IMPACTS OF ECOLOGY-THEMED INTERPRETATION PROGRAMS AT A COLORADO OPEN SPACE PRESERVE ON ATTITUDES, BELIEFS, AND KNOWLEDGE

By

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ABSTRACT

In this investigation participants in a series of interpretive education programs at a local nature preserve were asked to evaluate their attitudes, beliefs, and knowledge about wildlife conservation and ecology. The goal was to determine whether the interpretation programs impacted the participant's perspective. The research demonstrated that the majority of those who participated in the interpretation programs did have positive attitudes, beliefs and knowledge about wildlife conservation and ecology after doing so.

INTRODUCTION AND BACKGROUND

I am a volunteer naturalist – an informal educator – at one of Colorado's most scenic and treasured state parks. My mission is to inspire visitors. I aim to provide visitors with a greater appreciation of the state park's role in developing knowledge and appreciation of nature. My approach to interpretation rests on the principle that learning in nature, or in a setting that introduces natural science concepts, will cause many visitors to want to learn more about nature and to do more to protect and preserve it. My goal in writing this professional paper was to investigate the effectiveness of interpretation techniques used at a nearby nature preserve operated by a local government so that I could improve my own skills and positively impact the experiences of visitors to the state park at which I practice the craft of interpretation.

South Platte Park and Carson Nature Center

The location for this study, South Platte Park, was in the city of Littleton, Jefferson County, Colorado. The park was the subject of an effort over the course of more than a decade to set aside a natural area bordering the South Platte River and was opened in 1983 (South Suburban Parks and Recreation, 2016a). The 880-acre park includes five lakes, two and one-half miles of the South Platte River, and more than four miles of natural surface trails (South Suburban Parks and Recreation, 2016c).

The park was reclaimed from an area that had been heavily mined for more than a century and now provides habitat for more than 245 species of birds, including bald eagles and great blue herons. Almost two dozen species of waterfowl winter at the park (South Suburban Parks and Recreation, 2016b). Other wildlife species that depend on the

park include at least 60 mammals, reptiles, amphibians, and fish (South Suburban Parks and Recreation, 2016b). Among those terrestrial organisms are beaver, muskrat, raccoon, deer, and coyote (South Suburban Parks and Recreation, 2016a).

Project Goals and Approach

This research project was an attempt to improve the interpretive practices at South Platte Park. I hoped that, to the extent the study identifies particular actions that can and should be taken to maximize the educational benefits received by visitors who participate in interpretation programs, such actions will be duplicated at other preserves. Interpretation is an art, and individuals engaged in the craft bring idiosyncrasies to their efforts to inspire visitors to a nature preserve, but greater knowledge of the impact of particular methods of free-choice education may also increase the satisfaction these interpreters feel about their work.

This study investigated the degree to which visitors to South Platte Park who participated in group interpretive programs demonstrated positive attitudes and beliefs and relevant knowledge relating to the protection of wildlife, both generally and in the park. The following sub-questions were addressed.

- Does attendance at an ecology-themed interpretation program positively impact visitor attitudes about conservation of the park's wildlife?
- Does attendance at an ecology-themed interpretation program produce positive visitor beliefs about basic ecological principles, including the diversity of wildlife and importance of features of the park's landscape to wildlife populations?

- Do visitors demonstrate knowledge of basic ecology principles, including the importance of wildlife conservation, after participating in an interpretive learning opportunity?
- Do interpretation program participants differ in their attitudes, beliefs, and knowledge relevant to wildlife and ecology on the basis of their gender?

CONCEPTUAL FRAMEWORK

To me was all in all. I cannot paint
What then I was. The sounding cataract
Haunted me like a passion: the tall rock,
The mountain, and the deep and gloomy wood
Their colours, and their forms, were then to me
An appetite; a feeling and a love,
That had no need of a remoter charm,
By thought supplied, or any interest
Unborrowed from the eye . . .

William Wordsworth, Lines Written a Few Miles Above Tintern Abbey, On Revisiting the Banks of the Wye During a Tour. July 13, 1798.

A Brief History of the Conservation Movement

The romantic prose of Wordsworth (1798) presaged a growing movement to preserve the beauty of nature. Among those who took up the cause of the wilderness was the American writer Henry David Thoreau, who exclaimed in a famous 1862 essay that "[i]n Wildness is the preservation of the World" (Thoreau, 1862). The sentiment – that time in nature is more essential to the well-being of humans than almost any other human activity – was later expressed somewhat more roughly by John Muir, who wrote in 1872 that "[o]ne day's exposure to mountains is better than cartloads of books" (Wolfe, 1979, p. 95). The appeal of nature was not only aesthetic. Early nineteenth century scientists

also began to emphasize the importance of understanding the natural world. Joseph Banks, Charles Darwin, and Joseph Hooker highlighted the insights that nature held for humanity's understanding of its place in the universe, for example, and by mid-century the American philologist and conservationist George Perkins Marsh warned, in his "epoch-making" book (Miller, 2004, p. 362) of the damage humanity had already done to the natural world (Marsh, 1967) while the German scientist Ernst Haeckel (1866) first described a conception of organisms as inextricable components of an ecosystem.

The impact of these ideas did not immediately cause human societies to take seriously the imperative of preserving nature. As wildlife suffered ever-increasing destruction at the hands of humanity, a conservation movement took root first in Europe and then in North America. However, it was in the United States where the infant conservation movement began a drive to preserve entire landscapes. Yellowstone National Park, the first such preserve on the planet, was designated in 1872 (Runte, 2010).

Worldwide Nature Preservation Trends

More than 15 percent of Earth's land has been set aside for the conservation of nature (United Nations, 2014). According to the International Union for the Conservation of Nature (IUCN), the definition applies to "a clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008, p. 8)." As of 2008, the amount of terrain that is included in protected preserves, as that term by IUCN, is equivalent to the area of South America

(Dudley, 2008). Mogelgaard (2006) noted that the trend has increased since the 1970s as international agreements, particularly the Convention on Biological Diversity (CBD), have pushed governments to designate additional reserves. The CBD, which came into effect in 1993, requires signatory nations to "conserve and sustainably use" biodiversity (Raustiala & Victor, 1996, p.20), albeit in a manner consistent with their "particular conditions and capabilities" (United Nations & United Nations Environment Programme, 2015).

These preserves are popular with the public. Worldwide, they receive eight billion visits every year. In most countries, notably excepting the United States and several other relatively affluent nations, visitation is increasing (Balmford et al., 2015). One reason for that prevailing trend is the growing prosperity of populations in some countries. In addition, international tourism has increased. The pattern seems to be less clear in the United States. A recent study concluded that a "fundamental and pervasive decline in nature recreation" (Pergams & Zaradic, 2008, p. 2297) has occurred. Between 1975 and 1993 the percentage of the U.S. population engaged in active nature-based recreation declined from 4.6 percent to 2.2 percent, although that proportion then increased to 2.6 percent by 2007 (Siikamaki, 2011). The reasons for this change in Americans' recreational habits are not entirely clear. They may include increases in travel costs (Stevens, More, & Markowski-Lindsay, 2014), a reduction in per capita income (Scott & Munson, 1994), or the imposition of admission fees (Stevens et al., 2014). On the other hand, observers have also noted a general decline in children's engagement with nature (Louv, 2005) and an increased "videophilia (Pergams & Zaradic, 2006)," or fascination

with electronic media, that may discourage individuals from engaging with the natural world.

In general, conservation of natural resources, including wildlife, is a popular ideology in the United States. A 2016 poll showed that more than half of Americans believe that environmental protection should receive greater weight in public policy than economic considerations, for example, although most do not consider themselves to be environmentalists (Gallup, 2016). It has been hypothesized that women are more likely than men to support measures aimed at protecting environmental quality (Braidotti, Charkiewicz, Hausler, & Wieringa, 1994), though little data to test that proposition seems to have been obtained.

Relevant Concepts of Learning Theory

A single definition of the term "learning" is not easy to find. An individual learns when he or she develops a "mechanism for making meaning in the physical world" (Falk, Dierking, & Foutz, 2007, p. xix.) The process results in changes to a person's attitudes, behavior, and process of acquiring knowledge (Falk et al., 2007). Researchers theorize that humans learn either behaviorally, cognitively, or constructively (Ertmer & Newby, 1993; Ormrod, 2000). Constructivism has become, during the past several decades, the most influential of the theories (Brandon, 2004). In general, constructivists believe that knowledge is obtained from participation in activities or from experience, that learning is driven by a student and not by an instructor, and that student knowledge should be assessed by multiple mechanisms (Roblyer, 2006). John Dewey, an early developer of the constructivist view of learning, advocated the importance of a leaner's interest in the

effort to build knowledge. The child, Dewey wrote, should be "the sun about which the appliances of education revolve" (Dewey, 1900, p. 51).

Free-Choice Learning

Learning happens throughout an individual's lifetime (Falk, 2005). Experience can, of course, be major source of learning, as John Dewey emphasized nearly 80 years ago (Dewey, 1998). For nearly all residents of the United States and many other nations, school attendance is also a significant source of learning. More than one in four Americans – about 83 million individuals – are currently enrolled in all levels of formal schooling (Davis & Bauman, 2013). It is not likely that traditional schooling can meet the educational needs of all the nation's citizens (Walker & Manjarrez, 2003), and, in any event, learning does not come only from life experience and educational institutions. In fact, most learning that an individual experiences occurs outside of schools (Banks et al., 2007; Falk, Heimlich, & Foutz, 2009). Free-choice learning is the most common means by which human beings learn (Falk & Dierking, 2002 in Genovesi, 2011). A number of researchers have concluded that free-choice learning is essentially self-directed because the learner does have control over what is learned (Falk, 2005; Tran, 2006; Bamberger & Tal, 2006; Kisiel, 2007). A learning opportunity does not qualify as free-choice in nature unless the learner understands that he or she may choose, or not choose, from among options (Falk, 2005). It is "[l]earner motivated, guided by learner interests, voluntary, personal, ongoing, contextually relevant, collaborative, nonlinear, and open-ended" (Bell, Lewenstein, Shouse, & Feder, 2009, p.11). Some researchers disagree, arguing that

learners in a free-choice environment are not required to exert any control over the educative process (Banz, 2008).

It is common for individuals, both adult and youth to experience free-choice learning at facilities such as museums, aquariums, and state and national parks (Falk, 2005). These facilities promote a style of learning known as free-choice learning; free-choice learning is distinguishable from "formal" and "non-formal" learning because the learner has the choice to choose among a variety of educational spaces, options, or themes (Bamberger & Tal, 2006; Falk, 2005) and because the term "non-formal" indicates an emphasis on the location at which learning occurs instead of the learner (Falk & Dierking, 2002).

