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A Moving Dune, A Stunning View: Visitors' Recollections of a Ranger-Led Hike at Indiana Dunes National Park

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Located 50 miles from Chicago, at Indiana Dunes National Park, thousands interact with rangers annually, many taking part in ranger-led hikes. The study focused on visitor recollections of a ranger-led hike that provided opportunities to learn about landscape change, recent events, and associated scientific findings. Interpreters are encouraged to co-construct audience-centered experiences, making space in interactions for visitors' knowledge, interests, and previous experience. Researchers observed six ranger-led hikes incorporating audience-centered design elements and recruited a convenience sample of twenty-one visitors for participation in a pre-hike survey to gather responses about interest and knowledge before the hike and their willingness to participate in a follow up post-hike phone interview. After ranger-led hikes, researchers conducted fifteen interviews using a phenomenological approach to glean visitors' recollections of the experience. Our findings confirm that visitors arrive with background knowledge, scientific interests, and curiosity. Months after the park experience, they were able to give examples of dune formation and change over time, the human effect on the landscape, and findings from recent events and scientific study at Mount Baldy. Interviewees recalled and reflected on rangers' facilitation and use of props, as well as visual details and feelings evoked by the physical conditions. The results offer a rare look at what sticks with visitors after their participation in a ranger-led hike.

Keywords: national parks, informal learning, visitors, STEM learning interest, STEM learning, interpretation

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INTRODUCTION

Interpretation in United States national parks has experienced significant changes in philosophy and practice in the 21st century. The interpreter's role had been envisioned as a guide (Mills, 1920), who ". . .reveals meanings and relationships" (Tilden, 2007, p. 33). National Park Service (NPS) interpreters have forged intellectual and emotional connections between visitors and the special places set aside for their historic significance, conservation and recreational value (Bacher et al., 2007). 21st century interpreters are expected to incorporate visitors' knowledge, interests, and previous experience (Knapp and Forist, 2014; National Park Service NPS, 2017). Interpreters can then take a constructivist approach to learning advocated by researchers in the field (Knapp and Benton, 2004; Copeland, 2006; Knapp, 2007; Knapp and Forist, 2014).

The ranger-led hikes studied at Indiana Dunes National Park were presented in concert with "Interpreters and Scientists Working on Our Parks" (iSWOOP), which aimed to increase science and visual literacy and STEM learning among visitors to United States national parks. iSWOOP equipped rangers with strategies to pique visitor interest in science behind the scenes and collections of still images, illustrations, figures, maps, and short video sequences (Allen et al., 2018). Props, stories, and visualizations can function as a portal for visitors in accessing the significance of the park (Knapp, 2007).

Park interpreters are part of an ecosystem that provides opportunities for place-based learning with potential impacts on visitors' engagement, knowledge, and interests (Friedman, 2008). Situational interest or momentary curiosity has been positively associated with attention and focus, comprehension and cognitive processing, memory and recall (National Research Council, 2009; Renninger and Su, 2012). As individuals become passionate about particular interests, they increasingly seek out other opportunities to learn, for example, by asking more curiosity questions or by visiting informal learning settings (Azevedo, 2013; Crowley et al., 2015).

Too little is understood about the dynamics of this type of free-choice learning in parks. The opportunity to analyze the knowledge and interests that park visitors enter a ranger-led experience with and what they recalled months later is rare. As explained by Storksdieck and Falk (2020), the roles visitors assume in their groups, motivations for visiting, and type of experience they seek out are even more varied in parks than in informal learning institutions with four walls and exhibits. Park visits can extend for days or weeks, potentially diluting or enhancing the impact of a particular learning opportunity. Furthermore, interests may be apparent only in a certain setting (Friedman, 2008) and triggered interests may be tangential to the intended focus or learning goals (Perry, 2002). Memories of place may eclipse memories of content (Forist, 2018). While recognizing these complexities, one can seek to understand what sticks with visitors after their participation in a specific activity. Recollecting, the act of retelling, is an indicator of learning (Friedman, 2008), common to interest and curiosity (Silvia, 2006). Thus we look at prior knowledge and interests in anticipation of, and recollections after a ranger-led hike, mindful that the experience is one element of a larger park visit.

