service

The following was removed as the associated POST question failed to be included in the distribution to the subjects.

Q4_2 Using the scale provided, please rate the following: - I want to help protect snakes

The following was removed as it was deemed too similar to another question on the survey:
Q6/Q4 Using the scale provided, how would you feel if you encountered a snake in the wild?

The following were removed as all students participated in the in-person program and did not have the opportunity to participate in a virtual program:
Please select Yes or No to the following statement: I have... - participated in an in-person Park Ranger lead snake program
Please select Yes or No to the following statement: I have... - seen a snake virtually during a Park Ranger lead program
Please select Yes or No to the following statement: I have... - seen a live snake in a tank
Please select Yes or No to the following statement: I have... - witnessed a snake being held by a Park Ranger