The United States has a "luxurious endowment" of such facilities (Falk & Dierking, 2010, p. 493). In such free-choice learning environments, the degree of learning that occurs is significantly dependent upon the extent of engagement chosen by the learner (Falk & Dierking, 2000). The learning environment is essentially constructivist in nature (Genovesi, 2011). Unlike a formal learning situation, in which students are given little control over their approach to learning (Cross, 2007; Falk & Dierking, 2002), students in a free-choice learning environment do not face pressure to accumulate knowledge in a prescribed sequence. To the contrary, the educative opportunities presented rely on the student's curiosity and personal motivation as the drivers of new learning (Hewitt, 2010). The free-choice learning environment is one that encourages learning within the particular context of the individual learner's life (Falk, 2005).

The reasons that individuals seek free-choice learning experiences are many. Free-choice learning is available in facilities that are frequently perceived by visitors as a place where relaxation is possible (Ham & Shew, 1979; Tofield, Coll, Vyle, & Bolstad, 2003). Visitors may find it easy to indulge their curiosity, or seek intellectual stimulation, at such a facility (Brody & Tomkiewicz, 2002; Heimlich, Falk, Bronnenkant, & Barlage, 2004). They may simply be hoping to spend time as a family in an enjoyable place (Ryan & Saward, 2004). Adults may recognize that a particular free-choice learning facility offers educational value (Broad, 1996; Falk et al., 2007 in Mony, 2007) and could well be motivated to advance their childrens' education when they visit one (Morgan & Hodgkinson, 1999; Falk, 2005). Children may visit free-choice learning facilities because they are interesting and fun (Falk, 2005). What seems clear is that individuals aim to satisfy personal intellectual or emotional objectives, develop or advance their own sense of identity, and/or to develop or clarify a personal value system (Carlson, 1988; Brown, Collins, & Duguid, 1989; Dirkx, 2001; Falk & Storksdieck, 2004; Heimlich et al., 2004). This idiosyncratic nature of the free-choice learning environment seems to contribute to a productive experience for the learner; available research indicates that free-choice learning situations are nurturing learning situations (Tran, 2006).

Falk and Dierking (2000) concluded that an entirely new theoretical model is necessary to explain the dynamics of free-choice learning. Their *Contextual Model of Learning* proposes that the learner's success depends on his or her personal, physical, and socio-cultural contexts (Falk & Dierking, 2000). Among the most important factors in those contexts is the learner's prior knowledge and experience (Banz, 2008; Falk, 2006;

Falk & Storksdieck, 2005; Adelman, Falk, & James, 2000). Falk and Dierking (1992) summarized this concept bluntly, writing that individuals are most likely to learn about subjects with which they are already familiar and in which they have an interest. In fact, a learner's prior knowledge and experience may even influence that learner's use of an exhibit or participation in a program (Stocklmayer, 2002; Tunnicliffe & Reiss, 2000). An individual's mental model can also be an important factor in the success of a free-choice learning program because it heavily influences the depth and character of the interaction between a learner and an interpretive program or exhibit (Stocklmayer, 2002). Inclusion of features with which the individual is familiar may increase the likelihood that the learner will gain new knowledge (Banz, 2008; Stocklmayer, 2005; Doering & Pekarik, 1996). Similarly, the novelty is helpful because it may cause the learner to be more curious than he or she otherwise would and thereby increase the degree to which the learner pays attention to the interpretive program or exhibit (Sandifer, 2003; Falk & Balling, 1982).

Motivation is not a sufficient explanation for the outcome a visitor experiences at a free-choice learning facility (Falk & Storksdieck, 2005). Certain characteristics of individuals also play a part; these include interest and the makeup of any group with which the individual shares the visit in addition to prior knowledge and experience (Falk et al., 2007 as cited in Mony, 2007). In 2006 free-choice education researcher John Falk grouped these characteristics into five categories: (1) explorers, who are mainly driven by interest in a particular subject or curiosity, (2) facilitators, who aim to help those accompanying them achieve their objectives; (3) professionals or hobbyists, who are

knowledgeable about a particular subject and may be primarily concerned with the means by which information is communicated; (4) experience seekers, who have the goal of completing an educational program for its own sake and not for any educational value it offers; and (5) spiritual pilgrims, who visit because they wish to enjoy the environment available at the facility (Falk, 2006).

Other studies have concluded that the success of a free-learning experience depends in part on the participant's "learning agenda" (Dierking & Falk, 1994, p. 62) and on the degree of family participation (Borun, Chambers, & Cleghorn, 1996). Additional research has found that free-learning environments work best when exhibits and activities are interactive and experience-based (Van Moer, De Mette, & Elias, 2008). Falk (2005) concluded that half of all American science learning results from visits to free-choice learning and then Falk (1999) similarly concluded that substantial and enduring knowledge gains are experienced by those that participate in free-choice learning experiences. Free-choice learning environments appear to contribute to learning in a very large percentage of those who participate in relevant activities (Briseno-Garzon, Anderson, & Anderson, 2007; Falk & Dierking, 2002; Stocklmayer, 2005).

Scientific Literacy among Americans

Americans are confronted daily with news about scientific developments or about policy debates that touch on scientific knowledge. In recent years the major newspapers of the country have run stories that covered, for example, the discovery of a potentially Earth-like exoplanet (Overbye, 2015) and fossils of feathered dinosaurs (Browne, 1997; Khan, 2015), as well as research into the loss of Antarctic ice sheets (Gillis, 2015), the

exploration of the solar system (Corum, 2015; Kaufman, 2015; Sokol, 2015) and over-harvesting on marine life (Zimmer, 2015).

The popular literature broadly covers science, too, with recent best-selling books focused on astronomy (Scharf, 2015), chemistry (Kean, 2013), climate disruption (Hansen, 2010), cosmology and physics (Randall, 2015), environmental science (Carson, 2002), evolution (Nye, 2015), extinctions and biodiversity conservation (Kolbert, 2015), genetics (Dawkins, 2006; Kean, 2013), geology (Hazen, 2013), oceanography (Earle, 2009), paleontology (Switek, 2013), and zoology (Goodall, 2010). But the importance of scientific literacy goes beyond the capacity to understand these discussions and debates. Even something as simple as a trip to the grocery store calls for it because "personal decision-making, participation in civic and cultural affairs, and economic productivity" also depend on a reasonable individual understanding of science and its methods (National Research Council, 1996, p. 22).

Americans may not be particularly scientifically literate, despite the importance of that knowledge to our society. A 2007 survey concluded that only 28 percent of individuals in the nation are capable of understanding a news story about science in a daily newspaper or mass market magazine (Michigan State University, 2007). That means more than 200 million Americans lack sufficient understanding of science to do so (Duncan, 2007). A later survey by the California Academy of Sciences concluded that the scientific literacy rate among Americans is only 21 percent (California Academy of Sciences, 2009). The nation's people appear to value science as an intellectual endeavor and to recognize that it has improved the quality of life for most Americans, but most

individuals apparently disregard scientific knowledge when it contradicts their ideological, political, or religious points of view (Funk & Rainie, 2015).

The Practice of Interpretation

The sort of education that occurs in nature preserves is not the sort of education that often occurs in a school. In a public or private school, children are generally taught according to state academic standards and/or a defined curriculum. In a nature preserve, museum, aquarium, zoo, or similar facility, interpretation is the usual technique deployed to assist visitors, including children, in understanding the significance of the facility's assets and features. This method of instruction is often compared to informal education (Brody & Tomkiewicz, 2002).

Interpretation is, essentially, a technique of communication (Ham, 1993; Blaser, 2015). The National Association for Interpretation defines it as "a mission-based communication process that forges emotional and intellectual connections between the interests of the audience and the meanings inherent in the resource" (Merriman & Brochu, 2006, p. 49). Another influential team of researchers in the field has written that interpretation really amounts to an "informational and inspirational process designed to enhance understanding, appreciation, and protection of our cultural and natural legacy" (Beck & Cable, 2002, p. 1). At its core, the practice aims to help people who are not educated in a scientific discipline to understand the ideas of the natural sciences (Ham, 1993).

However the objective of interpretation is articulated, it is obvious that the prospects for effective conservation of cultural, historical, and natural resources depends

heavily on the degree to which this task is accomplished (Jacobson, 1999). Note that the mission to which Merriman and Brochu (2006) and Beck and Cable (2002) referred, and which Jacobson (1999) highlighted, is not the only focus of interpretation. Interpreters may also focus on influencing positive behavior toward an environmentally or culturally significant or sensitive area, conveying a perspective about the physical or human environment, or promoting tourism. During a particular interpretive program, the interpreter may seek to advance more than these objectives (Benton, 2009).

While the practice of storytelling that sought also to educate may date to the very earliest history of the human race (Ortiz, 2007), the term *interpretation* was coined by two influential and pioneering American conservationists. John Muir, speaking about the Yosemite Valley, is reputed to have said, "I'll interpret the rocks, learn the language of flood, storm and the avalanche. I'll acquaint myself with the glaciers and wild gardens, and get as near the heart of the world as I can" (Gisel, 2008, p. 104; Wolfe, 2003, p. 144). Some years later, in 1920, Enos Mills, a Colorado homesteader and naturalist who spearheaded the establishment of Rocky Mountain National Park (Wild, 1977), wrote that the task of a nature guide is to "illuminate and reveal the alluring world outdoors by introducing determining influences and the respondent tendencies" (Mills, 1920, p. 214). He pioneered the development of standards to guide interpreters – then known as guides - in the task of helping others grow "excited" about nature (Mills, 1920, p. ii-iii).

Interpretation, as a discipline, is not static, of course, and a modern view of the practice has developed. The "how-to" of interpretation is vital if any or all of the objectives of the practice are to be achieved. Decades after the foundation built by John

Muir and Enos Mills, Tilden (1967) described those objectives. Among them are that interpretation must relate the object being shown or explained to something within the "personality or experience of the visitor," that interpretation is not primarily about sharing information, but instead aims to provide the visitor with "revelation" based on information, that interpretation aims to provoke, not instruct, and that interpretation seeks to provide a participant in a program with a holistic view of the resource. It is also important to note, that unlike traditional classroom education, interpretation is thematic in nature and all appropriate efforts needed to assure that it is pleasurable, organized, and relevant should be undertaken (Ham, 1993).

Despite the ubiquity of interpretation programs, relatively little is known of their efficacy (Brody & Tomkiewicz, 2002; National Education Council, 2006). Researchers have tended to look to data obtained from studies at museums (Gross et al., 2010). However, researchers have explored their effects at a variety of other free-learning facilities at which interpretation is used to inform the public about important cultural, historical, and natural resources. "Parks are settings that often include visitor centers, guides in the form of rangers, interpretive signs, programs, and opportunities similar to those in museums, aquariums, zoos, nature centers, and other free-choice learning environments" (Bourque, 2012, p.5).