In summer 2018, we conducted pre-hike surveys of visitors before and post-hike telephone interviews with them after ranger-led hikes on Mount Baldy at Indiana Dunes National Park, to understand the potential for STEM learning in national parks and what they recollect as memorable from that experience.

The Questions

Our questions emerged from a desire to support interpreters in delivering impactful, memorable STEM learning for park visitors. We sought to address these questions:

1. What scientific interests and knowledge do visitors begin their Mount Baldy hikes with?
2. What science content do visitors recall from their participation in an iSWOOP program at Mount Baldy?
3. What else do visitors recall about the ranger-led, iSWOOP-influenced experience?

METHODS

Positionality

The authors have backgrounds in science, education, and interpretation. All were actively conducting professional development and park-relevant research at the time of the study. The lead author attended six ranger-led hikes at Mount Baldy, greeting participants, acting as a participant observer, and as follow-up interviewer.

The Setting

In 1966 Congress placed 15,000 acres along Lake Michigan under the jurisdiction of NPS. Located just 50 miles from Chicago, millions have visited Indiana Dunes National Park (National Park Service NPS, 2020). The park is known for its great biodiversity; resource managers issue dozens of research permits annually.

Science Topics–Dune Formation and Change Over Time, Geology and a Near Death Experience

Mount Baldy presents unique opportunities for interpretation. In 2013 6-years old Nathan Woessner fell into a hole on Mount Baldy, which quickly filled in with sand (Sabar, 2014). After a successful rescue, NPS closed public access to Mount Baldy, where generations of children had enjoyed dune-sledding (Rowe, 2013). The accident precipitated new research (Argyilan et al., 2015). In 2017–2018, local geologist, Dr. Erin Argyilan, along with Dr. Todd Thompson and his colleagues at Indiana Geological & Water Survey, led hikes, gave presentations, and produced 3D models to strengthen the science content rangers presented to the public (See **Supplementary Video S1**; Czartorysky, 2018). Interpreters designed a multi-stop hike that emphasized key dynamics of the dune landscape that the public often misses. For example:

- Mount Baldy is a dune on a dune. The base dune is 3,000 years old.
- Wind patterns in combination with wave action and a jetty affect sediment deposition, deprivation, and erosion.
- The wind lifts fine grains of sand from the shoreline, which rise over and fall down the back side of the dune. This has caused the footprint of Mount Baldy to expand.
- Accounts of holes in dunes have not previously been documented by scientists.
- When buried, some trees are vulnerable to fungi-induced decay.
- The wind can remove sand, exposing cavities that were once buried trees, creating hazardous "dune decomposition chimneys" (Argyilan et al., 2015).

Participant Recruitment

Twenty-one adults from six different Mount Baldy hikes agreed to participate in the study (21 of 119 total visitors/17.6%).

Before the hikes began the researcher asked adult visitors if they would participate in a study on visitor experiences of ranger-led Mount Baldy hikes. Those responding affirmatively completed a brief pre-hike survey. All 21 granted permission to be contacted for a telephone interview. Visitors were promised anonymity and received an Indiana Dunes lapel pin as a token of thanks. Nearly three-quarters (15 of 21 or 71.4%) of those who agreed to participate in the study responded and were interviewed. This response accounts for 12.6% of hike attendees. Four attempts were made by email and telephone to contact the remaining individuals, with no success.

Pre-Hike Survey Instrument

The pre-hike survey included five questions: two probed visitors' scientific interests about Mount Baldy; one asked about prior knowledge; one asked their reasons for participating, and one elicited contact information for a phone interview. No demographic data were collected. The open-ended questions reported on include:

- What do you currently know about Mount Baldy?
- What scientific interest do you have regarding Mount Baldy?
- What are you interested in learning about Mount Baldy during today's hike?

Post-Hike Interview Instrument

Telephone interviews were conducted between 3 and 8 months after the person's park visit. A phenomenological approach was used to investigate participants' recollections of the interpretive experience, seeking clarification and understanding of people's perceptions and experiences, especially the meanings they give to events, concepts, and issues (Mabry, 2000). The interviews were open-ended, beginning with the question, "Can you please tell me about your Mount Baldy hike?" This choice was made to avoid establishing an initial bias toward recollections about the interpretive aspects of the hike. Prompts were based on interviewees' comments. For example, if the interviewee mentioned buried trees, the interviewer said: "Can you tell me more about the buried trees?" The majority were 10–15 min in duration.

Coding Pre-Hike Survey

Two researchers agreed upon code categories and checked their ability to apply the codes independently using the Dedoose qualitative data software (Lieber, 2020). Numerous codes were used for the existing knowledge question. Emergent themes in the other data led to three general categories describing visitor interest: 1) Curiosity to Learn; 2) Importance of Place; and 3) Outdoor Activity.

Coding the Post-Hike Interviews

Interviews were recorded and transcribed verbatim. Transcriptions were analyzed using Dedoose (Lieber, 2020). Researchers counted each time interviewees gave a response to a question or prompt as one comment, whether it was a word, a sentence, or several paragraphs in length. As described above, two researchers worked together creating and checking their ability to apply codes. From the 15 interviews, we garnered 214 comments initially coded as "impacts of the hike." Specific categories of recalled impacts were then determined to be: 1) Learning about Park; 2) Enjoyment of Park; 3) Appreciation of Ranger; and 4) Sharing the Experience (with others afterward). The greatest bulk of responses to the post-hike interviews fell into the recalled Learning about the park category. For this reason, data were further refined and coded according to topics of new learning including 1) Generally the Park; 2) Dune Formation and Change; 3) Park Stewardship; and 4) Technology.

RESULTS

We describe results from two datasets. First the pre-hike survey—of visitors' scientific interests and knowledge—we gathered 118 statements (responses to three open-ended questions) from 21 participants. We then describe visitors' recollections of their ranger-guided Mount Baldy hike using data collected from open-ended telephone interviews with 15 of the original 21 study participants. Analysis of 151 distinct statements from the 15 participants focuses on their recall of scientific content and discoveries, visual details of props and landscape elements from their hike, and ways they reflected on or shared their hike after their park visit.

Pre-Hike Surveys

In 21 pre-hike surveys, respondents offered 34 discrete statements about existing visitor knowledge (**Figure 1**). Half of the responses indicated some knowledge about the formation and movement of sand dunes over time (17 of 34 responses/50%). Just over one quarter of responses were about the accident in 2013 that led to Mount Baldy's closure (9 responses/26.5%): five of those responses (14.7%) referred to the 2013 accident while four responses (11.8%) referred to the area's closure. Another few listed some knowledge about natural history or ecology (4 responses/11.8%), past knowledge or personal connection to Mount Baldy (4 responses/11.8%) environmental protection and stewardship (1 response/2.9%) or the view from Mount Baldy (1 response/2.9%). We therefore concluded that 50% knew little about dune movement and change and close to 75% knew few if any specifics about the 2013 accident.

Reporting visitor interest, 84 discrete responses were offered (**Figure 2**). The majority were a reflection of their wanting to know/Curiosity to Learn (73 of 84 responses/86.9%). These included general interest, e.g., "this looked interesting," and those with more defined lines of interest, such as "interested in sustainability in national parks," or "to gain appreciation for different natural features of the country". Visitors expressed curiosity very specifically, wondering, "What made these dunes".

Just over a tenth of the responses revealed their wanting to see/Importance of Place as an interest (10 of 84 responses/11.9%). Responses included interests in visiting Indiana Dunes or an NPS site, visiting a closed area, revisiting a place that held a personal or