METHODOLOGY

This study was undertaken to determine whether visitors who participated in a free-choice learning opportunity at a public nature preserve experienced changes in their knowledge, beliefs, and or attitudes about certain aspects of the natural world. The goal

was to determine whether the interpretation program offered these visitors had a positive impact. The location of the study was South Platte Park, a suburban open space preserve located in Littleton, Colorado that is known for its diversity of wildlife habitats and species. Several dozen adult visitors participated in the study. All of the visitors were present at South Platte Park as a result of their individual or family decisions to visit; they were not part of an organized group activity and were not members of a school group. All of the interpretation programs included in the study occurred either on a weekday evening or on a weekend day. Weekday events were avoided so as to prevent an unreasonably high likelihood that participants would be retired, unemployed, or otherwise unrepresentative of the general population in the Littleton area and on the Front Range. The study was approved by Montana State University's Institutional Review Board (Appendix A).

During this action research project twenty-six individuals agreed to complete the Post-Visit Questionnaire and Post-Visit Likert Survey (*N = 26*). That number was approximately one-fourth of the total number of participants in the five interpretation events at which data was gathered. Demographic information relating to the visitors who chose to participate in the study was obtained. The population from which the data in this study was obtained included adults who attended five wildlife-related interpretation events at South Platte Park between January 30, 2016 and April 20, 2016. The titles of those events, and their specific focus, are detailed below (Table 1). All event titles and descriptions are taken from the relevant periodic newsletter of South Platte Park (South Platte Park, 2015; South Platte Park, 2016).

Table 1
Interpretation Events at which Data was Obtained

DATE	TITLE	FOCUS
Jan. 30, 2016	Raptors of Winter	"Hike to see wild hawks, eagles, and owls!"
Feb. 6, 2016	Wild Wings: Live Birds of Prey	"See captive falcons, owls, and hawks fly up close."
Feb. 20, 2016	Wild Wings: Live Birds of Prey	"See captive falcons, owls, and hawks fly up close."
Apr. 9, 2016	Cooley Lake Nature Walk	"[M]onthly walk of nature preserve portion of Park."
Apr. 13, 2016	Birdwatching for Beginners	"Practice the skills for a new outdoor hobby with an expert."

All individuals who participated in the five events were asked to complete the Post-Visit Questionnaire (Appendix B). Not every participant agreed to do so. In addition to inquiring about demographics, motivations for visiting South Platte Park, and the frequency with which visitors came to the preserve, the Post-Visit Questionnaire examined visitors' opinions about wildlife and its management. Questions were intended to discern visitor opinions about wildlife and wildlife management, and not other natural features of the preserve, because each interpretation event at which data was gathered was focused on wildlife. Participants in the interpretation programs were orally instructed to choose one answer to Post-Visit Questionnaire inquiries; however, not every respondent to the Post-Visit Questionnaire limited their responses in that manner. Some respondents provided more than one response to Post-Visit Questionnaire questions. Four questions on the Post-Visit Questionnaire targeted those areas of interest to South Platte Park administrators and three of them were open-ended, asking respondents to write a narrative answer. One of these questions provided four possible choices relating to the most important feature of the facility.

All individuals who participated in the five events were also asked to complete the Post-Visit Likert Survey (Appendix C). Not every participant agreed to do so. The

Post-Visit Likert Survey asked the visitors to rate their knowledge and beliefs about wildlife native to Colorado's Front Range and the importance of the land and waters at South Platte Park to the conservation of those species. It also asked visitors to rate their willingness to learn about ways they can act to protect wildlife and wildlife habitat. The Post-Visit Likert survey asked visitors to rate the statements to which they responded on a scale of one to five, with the lowest number corresponding to *strongly agree* and the highest number corresponding to *strongly disagree.* Participants in the interpretation programs observed during this study were orally instructed to choose one answer to Post-Visit Likert Survey inquiries; however, not every respondent limited their responses in that manner.

Post-Visit Questionnaire responses were tabulated and examined for the frequency of particular responses and then those responses were categorized on the basis of the respondent's gender. For open-ended inquiries that asked respondents to provide a narrative response, a table accumulating those responses in their entirety was constructed. For questions on the Post-Visit Questionnaire that asked the respondent to choose from a menu of answer options, statistical analysis was performed through the construction of a two-way table and the calculation of conditional frequencies. Responses to the Post-Visit Likert Survey were analyzed to determine their median and mode. The Post-Visit Likert Survey responses were also categorized by gender. The median and mode of those responses were determined and then within those groups were statistically analyzed using the chi-square test method. Participants were also observed during the course of the interpretation program in which they participated to gain further insights into the impact

of that free-choice educative opportunity. Anecdotes of some reactions, comments, and behaviors by participants were recorded in voice notes as qualitative evidence of the program's impact. In general, participant comments were not quoted in those voice notes. They were instead paraphrased.

Gender-correlated data was also recorded and analyzed. Because the available research indicates that, at least in some instances, women are more likely to hold attitudes favoring environmental values (Braidotti et al., 1994), it seemed appropriate to consider whether that supposition held true after participation in a South Platte Park interpretation program. No other demographic information that was collected was used in the analysis conducted as part of this study.

No baseline data in the form of responses to a questionnaire or Likert survey provided before participation in an interpretive education program commenced was obtained because South Platte Park administrators declined to permit the use of those data-gathering tools at that stage of individuals' visits to the preserve. Nor was qualitative observation a viable method of obtaining baseline data. There would have been no method by which to observe responses to a program that had not yet occurred and, because no interviews of participants were permitted, there was also no way to discern a participant's attitudes, beliefs, and knowledge relating to ecology or wildlife before any interpretation program commenced. Furthermore, because this action research project involved data gathering at a public facility, the agency responsible for management of that facility asked that some questions tendered to participants in interpretation programs

focus on their reasons for visiting South Platte Park, the features of the preserve that they most valued, and the frequency of their visits.

The data sources described herein are summarized in the following Triangulation Matrix (Table 2). The information obtained from the use of these data sources provides the triangulated data relating to my research questions regarding the impacts of interpretation programs on visitor attitudes about wildlife.

Table 2
Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: Do visitors that participate in group interpretive programs demonstrate positive attitudes and beliefs and relevant knowledge relating to the protection of wildlife after their attendance?	Post-Visit Questionnaire	Post-Visit Likert Survey	Researcher observations
Secondary Questions: Does attendance at an ecology-themed interpretation program positively impact visitor attitudes about conservation of wildlife?	Post-Visit Questionnaire	Post-Visit Likert Survey	Researcher observations
Does attendance at an ecology-themed interpretation program produce positive visitor beliefs about basic ecological principles?	Post-Visit Questionnaire	Post-Visit Likert Survey	Researcher observations
Do visitors demonstrate knowledge of basic ecology principles, including the importance of wildlife conservation, after participating in an interpretive learning opportunity?	Post-Visit Questionnaire	Post-Visit Likert Survey	Researcher observations
Do interpretation program participants differ in their attitudes, beliefs, and knowledge relevant to wildlife and ecology on the basis of their gender?	Post-Visit Questionnaire	Post-Visit Likert Survey	Researcher Observations

DATA AND ANALYSIS

The following table details the demographic characteristics of the respondents to the Post-Visit Questionnaire and/or Post-Visit Likert Survey (Table 3).

Table 3
Demographics for Longitudinal Study Subgroups

Parameter	Description of participants
Sample size (*N*)	26
Percent female	69.2%
Percent male	30.8%

Responses to the Post-Visit Questionnaire inquiry of interest to South Platte Park administrators indicated that most respondents regarded the preserve's wildlife as its most important feature. Those who answered the Post-Visit Questionnaire were given the choice of trails, fishing, wildlife, and interpretation programs as the most vital components of the park. Of 58 responses (some respondents circled more than one of the four multiple-choice answers on the questionnaire), 22 favored wildlife, while 18 selected trails as the most personally important feature of South Platte Park and 13 chose interpretation programs. Five respondents thought that fishing was the most valuable feature of the park to them.

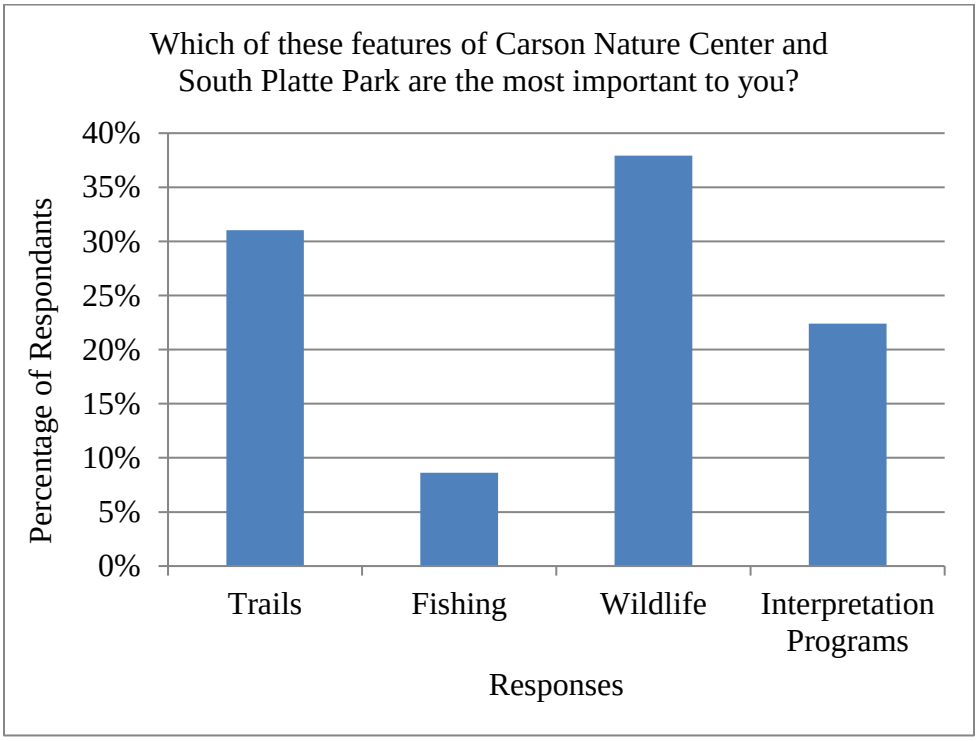

Figure 1. Frequency of responses to post-visit questionnaire inquiry relating to most personally important feature of South Platte Park, (*N*=58).

The responses to narrative response questions requested to be included by South Platte Park administrators exhibited a high degree of variability. Three such questions were included in the questionnaire. The first asked respondents the frequency of their visits to South Platte Park and the associated Carson Nature Center; the second asked respondents to specify the main driver (motivation) for their visits to the park; and the third asked respondents to specify what makes South Platte Park and the associated Carson Nature Center such important facilities in the area.