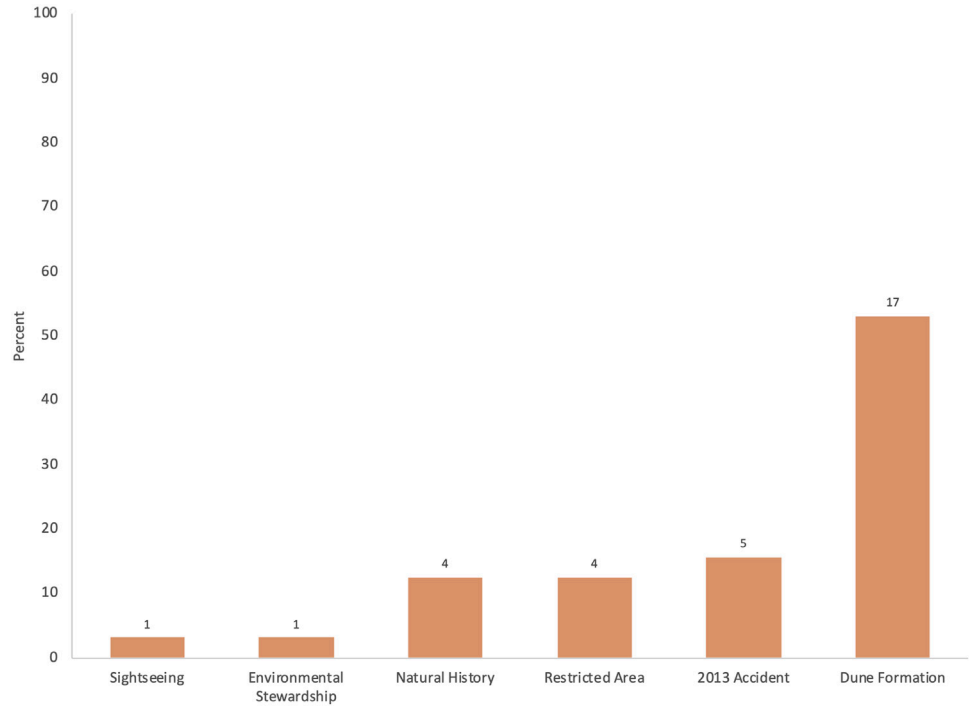

FIGURE 1 | Visitor knowledge prior to Mount Baldy hike (*n* = 34).

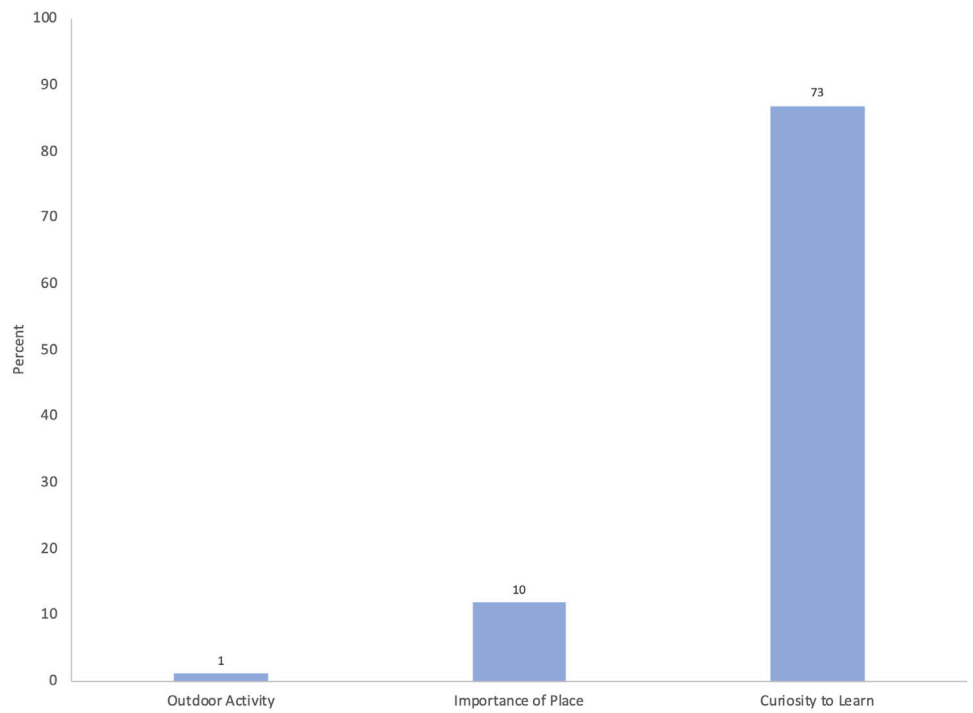

FIGURE 2 | Visitors interest prior to Mount Baldy hike (*n*-84).

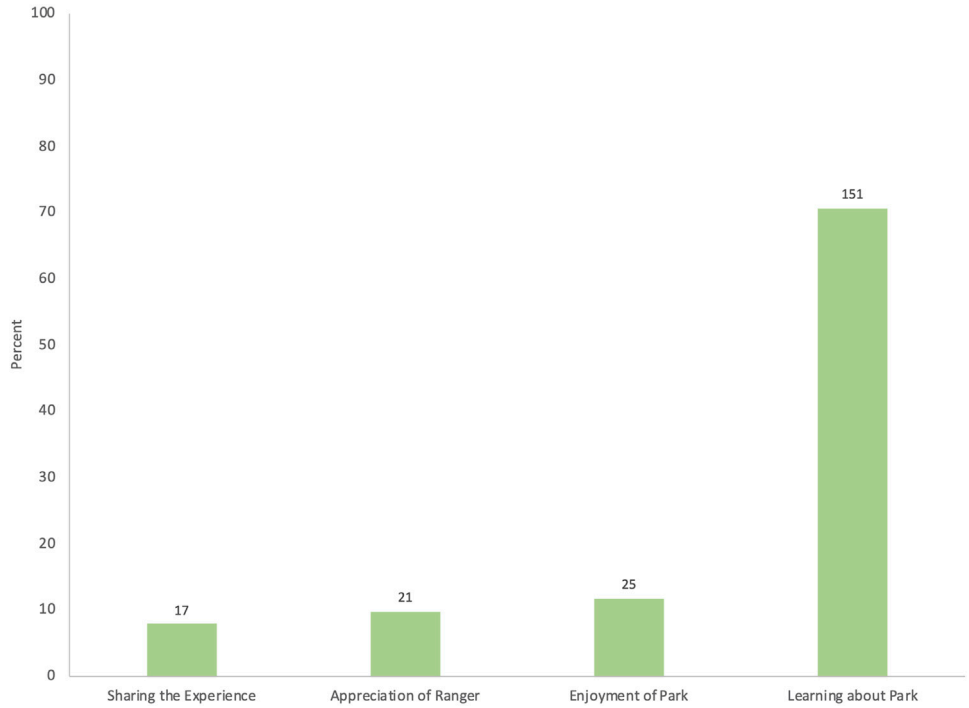

FIGURE 3 | Impacts of hike recalled by visitors (*n* = 214).

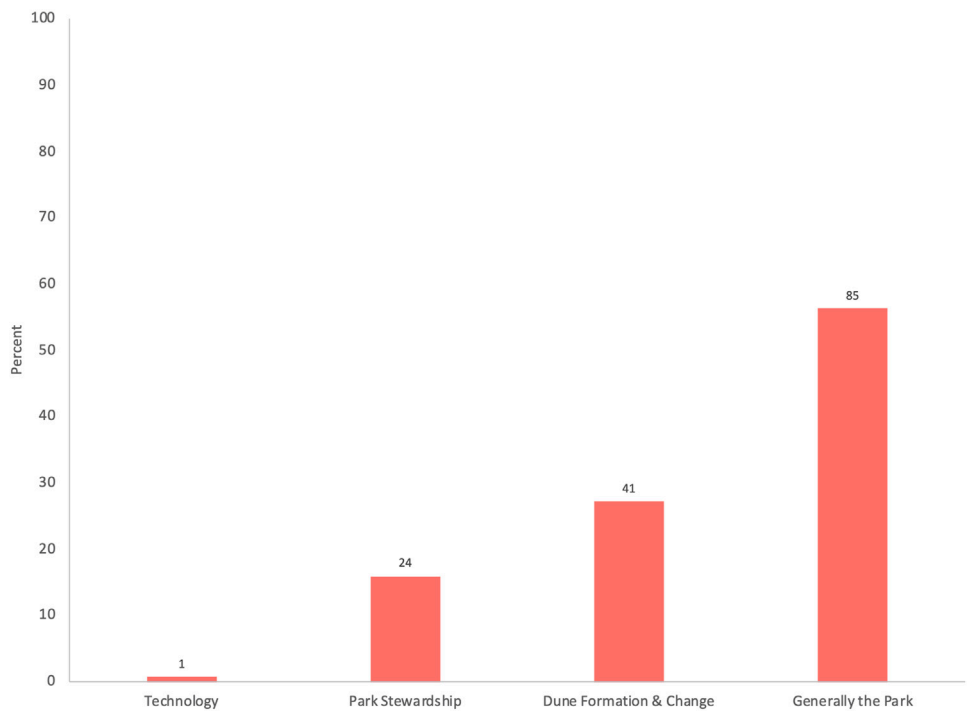

FIGURE 4 | Science content recalled from Mount Baldy Hike (*n* = 151).