When asked about the frequency of visits to the facility, respondents provided answers that ranged from "never" to "daily." Among 17 female respondents, three individuals indicated that they had experienced their first visit to the preserve. Two individuals said that they visit about once per month, one indicated that twice per month was her expected visitation frequency, one said that she visits "about" three times per month, and one wrote that she visits four times each month. One woman wrote that she visits the preserve a "couple times a year," while two specified that they visit twice or three times each year, one indicated that she visits three or four times per year, and one indicated that she visits four times each year. One woman wrote "not often," another wrote that she had visited only one time previously, another indicated that she had made two previous visits, and yet another wrote that she would "start coming frequently" without specifying how often she visited the park. Among male respondents, two respondents indicated that they visit the park four times each week, while another male wrote that he visits daily. A third man wrote that he visits one time per month, another wrote that he visits once or twice each year, and another wrote "never."

A clear majority of the respondents who provided an answer to the question relating to motivation for coming to South Platte Park pointed generally to the natural features of the preserve as a driver of visitation to the preserve. Fifteen of 23 male and female respondents, or 65.2 percent, included the words "nature," "beauty," "bird" or "birds," "wildlife," or "animals" in their responses. The remaining eight respondents (34.8 percent) mentioned other reasons, including three that cited interpretation program availability. Of the 17 female respondents to this question, 12 used those words. Three of the six men who responded to the question also used those words.

As to the inquiry relating to the basis of South Platte Park's regional importance as a recreational facility, fifteen of 21 respondents to the question (71.4 percent) used the word "nature," "wildlife," "bird" or "birds," "animals," "plant" or "plants," "beauty" or "beautiful," or "wild" in a written narrative of their answer. There was proportionately more agreement among males who answered this question that natural features drive the importance of South Platte Park to the region then there was among female respondents. For example, one man wrote that the park is an "educational/natural resource," another wrote that it is a "natural area close to home," a third said that South Platte Park has "open space, wildlife, and trails," and a fourth mentioned that the preserve "has a wild side." Thus, of the five male respondents to this question, four (80 percent) included one or more of the ten words specified in the first sentence of this paragraph, while only 11 of 16 females (68.8 percent) who responded to the question did so.

When participants were asked, in a series of inquiries on the Post-Visit Questionnaire, to choose responses that best described their attitudes, beliefs, and

knowledge about wildlife, ecology, and the management philosophy most likely to assure functional and healthy habitats at South Platte Park, they indicated a near-consensus that wildlife has significant aesthetic and scientific value, requires human stewardship, and is harmed by human activities and that such activities must be limited. The participants also generally agreed that development and natural resource exploitation are the major threats to wildlife persistence.

The first of these series of questions on the Post-Visit Questionnaire asked participants in the interpretation programs that were part of the study to specify their "views about wildlife." The descriptions of general opinion about wildlife that were provided as possible responses included the following statements: "wildlife symbolizes freedom and nature," "wildlife is part of a healthy ecosystem," "wildlife is dangerous," and "wildlife is a nuisance and detrimental to recreation and/or business." All of the 39 responses to this question (some of the 23 respondents to the question chose more than one of the four answer options provided on the Post-Visit Questionnaire) agreed that either "wildlife symbolizes freedom and nature" (18 responses) or "wildlife is part of a healthy ecosystem" (21 responses) best characterized their perspective. The use of a two-way table provided insight into the distribution of the responses to this question among male and female participants in the study (Table 4). Seventeen females and six males answered the question.

Table 4
Gender Correlation of Responses to Post-Visit Questionnaire Inquiry Relating to Views about Importance of Wildlife (*N*=39)

Gender of Respondent	Wildlife symbolizes freedom and nature	Wildlife is part of a healthy ecosystem	Wildlife is dangerous	Wildlife is a nuisance and detrimental to	Total

				recreation and/or business	
Female	46.43%	53.57%	0.00%	0.00%	100.00%
Male	45.45%	54.55%	0.00%	0.00%	100.00%
Total	46.15%	53.85%	0.00%	0.00%	100.00%

The joint frequencies provided some clue that, perhaps, female respondents were more likely to choose both response 1 and response 2 than were male respondents. However, it was necessary to calculate conditional relative frequencies to determine if this was, in fact, the case. Of the 46.15 percent of the total respondents who thought that the statement "wildlife symbolizes freedom and nature" best represented their views, women comprised 33.33 percent and men comprised 12.82 percent. With respect to the statement that "wildlife is part of a healthy ecosystem" (53.85 percent of the total), women accounted for 38.46 percent and men accounted for 15.38 percent. No one chose the statements that claimed that "wildlife is dangerous" or that "wildlife is a nuisance and detrimental to recreation and/or business."

This calculation may seem to indicate that women were slightly more likely than men to choose select the response that asserted "wildlife is part of a healthy ecosystem" than the response that asserted "wildlife symbolizes freedom and nature." However, the total sample size was small enough (N=39) that calculation of row conditional relative frequencies was necessary to determine whether such a conclusion is merited. That calculation indicated that 46.43 percent of women agree that "wildlife symbolizes freedom and nature" while 53.57 percent think that "wildlife is part of a healthy ecosystem." Among men, 45.45 percent think that "wildlife symbolizes freedom and nature," while 54.55 percent agree that "wildlife is part of a healthy ecosystem." Thus, women, by a margin of about one percent, were slightly more likely than men to choose

the statement that linked wildlife to "freedom and nature," while men were slightly more likely, by that same margin of approximately one percent, to say that wildlife is a component of a functional ecosystem.

Here again, though, the low sample size indicated a necessity to further clarify the meaning of the limited data. Calculation of column conditional relative frequencies indicated that, among all respondents who agreed that "wildlife symbolizes freedom and nature," 72.22 percent were women and 27.78 percent were men. Among all respondents who indicated that they believe that "wildlife is part of a healthy ecosystem," 71.43 percent were women and 28.57 percent were men. Those results confirmed that women were slightly more likely than men to demonstrate a belief that wildlife evokes "freedom and nature" and men were slightly more likely than women to indicate that "wildlife is part of a healthy ecosystem." It must be borne in mind that eleven of the 17 female respondents and five of the six male respondents chose both responses.

The Post-Visit Questionnaire question that asked participants in the interpretation programs studied to choose a statement that best described their individual opinion about how wildlife should be managed produced a similarly concentrated distribution of responses. Of 24 respondents, 87.5 percent agreed that "wildlife populations need careful management because many species are endangered or threatened." Only 8.33 percent believed that "wildlife populations should be controlled to minimize impacts to other species" while 4.17 percent believed that "wildlife populations should not be controlled because nature can support them"). No respondents agreed that "wildlife is common and does not require efforts to maintain populations." Again, a two-way table allows some

limited insight into the distribution of the responses to this question among male and female participants in the study (Table 5). Fifteen females and seven males answered the question. One of the females circled two responses to the question.

Table 5
Gender Correlation of Responses to Post-Visit Questionnaire Inquiry Relating to Views about Management of Wildlife (*N*=23)

Gender of Respondent	Wildlife populations should be controlled to minimize impacts to other species	Wildlife populations should not be controlled because nature can support them	Wildlife is common and does not require efforts to maintain populations	Wildlife populations need careful management because many species are endangered or threatened	Total
Female	12.50 %	0.00%	0.00%	87.50%	100.00%
Male	0.00%	14.29%	0.00%	85.71%	100.00%
Total	8.70%	4.35%	0.00%	86.96%	100.00%

The joint frequencies indicated that female respondents may have been more likely to choose the statements “wildlife populations should be controlled to minimize impacts to other species” and “wildlife populations need careful management because many species are endangered or threatened” than were male respondents. By contrast, male respondents may have been more inclined to believe that “wildlife populations should not be controlled because nature can support them” than were female respondents. However, it was necessary to calculate conditional relative frequencies to determine if this is an accurate supposition.

Women were 69.57 percent of all respondents and 87.5 percent of them (60.87 percent of total respondents) chose the statement “wildlife populations need careful management because many species are endangered or threatened, while 12.5 percent of females selected “wildlife populations should be controlled to minimize impacts to other species.” Among men (30.43 percent of the total number of respondents), 85.7 percent of

them (26.09 percent of all respondents) agreed that “wildlife populations need careful management because many species are endangered or threatened,” while 14.3 percent of them thought that “wildlife populations should not be controlled because nature can support them.”

This calculation may seem to indicate that women were somewhat more likely than men to choose select the response that asserted “wildlife populations should be controlled to minimize impacts to other species” and the response stating that “wildlife populations need careful management because many species are endangered or threatened.” Nevertheless, the small sample size for this question (N=23) was again too small to be certain of these claims. Calculation of column conditional relative frequencies was therefore necessary.

That calculation showed that all of the respondents who agreed that “wildlife populations should be controlled to minimize impacts to other species” were women, while all of the respondents who thought that “wildlife populations should not be controlled because nature can support them” were male. Only the statement that asserted “wildlife populations need careful management because many species are endangered or threatened” drew supporters from both genders. Seven of every ten respondents who agreed with that statement were female and three of every ten of those respondents were men. In effect, that statement drew a consensus among people of both genders that the situation facing many wildlife species calls for intensive human involvement in guiding their fate.

The third multiple choice question on the Post-Visit Questionnaire that related to wildlife and ecology produced something of a break in the pattern of near-consensus. That question asked respondents to choose a statement that "best reflect[ed] [their] views about protection of the environment" and provided four options for a response: "ecosystems should be maintained in their natural states, or as close to it as possible, and wildlife and its habitat should be protected as much as possible;" "the needs and desires of humans should generally take priority over the habitat needs of other species;" "ecosystems should not be given more priority than developmental needs or human needs for natural resources;" and "the need to protect ecosystems and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves." Nineteen respondents (63.3 percent) chose the statement that "ecosystems should be maintained in their natural state, or as close to it as possible, and wildlife and its habitat should be protected as much as possible," while 11 (36.7 percent) chose the statement that "the need to protect ecosystems and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves." No respondent chose either the second or third of these responses.

The assembly of a two-way table does permit, here as with the other questions on the Post-Visit Questionnaire that asked respondents to choose from an array of statements, some insight into the distribution of the responses to the question among male and female participants in the study (Table 6). Sixteen females and six males answered

the question. Six of the female respondents and two of the male respondents circled two responses to the question.

Table 6
Gender Correlation of Responses to Post-Visit Questionnaire Inquiry Relating to Views about Environmental Protection (*N*=30)

Gender of Respondent	Ecosystems should be maintained in or close to their natural states	Human needs and desires should take priority over wildlife habitat needs	Ecosystems should not have more priority than human needs and desires	Protection of ecosystems and wildlife is important and human activities should be limited	Total
Female	63.64%	0.00%	0.00%	36.36%	100.00%
Male	75.00%	0.00%	0.00%	25.00%	100.00%
Total	66.67%	0.00%	0.00%	33.33%	100.00%

The joint frequencies might prompt one to conclude that male respondents were three times as likely to say that ecosystems should be maintained in or close to their natural states as they were to say that protection of ecosystems and wildlife is important and human activities should be limited, while women were only 1.9 times as likely to choose the first statement as they were to choose the fourth statement. The small sample size for this question (*N*=30) again demanded calculation of conditional relative frequencies, row-conditional relative frequencies, and column-conditional relative frequencies to decide if this is an accurate assumption and whether there were any significant associations between either gender and any of the responses to the question. Women were 73.3 percent of all respondents to the Post-Visit Questionnaire inquiry relating to views about environmental protection, while men comprised 26.7 percent of respondents. Determination of conditional relative frequencies revealed that, of those women, 63.6 percent (46.7 percent of all respondents) agreed that "ecosystems should be maintained in their natural states, or as close to is as possible, and wildlife and its habitat should be protected as much as possible." The remaining 36.4 percent of responding women (26.7 percent of all respondents) believed that "the need to protect ecosystems

and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves." Among men, 75 percent of those responding (20 percent of all respondents) agreed that "ecosystems should be maintained in their natural states, or as close to it as possible, and wildlife and its habitat should be protected as much as possible." The remaining 25 percent of men (6.7 percent of all respondents) chose the assertion that "the need to protect ecosystems and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves."

Looking to column conditional relative frequencies, women were 70 percent of those who chose the first of those statements and 80 percent of those who chose the second of them, while men were 30 percent of those who chose the first statement and 20 percent of those who chose the second. Thus, there did not appear to be a clear basis upon which to conclude that women or men were more likely to choose one statement over the other. However, relative frequency determinations did permit a conclusion that the statement indicating that "ecosystems should be maintained in their natural states, or as close to it as possible, and wildlife and its habitat should be protected as much as possible" was both more likely to be chosen by members of both genders than the statement asserting that "the need to protect ecosystems and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves."

The last question on the Post-Visit Questionnaire that asked participants in the five interpretation programs included in the study's scope focused on obstacles to the

survival of wildlife species. Respondents were asked to choose one of four statements that answered the question "What do you think is the greatest single challenge facing wildlife species generally?" The response options included "loss of habitat to development and natural resource use;" "hunting and poaching;" "pollution;" and "other." While this question did prompt at least a few respondents to choose each response option, it likewise produced a clear majority sentiment. In this case, 62.5 percent of respondents chose the statement that "loss of habitat to development and natural resource use" is the most significant challenge for wildlife, while 18.7 percent of respondents said that "pollution" is and 9.4 percent of respondents chose both "hunting and poaching" and "other."

A two-way table was again used to summarize the overall gender-based distribution of responses to this question (Table 7). Sixteen females and five males answered the question. Five of the female respondents and two of the male respondents circled multiple responses to the question; one of the female respondents selected three of the four response possibilities.

Table 7
Gender Correlation of Responses to Post-Visit Questionnaire Inquiry Relating to Views about Challenges Facing Wildlife Species (*N*=29)

Gender of Respondent	Loss of habitat to development and natural resource use	Hunting and poaching	Pollution	Other	Total
Female	63.64%	9.09%	18.18%	9.09%	100.00%
Male	71.43%	0.00%	14.29%	14.29%	100.00%
Total	65.52%	6.90%	17.24%	10.34%	100.00%

The joint frequencies might have prompted a conclusion that respondents of both genders were most likely to choose response a ("loss of habitat to development and

natural resource use"). However, with a sample size of less than three dozen (*N*=29) the calculation of conditional relative frequencies, row-conditional relative frequencies, and column-conditional relative frequencies was again appropriate. Women were 75.9 percent of all respondents to this question. Nearly two-thirds of them (63.6 percent of all women who responded, 48.3 percent of all respondents) agreed that the most significant challenge for wildlife is "loss of habitat to development and natural resource use." The remaining women divided their preference among the other three options. Nearly 20 percent of them (18.2 percent of all responding women, 13.8 percent of all respondents) said that pollution is the greatest peril for wildlife, while 9.1 percent of female respondents (6.9 percent of all respondents) believed that "hunting and poaching" is the leading threat to wildlife and the same proportion chose the term "other" as the best expression of their views on the matter.

Men, on the other hand, were 24.1 percent of all respondents to this question. A strong majority of them (71.4 percent, 17.24 percent of all respondents) agreed that habitat loss best explains the plight of wildlife, while 14.3 percent of men who answered the question (3.45 percent of all respondents) selected "pollution" and the same proportion of the male respondents chose "other" as the best summary of their opinion. Thus, 73.7 percent of all those who thought that wildlife is most imperiled by habitat loss were women, while only 26.3 percent of respondents who chose that statement as the best reflection of their belief were men; by contrast, two-thirds of those who chose the vague term "other" to describe their opinion about the biggest threat to wildlife were women and one-third of the respondents who picked that option were men. Some of the

individuals who chose the term “other” as most representative of their perspective offered explanatory comments. One male wrote that he believed the “lack of education/interest by [the] general public” accounts for the situation facing wildlife species, while a female respondent wrote that “human ignorance and self-determined sense of superiority” explains it.

Among the other two options, only women believed that “hunting and poaching” threatens wildlife. No men chose that statement as a reflection of their views. As for “pollution,” 80 percent of all respondents who selected that assertion as the one most closely matching their opinion were women and 20 percent of those who chose it were men. As with the other questions included in the Post-Visit Questionnaire, women were more proportionally far more likely to answer than men and, therefore, no clear conclusion about a gender-related trend in responses can be discerned in the absence of a larger, more random sample.

The six-part Post-Visit Likert Survey mostly focused on the wildlife-related attitudes, beliefs, and knowledge of those who had attended one of the five interpretation events at South Platte Park. The first statement on the Post-Visit Likert Survey is not focused on general attitudes, beliefs, and knowledge about wildlife. Instead, this statement aimed to gather data that would help South Platte Park management understand whether the public understands that the facility generally plays an important role in Front Range wildlife conservation efforts. A clear consensus that the preserve is vital existed; 90.5 percent of respondents said that they *strongly agree*, while 9.5 percent said they

agree. No respondent said that they had a *neutral* response to the statement or chose to *disagree* or *strongly disagree* with it.

The remaining statements included in the Post-Visit Likert Survey aimed to obtain data that would show whether participation in those interpretation events had positively impacted visitor attitudes, beliefs, and knowledge relating to wildlife. The results of the Post-Visit Likert Survey are detailed below (Table 7).

Table 8
Post-Visit Likert Survey Results

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Carson Nature Center and South Platte Park are important parts of Colorado's effort to protect wildlife.	19	2	0	0	0
I know more about the variety of wildlife that is native to the Front Range now that I have attended a program at South Platte Park.	17	3	1	0	0
It is important to protect wildlife populations and South Platte Park is an example on an effective way of doing so.	19	2	1	0	0
After attending a program at South Platte Park, I have a stronger understanding of wildlife in this area.	17	2	2	0	0
I am more motivated to learn about actions I can take that will help protect wildlife and its habitat.	16	3	2	0	0
The South Platte River and its ecosystem are vital for wildlife species.	20	0	0	0	0

Note. The total number of responses to each Post-Visit Likert Survey question varied. For question 1, *N*=21; for question 2, *N*=21; for question 3, *N*=22; for question 4, *N*=21; for question 5, *N*=21; for question 6, *N*=20

As is obvious, the mode for all of the Post-Visit Likert Survey responses is the *strongly agree* response. The median response for the statement is also *strongly agree*. It is not possible to calculate a mean or the standard deviation for such ordinal data (Jamieson, 2004). A cross-tabulation on the basis of respondent gender does not reveal any significant differences in the responses to the first Post-Visit Likert Survey statement.

Thirteen women said they *strongly agree,* while one said she *agree[d]*. Among the seven male respondents, six indicated that they *strongly agree* and one said he could *agree*.

The second statement included on the Post-Visit Likert Survey asked respondents to decide whether they *strongly agree, agree,* were *neutral* about the statement, *disagree,* or *strongly disagree* that "I know more about the variety of wildlife that is native to the Front Range now that I have attended a program at South Platte Park." Twenty-one participants responded to this statement on the Post-Visit Likert Survey. Seventeen, or 80.1 percent, indicated that they *strongly agree[d]*, 14.3 percent said they *agree[d]*, and 4.8 percent said they had a *neutral* reaction to the statement. Again, the mode of the responses to this Post-Visit Likert Survey statement was evident: it is the assertion that the respondent *strongly agree[d]*. The median response was also *strongly agree*. Observation of participants during and after the five interpretive education programs that were the bulwark of the study seemed to reinforce this Post-Visit Likert Survey statement's hypothesis that the work of the interpreter helped improve knowledge of wildlife. Two women were overheard commenting on the knowledge of the interpreter on a hike to a lake within the preserve that is ordinarily closed, while one man during the same event was heard telling his companion that the interpreter had helped him understand the behavior of ospreys better than he had before.

The third statement on the Post-Visit Likert Survey asked respondents to indicate their reaction to this assertion: "It is important to protect wildlife populations and South Platte Park is an example of an effective way of doing so." Nineteen respondents (86.4 percent) said they *strongly agree[d]* with the statement, 9.1 percent said they *agree[d]*,

and 4.5 percent indicated a *neutral* position. The mode of the response data set for this Post-Visit Likert Survey statement was, again, *strongly agree*. That option was also the median response.

The fourth statement on the Post-Visit Likert Survey posited this conclusion for visitors to consider: "After attending a program at South Platte Park, I have a stronger understanding of wildlife in this area." Seventeen of the 21 respondents to this statement (80.1 percent) chose to say they *strongly agree[d]*, while 9.5 percent *agree[d]* and another 9.5 percent indicated a *neutral* reaction. Thus, the mode was again the first choice (*strongly agree*), as was the median.

Post-Visit Likert Survey statement number five asked respondents to assess their degree of agreement with the claim that "I am more motivated to learn about actions I can take that will help protect wildlife and its habitat." Twenty-one individuals responded to this statement; 16 (76.2 percent)) chose to *strongly agree*, 14.3 percent *agree[d]*, and 9.5 percent said they had a *neutral* reaction to the statement. The mode and median of this response set was, therefore, the first response option (*strongly agree*).

The last Post-Visit Likert Survey statement asked for participants to respond to this assertion: "The South Platte River and its ecosystem are vital for wildlife species." All of the respondents (N=20) chose response 1 ("strongly agree"). The median and mode for the survey data relating to this statement is therefore obvious. No graph is necessary to indicate that unanimity among the sample.