family connection, or an interest in enjoying the view. These were all seen as indicators of the importance that particular place had in the visitors' decision to join a Mount Baldy hike. Just one response (1.2%) indicated interest in their wanting to do/Outdoor Activity.

Post-Hike Interviews

Data from the open-ended telephone post-hike interviews illuminated impacts of the hike as aspects of the ranger-led experience that were memorable and recalled by respondents (**Figure 3**). A total of 214 statements were drawn from the interview transcripts. Nearly three quarters of these (151 of 214 or 70.6%) fell within the Learning about Park category describing recalled knowledge from the hike. Data reflecting specific topics of recalled learning were further categorized and will be elaborated upon below. The balance of responses (63 of 214/29.4%) were about recalled Enjoyment of Place (25/11.7%), recalled Appreciation of Ranger(s) leading the hike (21/10.0%), or recalled Sharing of the Experience with others after their Mount Baldy hike (17/7.9%).

CONTENT LEARNING RECALLED ON THE RANGER-LED HIKE

Recollections coded as recalled Learning about Park are further categorized by topics of recalled learning (**Figure 4**). More than half, 85 comments (56.3%) were coded as recalled learning about Generally the Park (for example, visitors referred to off-trail hikers trampling plants). More than a quarter of the responses demonstrated recalled learning about Dune Formation and Change (41 of 151/27.2%). Twenty-four visitor (15.9%) comments referred to recalled learning about Park Stewardship. One response (0.7%) indicated recalled learning about Technology.

Beyond the categories of learning recalled as noted above, sub-themes emerged that, in some cases, were revealed in more than one of the categories below.

Recalled Learning About the Park and Dunes: Dune Formation and Change

The various phenomena related to dune formation and change arose as a significant element of the Mount Baldy hike. Interviewees were forthcoming with explanations for the changing shape of the dune. Many statements highlighted human impacts related to dune formation and change. For instance, five of the responses in this category mentioned the Michigan City jetty that has trapped sand on its eastern side, preventing accretion of new sand to replenish Mount Baldy. While the pre-hike survey indicated that the majority of interviewees had no prior knowledge of the nearly fatal 2013 accident, 14 out of 15 interviewees explained details of the boy who fell into a hole in Mount Baldy, his rescue, and the geological study that it precipitated. Connecting dune formation and change over time with recent scientific findings and that accident, one interviewee recalled:

> It was just that it was formed by trees that had been consumed by the dune. And I think there were some other processes, some fungus or something that was inside the trees that kind of made the outside of the trees stay intact so that the inside of them was not, not sand. And that's what made the hole.

Recalled Learning About the Park and Dunes: Parks as Outdoor Labs

Recent studies and scientists' methods were mentioned in some interviews. Two visitors mentioned that scientists employed technologies to investigate the holes in the dune (ground penetrating radar, laser scanning, and core samples), although more referred to scientists' methods generically, e.g.,"scans" and "radio graph". Recollections of the research flowed into recollections of the reasons for restricted access to Mount Baldy.

> And she had said there'd been a lot of research after that with some kind of. . .I thought they'd mapped out where all the holes were not determined, where we were really able to go on the dunes.
>
> . . . We learned that before the dune was there, it was trees and shrubs and just like greenery and then over time as the dune formed to cover all that up and of course without some light, all that stuff died and started to decay over time and eventually leading to soft spots and why we can't walk on the dunes today.