INTERPRETATION AND CONCLUSION

This project demonstrated that individuals who participated in the five interpretation programs studied at South Platte Park demonstrated more positive attitudes and beliefs about wildlife and its conservation after that participation. The clear pattern of responses to both the Post-Visit Questionnaire and the Post-Visit Likert Survey provided at least some indication of this outcome. The same can be said of several of the secondary questions: attendance at an ecology-themed interpretation program seems to have positively impacted visitor attitudes about conservation of the park's wildlife, produced positive visitor beliefs about basic ecological principles, and resulted in a demonstrated knowledge of basic ecology principles. Such is the obvious conclusion pointed to by the responses to the Post-Visit Questionnaire and the Post-Visit Likert Survey: each inquiry resulted in near-consensus in support of wildlife protection, the value of wildlife to a preserve and to a community, and the risk to wildlife posed by human activities.

These positive outcomes may be the result of the active approach to interpretation that was employed during the programs observed during the course of this study. As previously demonstrated in research by Falk and Dierking (1992), engagement with participants, and encouragement of participation in the informal learning that is the goal of the program, is likely to result both in more learning and more enduring knowledge gains. It is also possible that the idiosyncratic nature of the interpreters themselves, or of the particular informal education methods they used, may have helped drive these positive outcomes. Because interpretation is mission-driven, it is not logical to expect that one method would be exclusively effective. As shown by Merriman and Brochu (2006), Beck and Cable (2002), and Jacobson (1999), the willingness of the interpreter to focus

on influencing positive behavior toward an environmentally or culturally significant or sensitive area and/or to convey a particular intellectual or emotional perspective about the physical or human environment may be at least as likely to drive such positive outcomes.

Unfortunately, there was no way to be sure that these outcomes were driven by the respondents' participation in the interpretation programs. There was no opportunity to administer a preliminary questionnaire or Likert survey to any participant in the interpretation programs because South Suburban Parks & Recreation District management refused to provide one. There were, moreover, few interpretive education events at which data after the fact could be obtained. The winter season in Colorado is long, with unpredictable and sometimes severe weather, and attendance at any winter-season outdoor activity is often sparse.

Those limitations of the study indicated two general technical problems with the data-gathering process. First, the sample size was very small. Only 26 individuals provided any Post-Visit Questionnaire or Post-Visit Likert Survey responses. Moreover, the number of responses was so low that it is not possible to draw any firm conclusions about gender differences on questions relating to wildlife and ecology. Thus, the study produced no clear answer to the fourth subsidiary research question: whether there were gender differences in the responses of interpretive program participants. Finally, there was an extremely high degree of consensus among those respondents. That leads to the second problem posed by the project: a probable lack of diversity among the respondents, at least in terms of ideas and attitudes about wildlife and its conservation. This was not surprising, considering that people who are interested in nature in some manner are those

likely to attend a nature-themed interpretation program at a nature preserve. Given the small number of respondents and the lack of an opportunity to administer a questionnaire or Likert survey visitors to the nature preserve before they attended an interpretation program, many statistical tools, including those such as the paired T-test method, the Wilcoxson signed rank test, an analysis of variance test, or a randomization or permutation test, were not practically available as a method of analyzing the data. The only feasible way of analyzing the Post-Visit Questionnaire data was to group it into two-way tables.

Were this project to be repeated, it would be appropriate to extend the study period into the spring, summer, and/or fall seasons so that more interpretation programs, and therefore more participants, would be likely to participate in providing data. Moreover, a pre-treatment regimen of a questionnaire and Likert survey would establish baseline data. In this study the inquiries included in the Post-Visit Questionnaire were somewhat open-ended. A future researcher may wish to improve the wording of those questions to include a more local focus. At least some of the threats to wildlife in one community or region may be different than in others, for example. In addition, research that aims for an evaluation of interpreter effectiveness could profit from incorporation of a greater variety of interpretation topics in the study.

A researcher would also be well-advised to interview as many participants in the interpretation programs as possible, a data gathering tool that was not permitted during the execution of this project. In terms of the actual interpretation methods employed, a future researcher may profit from examining closely the particular tools used by each

interpreter that participates in a study. Whether incorporation of formal learning standards into an interpretive experience offered to visitors affect outcomes and whether personal religious values and previous familiarity with basic principles of the scientific discipline highlighted by the features of the particular preserve appear to affect a visitor's openness to learning about the biota of this or other preserves may also be a fruitful area of study.

VALUE

The project may have demonstrated that hands-on, outdoor interpretive education techniques do reinforce the purpose of interpretation (to build an emotional and intellectual connection with nature). As Dewey (1900) so famously pointed out, interest is key to learning and learning, even if limited to building awareness of a resource, is the goal of interpretation (Mills, 1920). Ham (1993) argued for assuring interest by the consumers (informal learners) who participate in interpretation programs; even if active engagement in wildlife observation did not cause the positive attitudes and beliefs measured after the participant spent time at a South Platte Park interpretation event, it likely increased the odds that some knowledge was imparted during that program.

Of course, observations of a number of participants in the five programs that were part of this action research project indicated that the interpreter at each of those programs had a noticeable impact on participant knowledge and, therefore, attitude about wildlife, its conservation, and the local ecology. The pattern of a strong consensus about the value of wildlife and its conservation, and in favor of programs to perpetuate wildlife, may indicate that interpretation programs that focus on discussion with rangers or naturalists

or lecture are less likely to reinforce or build the emotional and intellectual links between visitors and the preserve's assets so essential to the long-term viability of the preserve.

One implication of the results obtained in this study is the possible benefit of interpretive techniques to achievement of learning objectives ordinarily associated with formal education. The Next Generation Science Standards (2013) contemplate that active learning by science students should be a priority for teachers. The sorts of opportunities for learners to touch and observe natural objects at a preserve have an obvious similarity. It has been hypothesized that students achieve better learning outcomes when they feel an emotional connection to the subject matter (Oatley & Nundy, 1996). This study's results may indicate that implementing an actual intent to provoke such an emotional connection to concepts in the natural sciences may indeed produce better academic outcomes.

Those conclusions were of obvious help as a map toward more effective use of interpretive methods in my volunteer service for Colorado Parks & Wildlife. It is not infrequent that a volunteer naturalist at a state park would have the opportunity to work with visitors in an outdoor setting. Rather than fall into a pattern of using a "talk and listen" method of informal education, I will be far more likely to encourage visitors to use their own observation skills and ask questions and to tie the natural phenomenon the visitors observe to larger issues like their importance to wildlife, ecosystems, and the role of the preserve. I believe that the enthusiasm that was most obvious when participants in the interpretation programs saw first-hand the connection between wildlife abundance and conditions "on the ground" indicates that I would achieve the most lasting beneficial

results for visitors, and for the preserve, by guiding them at the times, and to the places, where such actual visual observation is most likely.

Another benefit that I see accruing in my own work as an interpreter has to do with integration of broader ecological concepts. The data gathered in this study indicates that, in many groups, there is a reasonably sophisticated understanding of the connection between wildlife populations and human activities and of the importance of diverse habitats to a functional nature preserve. This may be an indication that individuals who voluntarily participate in informal learning activities in a nature preserve may be more aware of basic scientific principles than the general public, despite the many findings that Americans generally lack knowledge in this field (Duncan, 2007; Michigan State University, 2007). When engaging in efforts to teach about the assets at such a preserve, it might be best to assume more often that visitors, or at least those who are adults, require little reminders of such basic scientific knowledge. I anticipate that, instead, I will be able to delve deeper into the threats to local habitats and ecosystem function. That may, in turn, increase the likelihood that visitors will connect their experience at the preserve with the activities in which they, their families, their friends, and other fellow citizens engage on a day-to-day basis.

If I and the many other informal educators who engage in interpretation at this country's many nature preserves and museums (Falk & Dierking, 2010) succeed in doing so, the worrisome loss of connection to nature identified by Louv (2005) and the "videophilia" identified by Pergams and colleagues (2006) may be overcome. Those who participate in informed interpretation programs may, in turn, re-kindle the passion

celebrated by Wordsworth (1798) in his eponymous poem and so important if the people of our society, and others, are to cope with the changes in our natural environment.

REFERENCES CITED

Adelman, L., Falk, J., & James, S. (2000). Impact of national aquarium in Baltimore on visitors' conservation attitudes, behavior, and knowledge. *Curator 43*(1), 33-61.

Balmford, A., Green, J., Anderson, M., Beresford, J., Huang, C., Naidoo, R., Walpole, M., & Manica, A. (2015). Walk on the Wild Side: Estimating the Global Magnitude of Visits to Protected Areas. *PLoS Biol 13*(2), e1002074. From http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002074

Bamberger, Y. & Tal, T. (2006). Learning in a personal context: Levels of choice in a free choice learning environment in science and natural history museums. *Science Education 91*(1), 75-95.

Banz, R. (2008). Self-directed learning: Implications for museums. *Journal of Museum Education 33*(1), 43-54.

Banks, J., Au, K., Ball, A., Bell, P., Gordon, E., Gutiérrez, K., & Zhou, M. (2007). Learning in and out of school in diverse environments: Life-wide, life-long, and life-deep learning. The LIFE Center (The Learning in Informal and Formal Environments Center), University of Washington, Seattle, Washington, Stanford University, Palo Alto, California, and SRI International and Center for Multicultural Education, University of Washington, Seattle, Washington. From http://life-slc.org/docs/Banks_etal-LIFE-Diversity-Report.pdf

Beck, L. & Cable, T. (2002). The meaning of interpretation. *Journal of Interpretation Research 7*(1), 7-10.

Bell, P., Lewenstein, B., Shouse, A., & Feder, M. (Eds). (2009). *Learning Science in Informal Environments: People, Places and Pursuits*. Washington: National Academies Press.

Benton, G. (2009). From principle to practice: Four conceptions of interpration. *Journal of Interpretation Research 14(1),* 7-31. From https://www.interpnet.com/docs/JIR-v14n1.pdf

Blaser, Monica K. (2015). *Opportunities of an Interpretive Application for Self-Guided Tourism Within the National Park System*. (Unpublished professional paper). University of Nebraska, Lincoln, Nebraska. From http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1005&context=journalismprojects

Borun, M., Chambers, M., & Cleghorn, A. (1996). Families are learning in science museums. *Curator 39(2),* 123-138.

Bourque, C. (2012). *Family Learning in Free-Choice Educational Settings: A Review of the Literature for the National Park Service*. (Unpublished professional paper). University of Wyoming, Laramie, Wyoming. From http://www.nps.gov/resources/upload/Task-6-NPSAB-Education-Family-Learning.pdf

Braidotti, R., Charkiewicz, E., Hausler, S., & Wieringa, S. (1994). *Women, The Environment, and Sustainable Development: Towards a Theoretical Synthesis*. London: Zed Books Ltd.

Brandon, B. (2004). How do people learn? Some new ideas for e-learning designers. The eLearning Developers' Journal. From http://www.elearningguild.com/pdf/2/060104-des.pdf

Briseno-Garzon, A., Anderson, D., & Anderson, A. (2007). Adult learning experiences from an aquarium visit: The role of social interactions in family groups. *Curator 50*(3), 299-318.

Broad, G. (1996). Visitor profile and evaluation of informal education at Jersey Zoo. *The Dodo Journal of Wildlife Preservation Trusts 32*, 166-192.

Brody, M. and Tomkiewicz, W. (2002). Park visitors' understanding, values and beliefs related to their experience at Midway Geyser Basin, Yellowstone National Park, USA. *International Journal of Science Education 24*(11), 1119-1141.

Brown, J., Collins, A. and Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher 18*(1), 32–42.

Browne, M. (1997, April 25). In China, a spectacular trove of dinosaur fossils is found. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/1997/04/25/us/in-china-a-spectacular-trove-of-dinosaur-fossils-is-found.html

California Academy of Sciences. (2009, March 13). American Adults Flunk Basic Science. Retrieved November 9, 2015 from http://www.sciencedaily.com/releases/2009/03/090312115133.htm

Carlson, M. (1988). *Meaning-Making: Therapeutic Processes in Adult Development*. New York: W.W. Norton & Co.

Carson, R. (2002). *Silent Spring: 50th Anniversary Edition*. New York: Houghton-Mifflin.

Corum, J. (2015, October 13). NASA's New Horizons probe glimpses Pluto's icy heart. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/interactive/2015/07/15/science/space/new-horizons-pluto-flyby-photos.html

Cross, J. (2007). Informal Learning: Rediscovering the Natural Pathways that Inspire Innovation and Performance. San Francisco: Pfeiffer.

Davis, J. and Bauman, K. (2013). School Enrollment in the United States: 2011 (Population Characteristics). U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census. From https://www.census.gov/prod/2013pubs/p20-571.pdf

Dawkins, R. (2006). *The Selfish Gene: 30th Anniversary Edition*. London: Oxford University Press.

Dewey, J. (1900). *The School and Society*. Chicago: The University of Chicago Press.

Dewey, J. (1998). *Experience and Education: The 60th Anniversary Edition*. West Lafayette: Kappa Delta Pi.

Dierking, L. & Falk, J. (1994). Family behavior and learning in informal settings: A review of the research. *Science Education 78*, 57-72.

Dirkx, J. (2001). The power of feelings: Emotion, imagination, and the construction of meaning in adult learning. *New Directions for Adult and Continuing Education 2001*: 63–72.

Doering, Z. & Pekarik, A. (1996). Questioning the entrance narrative. *Journal of Museum Education 21* (3), 20-25.

Dudley, N. (Ed.) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: International Union for the Conservation of Nature and Natural Resources. From http://portals.iucn.org/library/efiles/documents/PAPS-016.pdf

Duncan, D.E. (2007, February 21). 216 Million Americans Are Scientifically Illiterate (Part I). MIT Technology Review. Retrieved November 9, 2015 from http://www.technologyreview.com/view/407346/216-million-americans-are-scientifically-illiterate-part-i/

Earle, S. (2009). *The World is Blue: How Our Fate and the Ocean's Are One*. New York: National Geographic.

Ertmer, P. & Newby, T. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly 6(4),* pp. 50–72. From http://northweststate.edu/wp-content/uploads/files/21143_ftp.pdf

Falk, J. (2005). Free-choice environmental learning: Framing the discussion. *Environmental Education Research 11*(3), 265-280. From http://tclearninglounge.org/robert/design-informal-science-practicum-WI13/readings/FALK-Free-choice-environmental-learning.pdf

Falk, J. (2006). An identity-centered approach to understanding museum learning. *Curator 49*(2), 151-166.

Falk, J. & Bolling, J. (1982). The field trip milieu: Learning and behavior as a function of contextual events. *Journal of Educational Research 76*(1), 22-28.

Falk, J. & Dierking, L. (1992). *The Museum Experience*. Washington: Whalesback Books.

Falk, J. & Dierking, L. (2000). *Learning from Museums: Visitor Experiences and the Making of Meaning*. Walnut Creek: AltaMira Press.

Falk, J. & Dierking, L. (2002). *Lessons Without Limit: How Free-Choice Learning is Transforming Education*. Walnut Creek: AltaMira Press.

Falk, J. & Dierking, L. (2010). *The 95 percent solution*. *American Scientist*. 98(6):486-493. From http://www.upf.edu/pcstacademy/_docs/The_95x_solution.pdf

Falk, J., Dierking, L., & Foutz, S. (2007). Preface. In J.H. Falk, L.D. Dierking, & S. Foutz (Eds.). *In principle, In practice: Museums as Learning Institutions* (pp. xiii-xx). Lanham: AltaMira Press.

Falk, J., Heimlich, J., & Foutz, S. (2009). *Free-Choice Learning and the Environment*. Lanham: AltaMira Press.

Falk, J. & Storksdieck, M. (2004). Understanding the long-term impact of a visit to a science center. Final Report to the National Science Foundation, Grant #ESI-0125545 (Annapolis, MD, Institute for Learning Innovation).

Falk, J. & Storksdieck, M. (2005). Using the contextual model of learning to understand visitor learning from a science center exhibition. *Science Education 89*(5), 744-778.

Funk, C. & Rainie, L. (2015, January 29). Public and scientists' views on science and society. Pew Research Center. Retrieved November 9, 2015 from http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/

Gallup, Inc. (2016). In Depth Topics A-Z: Environment. Retrieved June 23, 2016 from http://www.gallup.com/poll/1615/Environment.aspx

Genovese, J. (2011). An Exploratory Study of a New Educational Method Using Live Animals and Visual Thinking Strategies for Natural Science Teaching in Museums. (Unpublished professional paper). Drexel University, Philadelphia, Pennsylvania.

Gillis, J. (2015, September 11). Study predicts Antarctica ice melt if all fossil fuels are burned. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/2015/09/12/science/climate-study-predicts-huge-sea-level-rise-if-all-fossil-fuels-are-burned.html

Gisel, B. (2008). *Nature's Beloved Son: Rediscovering John Muir's Botanical Legacy*. Berkeley: Heyday Books.

Goodall, J. (2010). *In the Shadow of Man*. New York: Mariner.

Gross, M.P. & Zimmerman, R. (2010). Park and museum interpretation: Helping visitors find meaning. *Curator 45(4),* 265-276.

Haeckel, E. (1866). *General Morphology of the Organisms*. Berlin: G. Reimer.

Ham, S. (1993). *Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets*. Golden: North American Press.

Ham, S. & Shew, R. (1979). A comparison on visitors' and interpreters' assessments of conducted interpretive activities. *Journal of Interpretation 4(2),* 39-43

Hansen, J. (2010). *Storms of my Grandchildren: The Truth about the Coming Climate Catastrophe and our Last Chance to Save Humanity*. (Reprint ed.). New York: Bloomsbury.

Hazen, R. (2013). *The Story of Earth: The First 4.5 Billion Years, From Stardust to Living Planet*. (Reprint ed.). New York: Penguin.

Heimlich, J., Falk, J., Bronnenkant, K. & Barlage, J. (2004). Measuring the learning outcomes of adult visitors to zoos and aquariums: phase I technical report (Unpublished technical report). Annapolis, MD: Institute for Learning Innovation.

Hewitt, A. (2010). The Effects of Self Tours on School Groups in the Dinosaurs Under the Big Sky Exhibit at the Museum of the Rockies. (Unpublished professional paper). Montana State University, Bozeman, Montana. From http://www.montana.edu/msse/documents/WeikertAngela%20Capstone.pdf

Jacobson, S. (1999). *Communication Skills for Conservation Professionals*. Washington: Island Press.

Jamieson, S. (2004). Likert Scales: how to (ab)use them. *Medical Education 38,* 1217–1218. Retrieved May 17, 2016 from http://xa.yimg.com/kq/groups/18751725/128169439/name/1likertscales.pdf

Kaufman, M. (2015, March 5). Ancient Mars had an ocean, scientists say. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/2015/03/06/science/mars-had-an-ocean-scientists-say-pointing-to-new-data.html

Kean, S. (2013). *The Violinist's Thumb: And Other Lost Tales of Love, War, and Genius, as Written by our Genetic Code*. (Reprint ed.). New York: Back Bay Books.

Khan, A. (2015, April 28). A dinosaur with bat-like wings? Strange fossil baffles scientists. Los Angeles Times. Retrieved November 9, 2015 from http://www.latimes.com/science/sciencenow/la-sci-sn-dinosaur-bat-wings-strange-fossil-glide-fly-20150429-story.html

Kisiel, J. (2007). Examining teacher choices for science museum worksheets. *Journal of Science Teacher Education 18(1)*, 29-43.

Kolbert, E. (2015). *The Sixth Extinction: An Unnatural History*. (Reprint ed.) New York: Picador.

Louv, R. (2005). *Last Child in the Woods: Saving our Kids from Nature Deficit Disorder*. Chapel Hill: Algonquin Books.

Marsh, G. (1967). *Man and Nature, or Physical Geography as Modified by Human Action*. Cambridge: Harvard University Press

Merriman, T., & Brochu, L. (2006). *The History of Heritage Interpretation in the United States*. Fort Collins: InterpPress.

Michigan State University. (2007, February 27). Scientific Literacy: How Do Americans Stack Up? Retrieved Nov. 9, 2015 from http://www.sciencedaily.com/releases/2007/02/070218134322.htm

Miller, C. (2004). *Gifford Pinchot and the Making of Modern Environmentalism*. Washington: Island Press.

Mills, E.A. (1920). *The Adventures of a Nature Guide and Essays in Interpretation*. New York: Doubleday.

Mogelgaard, K. (2006). How Much Land Should be Protected for Biodiversity? From http://www.prb.org/Publications/Articles/2006/HowMuchLandShouldBeProtectedforBiodiversity.aspx

Mony, R. (2007). An Exploratory Study of Docents as a Channel for Institutional Messages at Free-Choice Conservation Education Settings. (Unpublished professional paper). Ohio State University, Columbus, Ohio. Retrieved November 9, 2015 from http://etd.ohiolink.edu/rws_etd/document/get/osu1186780088/inline

Morgan, J. & Hodgkinson, M. (1999). The motivation and social orientation of visitors attending a contemporary zoological park. *Environment and Behavior 31(2),* 227-239.