Recalled Learning About the Park and Dunes: Parks and Their Contexts as a Topic of Interest

Visitors articulated their interest in national parks and mentioned ways they sustained it, for example, by following parks, seeking information, planning travel, and talking with others about what they enjoyed. Eight respondents reported sharing their experience with family and friends after their visit. One stated,

> I am from North Carolina...you know, people that are from the Smoky Mountains, . . . they do not know Indiana has the dunes. . . . I showed people that I work with, "Look at these dunes; it is amazing" A lot of people had no idea.

Another interviewee said, " . . . *Been to a few national parks over the past year, which has been really exciting . . . you just learn such a vast amount of information ....*" Five interviewees spoke explicitly about experiences with rangers in other parks.

One interviewee mentioned the ranger's influence on their experiences after their guided hike:

> . . . Even yesterday I was out in Miller Woods and I see...these low lying pools of water. It makes me think, "Ha, is this from the recent receding glaciers? What is this area all about?" . . . And so, I stop and I will read the

information, because I had such a good experience with what she was saying and (that) promotes me to think.

MEMORABLE ELEMENTS OF HIKE

Interviewees mentioned the weather, the terrain and duration of the hike, as well as the view, which made an impression on them.

> I mean it's. . .the high point in the dunes. So that's the coolest stuff and the stunning view from the top.
>
> Well, I recall I enjoyed it quite a bit. I mean it was a great view. . . . There was some tough parts getting up there...that was a climb. But. . .got some great photos and, and my son really loved being up there and. . .learned a lot about the dune . . .the holes that are being created and that sort of thing.

Included in visitor interviews were their recollections regarding interpretive elements of the Mount Baldy hikes. Just over 15% (33 of 210/15.7%) referred to demonstrations by the rangers. The majority of these (21 of 33/63.6%) were images or models. Rangers held up and passed around laminated images, displayed 3D models that some visitors touched, and sand sorters, one of the scientific tools geologists use. These props and visuals made an impression.

> I think that those (models) were an easy way of understanding what they actually meant when they said that the shape of the sand dunes have changed .... You are seeing that and like actually showing it to me. I think that makes you remember it for longer.

In a smaller proportion of cases (12 of 33 or 36.4%), the rangers demonstrated elements of the natural or built environment to emphasize points in the Mount Baldy story.

> I think that the biggest, well kind of physical tool, the fence, the barrier, that "don't climb on the sand dune"...at the parking lot. That was going to be in your face like, right up front. . .The first thing you realize is, wow, the dune is right here in the lot, it's coming this way.

In sum, interpreters delivered a multi-stop, multisensory experience of Mount Baldy. While visitors originally claimed some knowledge on their pre-hike surveys, they were able to provide details in their post-hike interviews that they had not included on pre-hike surveys. We found an interest in and detailed recall of the changing dynamics of dunes and sand, of the 2013 accident which precipitated restricted use as well as new research findings, along with emotional, physical, and social memories of the experience. At times visitors were vague on details, labored to remember, or seem to have misremembered details. Such responses were not a focus of this study.

DISCUSSION

Our questions centered on visitors' pre-hike knowledge and interests and their post-hike recollections. Visitors to parks have their own agendas and, particularly in immersive experiences, may attend to their family members and the surroundings as much as to the interpreters (Falk, 2009). Without the need to apply the information, it is reasonable to expect that months after a ranger-led hike, details of the scientific content covered might be vague. Previous studies have shown that the actual interpretation offered fades, eclipsed by memories of the place itself (Forist, 2018). iSWOOP's professional development is designed to make science communication in parks memorable through the use of arresting visuals, stories of how scientists know what they know, and opportunities for interaction. While we conjectured that the story of holes in Mount Baldy leading to new understandings of dune and tree interaction would make an impression, we were not predicting that visitors would have detailed recall of the dynamics of dune formation and change. Nonetheless, pre-hike surveys and post-hike interviews yielded a data set that paints a rich picture of the lasting impression left on a subset of visitors participating in Mount Baldy hikes.