National Education Council. (2006). Interpretation and education renaissance action plan. Retrieved from National Park Service, U.S. Department of the Interior, Interpretation and Education Program. From http://www.nps.gov/interp/renaissance/lowresolutionieactionplan.pdf

National Research Council. (1996). *National Science Education Standards*. National Committee on Science Education Standards and Assessment. Washington: National Academies Press.

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By States.* From http://www.nextgenscience.org

Nye, B. (2015). *Undeniable: Evolution and the Science of Creation*. (Reprint ed.) New York: St. Martin's Griffin.

Oatley, K., & Nundy, S. (1996). Rethinking the role of emotions in education. In D. Olson & N. Torrance (Eds.). *The Handbook of Education and Human Development: New Models of Learning, Teaching and Schooling* (pp. 257-274). Cambridge: Blackwell Publishers.

Ormrod, J. (2000). *Educational Psychology: Developing Learners* (3rd ed.). Columbus: Merrill.

Ortiz, M. (2007). Motivations for Attending Ranger-Led Interpretive Programs in Yosemite National Park. (Unpublished professional paper). Stephen F. Austin State University, Nacogdoches, Texas. From http://www2.sfasu.edu/msri/Theses/Ortiz,%20Marea.pdfMO-1.pdf

Overbye, D. (2015, July 23). NASA says data reveals an Earth-like planet, Kepler 452b. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/2015/07/24/science/space/kepler-data-reveals-what-might-be-best-goldilocks-planet-yet.html

Pergams, O. & Zaradic, P. (2006). Is love of nature in the U.S. becoming love of electronic media? 16-year downtrend in national park visits explained by watching movies, playing video games, internet use, and oil prices. *Journal of Environmental Management 80,* 387-393. From http://www.videophilia.org/uploads/JEM.pdf

Pergams, O. & Zaradic, P. (2008). Evidence for a fundamental and pervasive shift away from nature-based recreation. *Proceedings of the National Academy of Sciences 105(7)*: 2295-2300. From http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2268130/

Randall, L. (2015). *Dark Matter and the Dinosaurs: The Astounding Interconnectedness of the Universe*. New York: Ecco Press.

Raustiala, K. & Victor, D. May (1996). *Biodiversity Since Rio: The Future of the Convention on Biological Diversity*. Environment 38(4):17-43.

Roblyer, M. (2006). *Integrating Educational Technology Into Teaching* (4th ed.). Upper Saddle River: Pearson Prentice Hall.

Runte, A. (2010). *National Parks: The American Experience*. Lanham: Taylor Trade Publishing.

Ryan, C., & Saward, J. (2004). The zoo as ecotourism attraction: Visitor reactions, perceptions and management implications. The case of Hamilton Zoo, New Zealand. *Journal of Sustainable Tourism 12(3),* 245-266.

Sandifer, C. (2003). Technological novelty and open-endedness: Two characteristics of interactive exhibits that contribute to the holding of visitor attention in a science museum. *Journal of Research in Science Teaching 40(2),* 121-137.

Scharf, C. (2015). *The Copernicus Complex: Our Cosmic Significance in a Universe of Planets and Probabilities*. (Reprint ed.) New York: Farrar, Straus, & Giroux.

Scott, D. & Munson, W. (1994). Perceived constraints to park usage among individuals with low incomes. *Journal of Park and Recreation Administration 12(4)*, 79-96. From http://www.people.tamu.edu/~dscott/340/U3%20Readings/2%20-%201994%20JPRA%Income%20and%20constraints.pdf

Siikamaki, J. (2011). Contributions of the U.S. state park system to nature recreation. *Proceedings of the National Academy of Sciences 108(34)*, 14031-14036.

Sokol, J. (2015, October 29). Salt flats on Europa mean moon's ocean may come to surface. New Scientist. Retrieved November 9, 2015 from http://www.newscientist.com/article/dn28417-salt-flats-on-europa-mean-moons-ocean-may-come-to-surface/

South Platte Park. (2015). Explore. Enjoy. 2015/16 Winter Newsletter.

South Platte Park. (2016). Explore. Enjoy. 2016 Spring Newsletter.

South Suburban Parks and Recreation (2016a). A Conservation History: South Platte Park. Promotional brochure.

South Suburban Parks and Recreation (2016b). South Platte Park: A Natural Area. Promotional brochure.

South Suburban Parks and Recreation (2016c). South Platte Park Carson Nature Center. Retrieved March 29, 2016 from http://www.ssprd.org/nature

Stevens, T., More, T., & Markowski-Lindsay, M. (2014). Declining National Park visitation: An economic analysis. *Journal of Leisure Research, 46(2)*, 153-164.

Stocklmayer, S. (2002). New experiences and old knowledge: Towards a model for the personal awareness of science and technology. *International Journal of Science Education 24(8)*, 835-858.

Stocklmayer, S. (2005). Public awareness of science and informal learning – a perspective on the role of science museums. Australia: National Center for the Public Awareness of Science. Retrieved November 9, 2015 from http://mps.uchicago.edu/docs/articles/Informal_Science_Susan_Stocklmayer_Think_Piece.pdf

Switek, B. (2013). *My Beloved Brontosaurus: On the Road with Old Bones, New Science, and our Favorite Dinosaurs*. New York: Farrar, Straus, Giroux.

Thoreau, H. (June 1862). Walking. The Atlantic Monthly. 9:657-674. From http://www.theatlantic.com/magazine/archive/1862/06/walking/304674/

Tilden, F. (1967). *Interpreting our Heritage*. Chapel Hill: University of North Carolina Press.

Tofield, S., Coll, R., Vyle, B., & Bolstad, R. (2003). Zoos as a source of free choice learning. *Research in Science and Technology Education 21(1),* 67.

Tran, L. (2006). Teaching science in museums: The pedagogy and goals of museum educators. *Science Education 91(2),* 278-297.

Tunnicliffe, S. & Reiss. M. (2000). What sense do children make of three-dimensional, life-sized "representations" of animals? *School Science and Mathematics 100,* 128-138.

United Nations. (2014). 2014 United Nations List of Protected Areas. From http://worldparkscongress.org/drupal/sites/default/files/documents/docs/2014%20UN%20List%20of%20Protected%20Areas%20EN%20web.pdf

United Nations & United Nations Environment Program. (2015). Article 6: General Measures for Conservation and Sustainable Use. In Convention on Biological Diversity. From http://www.cbd.int/convention/articles/default.shtml?a=cbd-06

Van Moer, E., De Mette, T., & Elias, W. (2008). From obstacle to growth: Dewey's legacy of experience-based art education. *International Journal of Art & Design Education 27(1),* 43-52.

Walker, C. & Manjarrez, C. (2003). Partnerships for free choice learning: Public libraries, museums, and public broadcasters working together. Washington, DC, The Urban Institute and Urban Libraries Council. From http://www.urban.org/research/publication/partnerships-free-choice-learning

Wild, P. (1977). The father of Rocky Mountain Park. High Country News 9(15), July 29, 1977, p. 1. From http://s3.amazonaws.com/hcn-media/archive-pdf/1977_07_29.pdf

Wolfe, L. (1979). *John of the Mountains: The Unpublished Journals of John Muir*. Madison: University of Wisconsin Press.

Wolfe, L. (2003). *Son of the Wilderness: The Life of John Muir*. Madison: University of Wisconsin Press.

Wordsworth, W. "Lines Written a Few Miles Above Tintern Abbey, On Revisiting the Banks of the Wye During a Tour. July 13, 1798." *Poetry Foundation*. Poetry Foundation. n.d. Web. July 11, 2016.

Zimmer, Carl. (2015, January 15). Ocean life faces mass extinction, study says. The New York Times. Retrieved November 9, 2015 from http://www.nytimes.com/2015/01/16/science/earth/study-raises-alarm-for-health-of-ocean-life.html

APPENDICES

APPENDIX A

MSU PROJECT EXEMPTION

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
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MEMORANDUM

TO: Henry Lacey and John Graves

FROM: Mark Quinn, Chair Mark Quinn CHJ

DATE: February 3, 2016

RE: *"Impacts on Attitudes, Beliefs and Knowledge of Ecology-Themed Interpretation Programs at a Colorado Open Space Preserve" [HL020316-EX]*

The above research, described in your submission of February 3, 2016, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

POST-VISIT QUESTIONNAIRE

Questionnaire and/or Voluntary Interview Questions

1. How frequently do you visit Carson Nature Center and South Platte Park?

2. What is the main driver (motivation) of your visits to this park?

3. What makes Carson Nature Center and South Platte Park such important facilities in the area?

4. Which of these features of Carson Nature Center and South Platte Park are the most important to you?

    a. Trails

    b. Fishing

    c. Wildlife

    d. Interpretation programs

5. What are your views about wildlife? Circle one response.

    a. Wildlife symbolizes freedom and nature.

    b. Wildlife is part of a healthy ecosystem.

    c. Wildlife is dangerous.

    d. Wildlife is a nuisance and detrimental to recreation and/or business.

6. Which of these statements best reflect your views about management of wildlife? Circle one response.

    a. Wildlife populations should be controlled to minimize impacts to other species.

    b. Wildlife populations should not be controlled because nature can support them.

c. Wildlife is common and does not require efforts to maintain populations.

d. Wildlife populations need careful management because many species are endangered or threatened.

7. Which of these statements best reflect your views about protection of the environment? Circle one response.

a. Ecosystems should be maintained in their natural states, or as close to it as possible, and wildlife and its habitat should be protected as much as possible.

b. The needs and desires of humans should generally take priority over the habitat needs of other species.

c. Ecosystems should not be given more priority than developmental needs or human needs for natural resources.

d. The need to protect ecosystems and wildlife species from human impacts is important and government should take action to limit human activities that harm, including providing preserves.

8. What do you think is the greatest single challenge facing wildlife species generally? Circle one response.

a. Loss of habitat to development and natural resource use

b. Hunting and poaching

c. Pollution

d. Other

9. How would you describe the area in which you now live? Circle one response.

a. Urban area

b. Suburban area

c. Semi-rural area

d. Rural area

10. How would you describe the area in which you lived as a child? Circle one response.

a. Urban area

b. Suburban area

c. Semi-rural area

d. Rural area

APPENDIX C

POST-VISIT LIKERT SURVEY

Likert Survey Questions

Question	1 – Strongly Agree	2 – Agree	3 – Neutral	4 – Disagree	5 – Strongly Disagree
Carson Nature Center and South Platte Park are important parts of Colorado's effort to protect wildlife.					
I know more about the variety of wildlife that is native to the Front Range now that I have attended a program at South Platte Park.					
It is important to protect wildlife populations and South Platte Park is an example of an effective way of doing so.					
After attending a program at South Platte Park, I have a stronger understanding of wildlife in this area.					
I am more motivated to learn about actions I can take that will help protect wildlife and its habitat.					
The South Platte River and its ecosystem are vital for wildlife species.					