Visitors arrived at the hike wanting to learn more about the history of the site, human impacts, and the park's plan for access. In interviews, visitors had much to say about these topics (nearly three-quarters of 214 interview statements referred to knowledge recalled from the hike) confirming findings from research in other out-of-school settings showing that people have greater motivation to engage and learn if the subject matter is directly relevant to their interests and/or if the learning process is interactive (Falk, 2001). Specifics of the rangers' pedagogical moves, e.g., displaying 3D models and leading an enactment of erosion, were memorable to a number of participants. Participants' comments affirmed findings on positive associations with props (Knapp and Benton, 2005; Stern et al., 2012) and their appreciation of rangers including ranger passion, leadership, and knowledge (Forist, 2003; Knapp, 2007). Four visitors made specific comments about the value they found in the rangers; knowledge. With five different rangers leading the observed hikes, it is not surprising that opinions and recollections were varied, with some highly appreciative of the rangers and impressed by their knowledge while others were neutral.

As noted previously, it has been recommended that interpreters follow a constructivist framework—an educational approach based in direct interactions between the learner and teacher, or in parks, the interpreter and the visitor (Copeland, 2006; Knapp, 2007; Black, 2012). As developed by Bruner (1966), constructivism is a process through which actively engaged learners (or visitors) construct new knowledge based upon their past knowledge in the context of new experience. In such a case, the interpreter's role is more that of a facilitator than an instructor and the visitor is engaged rather than instructed (Knapp, 2007; Whisnant et al., 2011). In this study, the relationship between visitor knowledge and interest as reported on our pre-hike survey and the outcomes of the telephone interviews might be thought of as reflecting new

knowledge constructed. The prominence of acquired knowledge reported during interviews (151 of 214 or 70.6% of all coded responses) indicates new knowledge. This, combined with the frequency that visitors reported their prior knowledge being utilized by rangers leading the Mount Baldy hikes (68 of 210 or 32.4% of comments regarding interpretive elements in the hikes), provides some evidence of a positive effect in applying a constructivist approach to interpretation. Further study is needed, looking at outcomes of an experience like the Mount Baldy hike in the context of pre-hike visitor interest and knowledge along with detailed analysis of constructivist elements included in hike delivery.

Ultimately, informal educators (and our funders) want to know to what extent ranger-led hikes are useful in sparking interests and effective as catalysts for knowledge gain? Based on this study, we can say that when visitors' curiosity and lines of interest align with the content delivered along with striking visuals, visitors' recollections were rich in detail. That visitors shared aspects of their experience with friends and family after their park visit is an indicator of knowledge acquired and continued interest in the park resources and features. Direct testaments to new interests sparked by the scientific content (joining a group, acquiring new books), were not offered during these interviews. Yet we know that visitors' interests may lie dormant for months, become an enjoyable focus when travelling or a seasonally limited opportunity opens.

The dataset for this study provides opportunities for further learning. We expect to take a deeper look at individual profiles to understand implied connections between visitors' expectations and their recollections. In future studies we would like to explore this relationship between experience input (visitors' existing knowledge and interest), application (interpretive techniques or methods), and output (visitor recollections). We would like to describe the relationship between interpretive methods employed (beyond the visuals, tools, and props reported on here) and visitor recall.

We hope future research could investigate the impact of the study methods on recall. For example: Does the act of writing down a question pre-dispose visitors to the ability to recall details? Does the anticipation of an interview about a past experience activate stored knowledge? Do visitors prepare once a follow-up interview is scheduled? If these interventions make STEM learning stick, can such techniques be intentionally used by interpreters?

CONCLUSION

Salient findings confirm that visitors arrive for guided experiences in parks with background knowledge, scientific interests, and curiosity. They have a desire to know, to see, and to do. Months after the park experience, interviewees were able to recall scientific knowledge and give examples of dune formation and change over time, the human effect on the landscape, explain the park staff's reasoning for area closures, and share details of the scientific study that led to new interdisciplinary findings. Participants of the hikes recalled visual details (such as the sand dune moving overtaking the parking lot), emotional responses (savoring a stunning view), physical feelings (successfully climbing the dune), and reflected on rangers' facilitation and use of props. This qualitative study provides insights for park leaders, interpreters and informal and STEM educators, affirming that ranger-led programs using visualizations, props, and dramatic stories as a vehicle for increasing knowledge and interest about humans' impact and landscape change were elements of visitors' recollections.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by TERC Internal Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2021.675672/full#supplementary-material

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